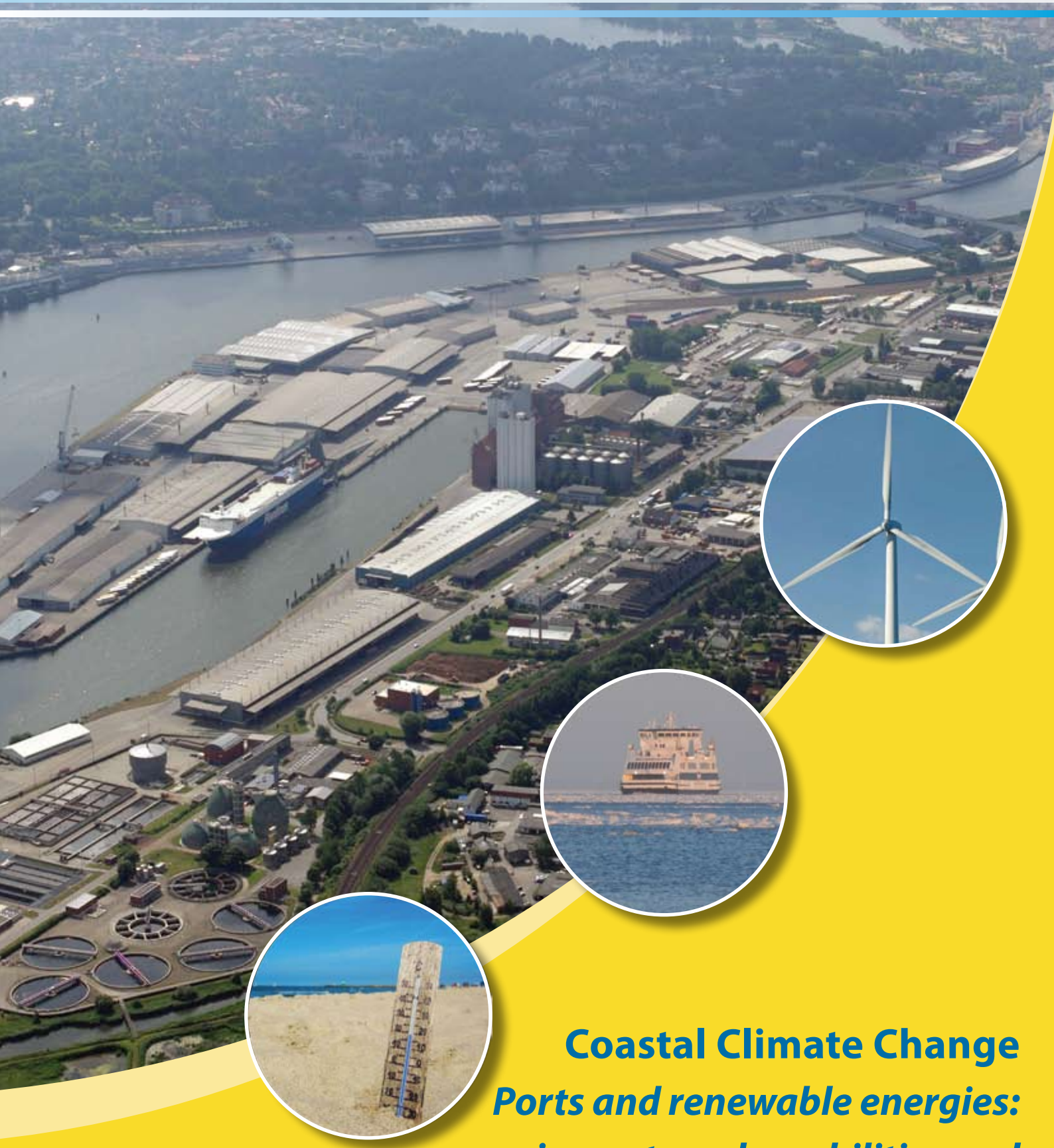
COASTAL & MARINE



Coastal Climate Change

Ports and renewable energies: impacts, vulnerabilities and adaptation

Volume 22 • No. 1 2013

Editorial

Dear reader,

"Blue growth" is one of the big buzzwords of today's European maritime policy. This is meant to be a long-term strategy to support growth in the maritime sector as a whole. A necessary task to implement such a strategy is the identification of economic, environmental and social challenges affecting the different sectors of maritime economy. Climate change is such a challenge with a wide range of possible impacts on existing, emerging and potential activities such as short-sea shipping, port development, and maritime employment. Several research projects like Baltadapt, RADOST and nordwest2050 have analysed what climate change actually means for the maritime economy and how adaptation strategies in regions like the Baltic Sea and the North Sea could look like. For those cases where climate change impacts require the modification of coastal and maritime infrastructure, e.g. adapted coastal protection measures or raised quays, the investment may be linked with the installation of renewable energy facilities. This allows not only combined climate change adaptation and mitigation actions, but helps also to refund the costs of adaptation.

Europe's seas have a high growth potential but they also suffer already today from severe environmental impacts. Education and training as well as innovative management tools are our keys to activate these growth potentials without harming our marine resources. The Generation BALT project gives insights how universities prepare for a marine century. And the Wadden Sea Region Planning Portal shows an example of how bottom-up cross-border management can be organised in areas like the unique Wadden Sea World Nature Heritage site. Enjoy reading!

Holger Janßen
Vice-president EUCC – The Coastal Union Germany

Coastal & Marine Union (EUCC)

The Coastal & Marine Union is dedicated to conserving and maintaining healthy seas and attractive coasts for both people and nature.
EUCC advocates best practice by developing coastal and marine policies, mobilising experts and stakeholders, providing advice and information, and implementing demonstration projects.

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Coastal & Marine Union (EUCC)
P. O.Box 11232, NL-2301 EE Leiden
Telephone: +31.71.5122900
E-mail: admin@eucc.net, www.eucc.net
Visiting address: Breestraat 89A, Leiden, NL

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EUCC's magazine 'Coastal & Marine' Special on 'Coastal Climate Change – Protecting and adapting maritime regions'
(volume 2013-1) , ISSN 1877-7953

Editor: Inga Haller (EUCC Germany)
Design & Layout: Erik Devilee
Printed by: Veldhuis Media, The Netherlands, Printed on FSC paper (Reviva Silk)

Opinions expressed in Coastal & Marine do not necessarily reflect the official views of EUCC.

Cover photo: Terminal Nordland Quay © Lübecker Hafen-Gesellschaft mbH

Photo cover insets: © University of Rostock, © Svenja Karstens, © Cindy Dengler

Thanks for support are expressed to: *Christian Filies, Holger Janßen and Matthias Mossbauer (EUCC Germany), and all contributing authors and photographers.*

Funding acknowledgements are given to: *Federal Ministry of Education and Research Germany (RADOST), Baltic Sea Region Programme 2007-2013 (Baltadapt), South Baltic Programme 2007-2013 (GenerationBALT) and EU Action Programme promoting European NGOs.*

Sole responsibility of this publication lies with the authors; the Commission is not responsible for any use that may be made of the information herein.

Mapping Human Activities in the Wadden Sea Region

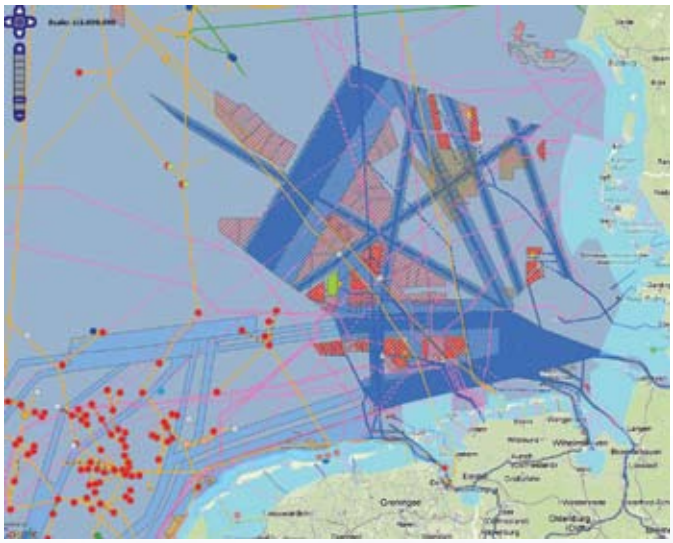
The Wadden Sea Region is a unique area: It is not only a UNESCO World Nature Heritage with a tremendous variety of plants and animals but also a world class cultural landscape created by the interaction of nature and humanity. This trilateral region, shared by Denmark, Germany and The Netherlands, is also subject to an increase of human activities, particularly growing harbour and shipping businesses as well as energy production along the coast and offshore. Climate change and the need for mitigation and adaptation measures act as an additional force for changes in regional development. In this situation a sound information system is needed to help to minimise impacts and manage the measures with a common cross-border approach. To serve stakeholders and administrative bodies with transboundary data on economic uses, spatial planning and conservation regimes, the Wadden Sea Forum (WSF) provides an innovative tool: The Wadden Sea Region Planning Portal.

The Planning Portal, based on a GIS, is an innovative application mapping the Wadden Sea Region including the offshore Exclusive Economic Zone (EEZ). It contains a wide range of uses, facilities and protection demands and is designed to meet the information needs of integrated management and marine spatial planning. As of 2013 the contents of the Planning Portal encompass a wide range of ongoing uses like mineral extraction, shipping, fisheries, energy production (fossils and renewables), energy storage and others more. Geographical background layers, including satellite images, nautical charts and information on the different protection regimes like Ramsar, PSSA, NATURA 2000 and the Trilateral Conservation Area complete the picture.

At present, quite a number of new layers are being included to make the Planning Portal more comprehensive. Data of further sectors like tourism will be part of the amendments. But it is also envisaged to provide information about the cultural history of the Wadden Sea Region, namely archaeological data, organ culture and habitation development. A challenge will be the integration of socio-economic data of the WSF sustainability indicators. This was very much wished by the regional and local governments to get a complete picture of the societal development.

All in all, the WSR Planning Portal is a very valuable instrument to provide extensive information of the socio-economic and spatial developments, attended by ecological information, on a transnational level of the southern North Sea and its coastal region.

Manfred Vollmer
Wadden Sea Forum e.V.



Energy production (natural gas & wind) and shipping in the Wadden Sea Region @ WSF/EUCC Germany

Background Information
The Wadden Sea Forum was established in 2002 and has become the status of a non-profit society in 2010. The central goal of the WSF is to contribute to an advanced and sustainable development in the Wadden Sea Region. In particular, this means integrating specific cross-sectoral and transboundary strategies, actions and techniques which are environmentally sound, economically viable and socially acceptable.
The WSF has formulated main tasks to reach the goals of contributing to a sustainable Wadden Sea Region. It will

- foster sustainable development in the Wadden Sea Region through exchange of information on experiences and best practice;
- bring together the sectoral interests of its members;
- exchange views on general themes and topical issues;
- initiate and implement projects and actions on topical issues;
- prepare advice on issues related to sustainable development and integrated coastal zone management;
- forward advice and recommendations to governments.

The Planning Portal has been developed by the WSF in co-operation with EUCC Germany, who further elaborates, improves and maintains the Portal. EUCC Germany is also hosting the data base and the GIS. The Portal can be experienced under http://www.waddensea-forum.org/Specialissues/wsr-gis.html.

Beltringharder Koog, © Archäologisches Landesamt SH

PORTS / SHIPPING

© Peter Karstens

Climate Change - A Transnational Challenge for Ports and Shipping in the Baltic Sea Region

More than 500 ports are located along the coasts of the Baltic Sea, one of the seas in the world with most traffic, accounting for up to 15% of the world's cargo transportation. These ports cover a wide range of different characteristics – from small private marinas up to large industrial harbours differing in types and volumes of cargo traffic, fishing, and other activities (industry, passenger transport, cruise tourism, yachting). Many ports are situated in vulnerable locations close to river mouths, prone to sea level rise, storm surges, and flooding both from the sea and the river side. The ports in the Baltic Sea region face many challenges such as global and regional economic, political, and environmental changes including climate change. Baltic Sea ports and maritime traffic will be affected by climate change in various ways. Rising temperatures, decreasing sea ice cover, sea level rise, changing precipitation and storm patterns might impact differently port infrastructure and operations, depending on geographic location and type of port. Some examples for transnational challenges for ports in the Baltic Sea region are given in the following.

An on-going tendency in maritime traffic is the increase in oil transportation. For example, two thirds of Russia's oil is transported via ships. During today's winter, the Gulf of Finland and the Gulf of Bothnia are ice covered and maritime traffic is restricted. Climate change projections anticipate a future reduction in ice cover and a shortening of the ice season which would facilitate shipping in these regions (see also page 9). Mapping of new shipping routes and ice free areas will be needed. However, shifting pack ice with heights up to 10 m can still occur and cause severe problems. Icebreaker fleets will have to adapt to the changing sea ice cover. At present, between 23 and 28 icebreakers operate in the Baltic Sea – too many during mild winters, but not enough during harsh winters. Construction and maintenance of icebreakers is expensive, thus new technical solutions and alternative ideas need to be identified. Some countries are working on multi-purpose vessels for oil pollution prevention, fire fighting, and icebreaking. With regard to climate change and varying sea ice conditions, a shared icebreaker fleet for the countries along the Gulf of Finland, the Gulf of Bothnia, and the Gulf of Riga seems to be a step in the right direction. International cooperation will offer many advantages.

Next to changes in sea ice, sea surface level changes are of high concern for many ports. Changes in regional sea level are determined by changes in global sea level as well as in local wind and pressure patterns and geological processes. Although the size of global sea level change is under debate, the total effect is anticipated to be larger in the southern and south-eastern part of the Baltic Sea, while the northern part will be less affected due to postglacial uplift. Adaptation measures for port facilities need to take into account regional differences. Where the sea level rises significantly, flooding might damage port infrastructure, equipment, and cargo. Ports in the southern Baltic Sea region, for example in Poland and Germany, might need to install additional protection schemes such as levees, seawalls, storm water drainage or dikes, and raise wharf levels. The largest port in Poland, the port of Gdansk, is located in one of the most flood prone areas of Poland. However, this region has – similar to many other parts of the southern Baltic Sea region – long experiences with inundations. Flood protection schemes including storm gates, pumping stations, or storage reservoirs are present. In the future, not only maintenance of existing protection infrastructure, but also reconstructions incorporating anticipated climate change impacts will be necessary. Sea level rise also aggravates storm surges and has an even higher impact on those than increased wind speeds. An increase in extreme storm events and higher storm surges would challenge maritime traffic and it's manoeuvring – especially in narrow port entrances such as the inland port of Gdansk.

Most ports in the Baltic Sea region do not see an urgent need to adapt their infrastructure and operations to climate change. Current problems and economic and political developments seem to have a far greater impact on ports. Climate change threats are rarely seen. Moreover, port authorities often do not know how to incorporate the uncertainties of climate change scenarios in their planning efforts, although their infrastructure needs long-term investments thus long-term planning (see also page 8). This fact has to be integrated into adaptation strategies.

The ports of Copenhagen and Malmö might be an example of good practice. In 2001, these two ports joined all their operations into one company and one legal entity. For the first time in history, two ports from two different countries are merging together. Climate change impact studies were conducted and the current protection level is high. Additionally, Copenhagen is elected as the European Green Capital of 2014, honouring its efforts in regard to environmental protection, including climate change mitigation and sustainable transport. Denmark and Sweden show that international cooperation can bring economic benefits on the one hand and facilitate climate change adaptation and mitigation measures on the other hand.

The EU Baltic Sea Region Strategy highlights that adaptation strategies are needed to cope with the inevitable consequences of climate change. The project Baltadapt (Baltic Sea Region Programme 2007-2013) is developing a transnational climate change adaptation strategy for the Baltic Sea region, focused on the sea and the coastline and certain sectors such as infrastructure including ports, but also tourism, fisheries, and biodiversity. The project facilitates a knowledge-brokerage process on climate change adaptation between research and policy, thus contributing to improved institutional capacity. This will help decision makers in the Baltic Sea Region to tackle the consequences of climate change (www.baltadapt.eu).

Svenja Karstens & Inga Krämer
Leibniz Institute for Baltic Sea Research Warnemünde

© Inga Krämer

Loading of heavy cargo, port of Lübeck, © Rolf Klein

Climate Change in the Baltic Sea Region: The Vulnerability of German Ports

As a gateway between ground and sea transportation, and as a business location for service and industry, ports are of great significance for the regional and national economy. At the same time, port structures are located in regions threatened by storms and rising sea levels. Due to highly interdependent value chains, weather related disruptions in port operation can cause serious economic damage. Thus, adaptation to possible climate impacts seems like an obvious task for port authorities. What can be said about the climate vulnerability for German Baltic port locations?

Regional Economic Importance of German Baltic Sea Ports

In 2010, the ports along the German Baltic Sea coast moved goods with a volume of 54.6 million tons. This volume corresponds to 6% of the entire international trade in Germany. Although the contribution of Baltic Sea ports to the total international trade is comparatively small, these ports play an essential role for the German economy as a hub for goods transported to and from north-eastern Europe.

As opposed to the container oriented North Sea ports, the German Baltic Sea ports are predominantly characterised by ferry and Ro/Ro services, and by the transportation of mass goods. In 2010, 51% of the total cargo handling was allotted to the transportation of vehicles and 36% related to mass goods. Transportation of containers in German Baltic Sea ports is at 4% only of minor significance. The most important types of goods are agricultural and silvicultural goods, petroleum products, and construction materials.

In 2010, the two most important ports along the German Baltic Sea coast were Rostock and Lübeck with 19.5 million tons and 17.8 million tons (excl. tare weight) handled, respectively. Regarding passenger transportation, with 11.4 million passengers, 40% of all passengers leaving and arriving at German sea ports travelled via German Baltic Sea ports in 2010. Especially Puttgarden, Rostock, and Kiel are important Baltic Sea passenger ports. As major hubs for transportation of passengers and goods, as well as central locations for industry and service providers, the German Baltic Sea ports contribute significantly to the security and strengthening of employment, income, and tax revenue in the coastal region. According to a study on the regional economic importance of the ports in Lübeck by UNICONSULT 2012, approximately 8,200 jobs in this city depend directly on its ports. For the city of Lübeck, the gross value associated with the port related economy is estimated at 542 million Euros.

Requirements and Potential for Adaptation

In a recent survey on the vulnerability of German Baltic Sea ports due to climate change within the frame of the German research project RADOST, the Institute for Ecological Economy Research (IÖW) has questioned port operators and port-based businesses (for details on this survey see page 8). The survey results on the ports' current readiness for a rise in sea level show that a majority of participating ports will be required to adapt by 2050 if the sea level rises faster than predicted by the IPCC. Especially older and low laying port areas will have to be elevated to avoid flooding. This opportunity of modernisation and reconstruction should be utilised to implement other adaptation measures.

The rise in sea level also increases the baseline level for storm high tides. Therefore, the occurrence probability of high water levels also increases. With regards to these aspects, the survey has shown that storm high tides with peak levels beyond 2m, such as it occurred twice during the last century, will cause severe disruptions and damages for two-thirds of participating ports. Because such events may take place at any time, the corresponding ports are advised to evaluate possible modifications and implement these measures. Furthermore, the possible intensification of westward winds may increase the net transport of sediments in exposed ports (e.g. Rostock). Therefore, dredging may have to be done in shorter intervals, especially to maintain the ships' passage way.

A more difficult manoeuvrability for ships due to heavy swell and more frequent storms may provide additional challenges. In order to avoid delays and accidents, the manoeuvre areas leading into the port should be widened. In many ports these areas are not available for these purposes or their extension may pose a severe intrusion into the marine ecosystem. Therefore, the use of towboats will have to increase.

The possible increase and intensification of heavy rainfall events may pose the risk of exhausted drainage systems in the ports. This problem already caused disruptions and damages in the past. Port operators should react by incorporating larger pipe diameters for new drainage systems.

In a workshop in September 2012, representatives of port infrastructure companies evaluated the need for adaption in German Baltic Sea ports as low. In reference to the model based predictions up to the middle of the 21st century, the workshop participants claimed that the German Baltic Sea ports are well prepared. During the last decades, new and replacement investments in infrastructure accounted for climate change, especially the rise in sea level, by including higher safety margins. The operators of port infrastructure assume that any further adaptation requirements can be met technologically and organisationally. Because the economic and technological development requires adaptation measures in much smaller intervals, an adjustment to changing climatic conditions can be considered accordingly.

Outlook

In continuation of the work done, possibilities for adaptation will be evaluated, and components for an adaptation strategy for German Baltic Sea ports will be developed. For this purpose, it will be essential that

1. the actors of port economy are supplied with precise and robust information regarding climate change at the German Baltic Sea coast,
2. operators of port infrastructure are provided with an instrument to estimate the port's climate vulnerability with little utilisation of resources, and
3. the already identified adaptation needs are defined in detail and transformed into actions, including the identification of responsibility, time line, and required resources for implementation.

André Schröder & Jesko Hirschfeld
Institute for Ecological Economy Research (IÖW), Germany

Road improvements, port of Lübeck, © Rolf Klein


Loading of paper, port of Lübeck, © Rolf Klein

Panoramic view of Scandinavia Quay, © Karl-Erhard Vögele

Survey Results on the Vulnerability of German Baltic Ports due to Climate Change

Survey conductor: Institute for Ecological Economy Research (IÖW)

10 port operators and 28 port-based businesses in the German Baltic Sea region participated in the survey (2012). Most of the ports and businesses (85%) have been affected negatively by storms during the last 15 years (see figure 1). Half of them even claimed medium to severe damages or disruptions. When asked how the number of damages and disruptions in operation due to extreme weather events has developed in the last 15 years, 64% answered that the number has been unchanged. However, 32% of participants stated that this number has increased.

Especially the increase in storm intensity, heavy rainfall events, high storm water levels, and in winter precipitation have negatively impacted up to 86% of the ports and businesses. Nearly half of the ports and businesses expect stricter insurance requirements, rising insurance premiums, and more disruptions in operation. A large percentage of participants viewed a reduction in gross value due to climate change as a risk and viewed rising costs for utilities and protective measures as a considerable risk. One third of participants are concerned with rising expenses for transportation, and damages to buildings, vehicles, and stored goods.

The IPCC currently estimates a rise in sea level of up to 59cm until the year 2100 compared to the year 2000. Assuming a linear increase, the sea level would rise by 30cm until 2050 (see the vertical scales in figure 2). Accordingly, at least one of the ten participating ports will have to implement adaptation measures by 2050. However, the rise in global sea level has been measured far above the IPCC's estimates. Recent studies conclude a more pronounced sea level rise until 2050 (see figure 2), which would force half of the surveyed ports to adapt actively before 2050.

Also, storm related high tides pose a risk to German Baltic Sea ports. For three out of ten ports, high tides during storm with a peak height of 1.99m above normal may lead to disruptions in operation and damages. During the last century, at three occasions this value was reached in the south-western Baltic Sea (see figure 3). If the high tides of 1904/05 and 1954 with peak values of 2.22m and 2.18m reoccur, 7 out of 10 ports expect severe disruptions and damages. A high water level with a peak value of 3.43m, as it occurred in 1872, will most certainly have severe consequences for all surveyed ports.

Weather related operational disruptions could affect especially port-affiliated businesses, which depend on a reliable and steady supply and delivery. If a disruption continues for one day or even seven days, respectively 22% and 89% of businesses may not be (fully) operational.

In contrast, global warming could in some respects provide also positive opportunities – most prominent could be the reduction in cost for winter services (70%), and in heating cost (48%), as well as improved port accessibility due to a reduction of sea ice (42%). However, it has to be noted that current research identified also scenarios as possible that could mean harsher winters in central Europe with more snow and more frequent periods of extreme cold. Should the latter be the case, the mentioned opportunities for ports and businesses will turn into risks as well.

André Schröder & Jesko Hirschfeld
Institute for Ecological Economy Research (IÖW), Germany

Figure 1: Disruptions in operation and damages caused by extreme weather events during the last 15 years

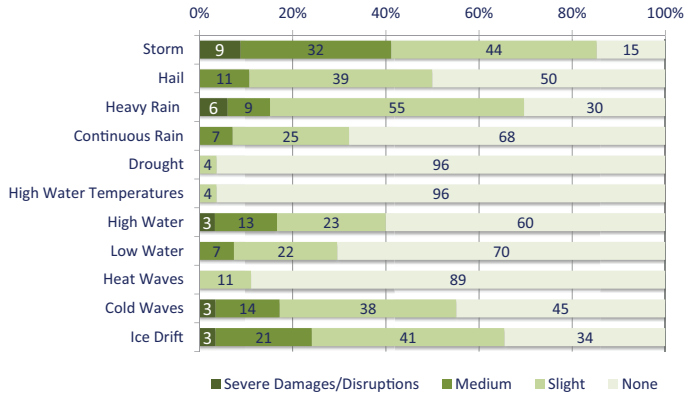


Figure 2: Critical amount of sea level rise for German Baltic Sea ports

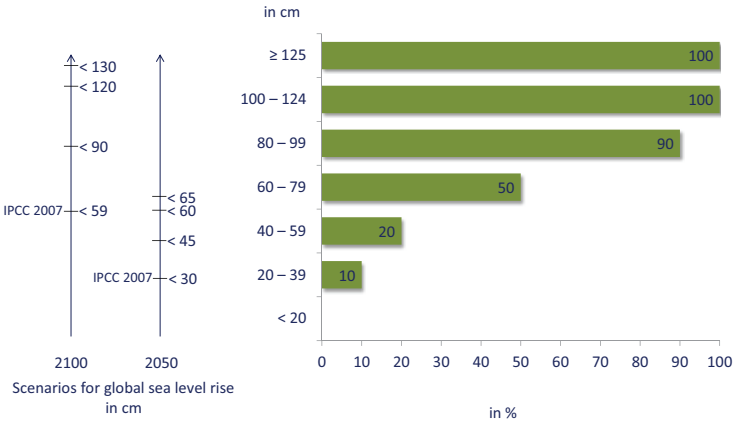
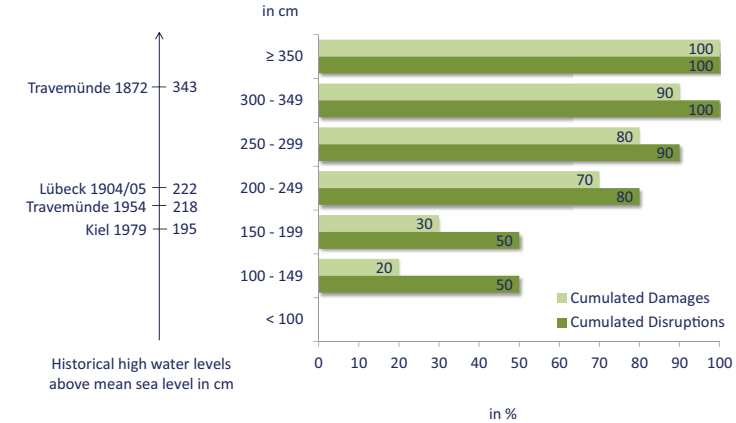


Figure 3: Critical amount of high water level for German Baltic sea ports



Melting Sea Ice in the Baltic Sea – Changes and Possible Effects

The Baltic Sea is one of the busiest water bodies for ship traffic in the world. Cargo, cruise and passenger vessels operate year-round, connecting ports of many Baltic Sea countries and beyond. However, in some northern and eastern regions, the sea ice coverage in winter and early spring restricts ship traffic to some extent and requires the assignment of ice breakers to keep shipping routes open for ship traffic (fig. 1). Given the discussion of global warming and the regional influences of climate change within the 21st century, changes in the occurrence and extent of sea ice coverage in the Baltic Sea are one of the open questions, especially on a regional scale. To judge the band width of possible future changes, scenario simulations are necessary and broadly used including different CO2-emission cases provided by the Intergovernmental Panel on Climate Change (IPCC). The Baltic Sea Research Institute (IOW) established simulations about the future of the Baltic Sea, based on the IPCC-scenarios A1B and B1, which show an air temperature increase of up to 3, respectively 2 Kelvin until the end of the century. According to the latest simulations, the Baltic Sea will get warmer, less saline and its sea-level will increase up to one meter. Connected to the warming, ice creation will decline, which means that the annual ice extent as well as the freezing period and ice thickness will drastically decrease (fig. 2). Previous studies showed, that a temperature increase of 1 Kelvin causes a shortening of the freezing period of one to two weeks. As a consequence, the ice thickness is reduced by 5 – 10 cm and the total ice-covered area in the Baltic Sea goes back up to 10,000 km^2.

The decline of ice creation will certainly have direct effects on the ecosystem (e.g. the ringed seal's breeding strongly depends on ice conditions) but also on ship traffic. For the Gulf of Bothnia the ice decline could most likely have a positive economic effect, as today the area cannot be used as shipping route for

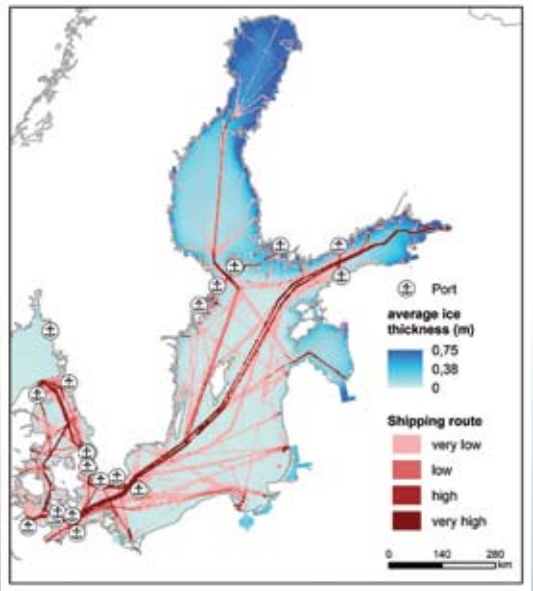


Figure 1: Average ice thickness 1970-2000

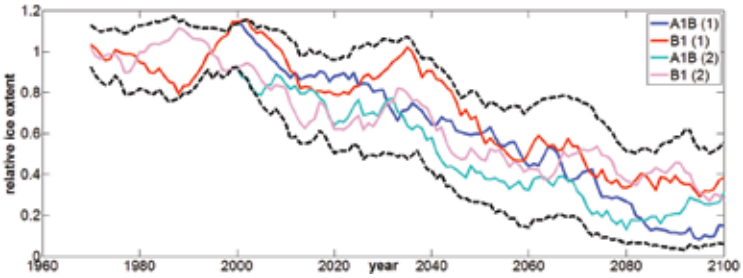


Figure 2: Decline of ice extent in different climate scenarios

one third of the year. Also other intensively cruised routes especially in the Gulf of Finland to St. Petersburg, Helsinki and Tallinn will in the future become utilisable without the usage of ice breakers (fig. 3), a fact that will increase the annual shipping period and make it more competitive. However, around the Gulf of Finland several marine protected areas (MPA) are located, which might be indirectly affected, as they are more endangered to be hit by pollutants from ship accidents in winter than in other seasons due to the surface currents, like recent simulations showed.

Model simulations can only show the band width of possible changes and may not be used as exact forecast. However, the results can provide valuable hints for the future adaptation of maritime regions and also for the management and protection of MPAs.

René Friedland
Leibniz Institute for Baltic Sea Research Warnemünde (IOW)

Anne Hiller, Holger Janßen
EUCC – The Coastal Union Germany

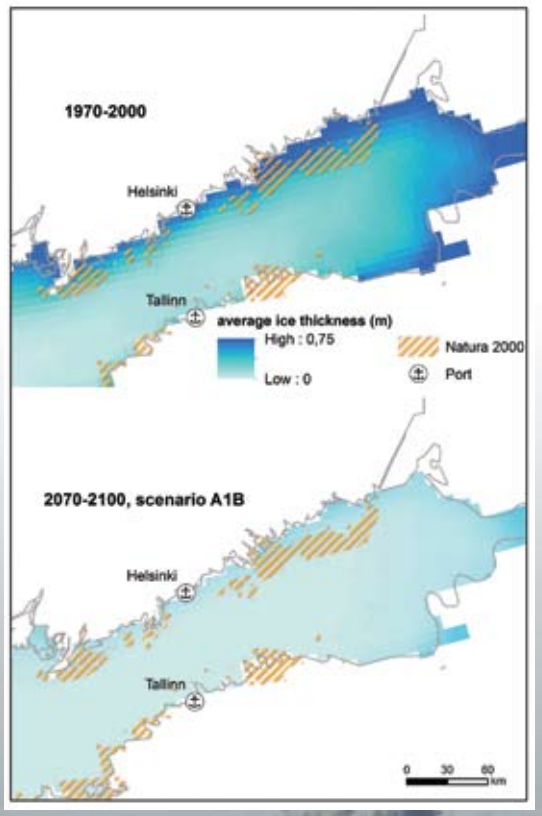


Figure 3: Average ice thickness in the Gulf of Riga, period 1970-2000 vs period 2070-2100 (A1B)

Ice breaker towing cargo ship, © Markus Wiesener

Climate Adaptation of Ports as an Issue of Regional Development: The Case of nordwest2050, Germany

The confrontation with extreme weather conditions belongs to the everyday business of port operations. Yet, ports belong to the category of critical infrastructures forming the backbone of socio-economic processes, especially under conditions of increasingly internationalised production and supply chains. Within the framework of the KLIMZUG project nordwest2050, the University of Applied Sciences Bremen (Hochschule Bremen) is responsible for working on climate adaptation within the regional port and logistic cluster, being one of the three economic activities addressed by the project.

Climate adaptation of ports is predominantly referred to as technical responses to extreme events (e.g. through coastal protection). The project, however, also addresses impacts on specific elements of the supply chain, and effects on the spatial function of a port (e.g. the changing competitiveness within the European port system). The overall exposition of the Weser-based port system to climate change, regarding extreme events or sea-level rise until 2050 is perceived as moderate. However, an increased occurrence of disturbances of port operations may put the economic position of the industry, e.g. in the European context, at stake. In our understanding, the ability of a specific port to adapt will also encompass the management of regional target conflicts and multi-level relations. Regarding the latter, the limits of exclusively regional approaches in addressing sustainability issues without higher-level support become evident. This touches upon the often mentioned distributive dimension of climate adaptation. Here, the challenge is to ensure the recognition of particularly vulnerable parts of society or societal interests while providing viable sectoral concepts.

Obviously, ports' choices of adaptation measures have consequences for all dimensions of sensitivity to climate change within the region and beyond.

With respect to climate adaptation, other sectors (such as agriculture), functions (such as coastal protection), or societal interests (such as nature conservation) may need different responses to climate change, e.g. regarding water body management. Here, adaptation strategies prioritising the needs of one sector instead of developing integrated solutions could lead to maladaptation in other parts of the society.

With regard to ports, different types of adaptation to climate change could emerge

- a pure ***growth orientation*** reflecting only the sectoral market conditions;
- an ***efficiency oriented version*** focussed on win-win solutions;
- a ***climate proof strategy*** also addressing further societal problems such as climate mitigation.

The latter type would also require a reduced CO_2 footprint of the entire transport system. Although the labels for these strategies are referring primarily to the relation between climate adaptation and climate protection, they also reflect the relation of sectoral adaptation strategies to other interests, such as ecosystem conservation, thereby denoting the degree to which climate adaptation of ports is integrated into broader strategies reacting to pressing societal problems (see table).

	Pure Market	Green Efficiency	Climate Proof
Assets of value chain	• Market solutions	• Energy efficiency • Pilot projects • Moderate proactive	• CO_2 free • Strong innovation • proactive
Critical infrastructure	• Demand side management favouring global players • Capacity redundancies	• Demand-side management favouring integrative solutions • Selective development	• Demand-side management favouring integrative solutions • Modal innovations • Resource conservation

Table: Types of adaptation strategies (blue fields = examples exist)

© *bremenports*

The regional industry claims that about 96,000 out of the 856,000 jobs within the region depend on the port and logistics cluster. The cluster, and particularly its container segment, benefits from its role within the prosperous German export economy. At the core of the cluster are the ports, situated at the Weser estuary and the neighbouring Jade bay. These include, as major twin ports, Bremen and Bremerhaven, the latter characterised by the largest European car-handling facility and the container port that participates in the fierce Europe-wide competition between terminals (Nordrange), and Wilhelmshaven as German crude oil port and location of the new JadeWeserPort container terminal. Further middle-sized ports with terminals specialised on particular goods or industries are Nordenham, Brake and Cuxhaven. In addition, inland-ports exist in Oldenburg and Cloppenburg.

As part of the project activities of nordwest2050, a close collaboration with *bremenports GmbH & Co. KG* and *niedersachsenports* has been established, focussing on climate change and port infrastructures in different regional locations.

Especially within the cooperation with *bremenports*, project work aims to identify and strengthen integrative solutions for port development for all most relevant fields. From the perspective of *bremenports*, climate adaptation has thus a clear link to the challenge of providing sustainable solutions. The agency is beginning to take up the different options, often referred to as green logistics, under the umbrella of its *greenports* vision. Up to now, however, most of these activities remain conceptual, but are hoped to establish the ground for pilot projects.

A further activity is taking place in cooperation the chamber of commerce of Bremen, focussing on learning processes and capacity building within the sector. Here, the actual work takes place within sub-committees of the chamber of commerce and working groups affiliated with the marketing agency *VIA BREMEN*. Furthermore, so-called regional conferences, organised by nordwest2050, and sectoral tradeshows are important for communicating the project results to a broader sectoral public.

Anna Meincke, Joachim Nibbe, Winfried Osthorst
University of Applied Science Bremen

© *bremenports*

The German Port of Lübeck: Adapting to Future Changes

With more than 400,000 transported passengers in 2011, a cargo handling of 26 million tonnes (incl. tare weight) and 300 departures each week, the German public port of Lübeck is the biggest ferry and Ro/Ro-port in the Baltic Sea region. Specialised in handling and storage of forest products, new and used cars as well as all types of rolling cargo, the port is broadly positioned. Due to well-developed road and rail connections to European economic centres, as well as to its access to the inland waterways network, Lübeck is of high significance for both local economy and international transport. The economic crisis hit the German import and export industry significantly: in 2009 the turnover in Lübeck fell by over 16 per cent compared to 31.5 million tonnes of cargo in 2008. For the future, economy experts estimate an increase of cargo handling by up to five per cent/year. Our own valuations assume a significant market recovery until the year 2015 and afterwards a continuous annual increase by three per cent.

For the port's future development it is crucial to be prepared for future challenges, including impacts of climate change. Due to the close position to the seashore, ports are particularly influenced by the sea level. A rise constitutes not only a risk for port operations, but also for the access from the hinterland. Higher base levels of floods and tidal waves constitute an additional danger. Changes in climatic factors such as precipitation, average temperatures or ice and heat days also require observation.

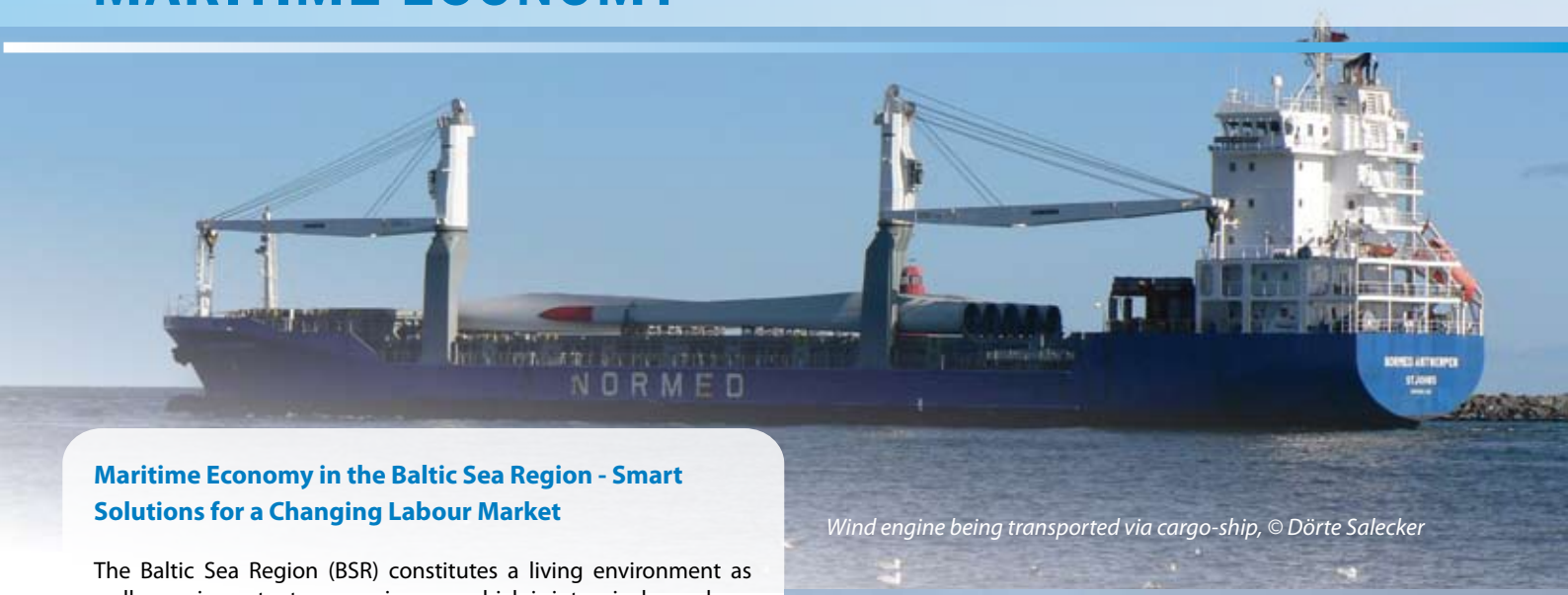
Recent analysis within the framework of the German RADOST project looks at the climate change vulnerability of the port of Lübeck. According to the IPCC scenario A1B (see page 9), in the surrounding area of Lübeck climate change will have a particular influence in winter months. With an increasing amount of precipitation and a possible increase in wind speed and number of storms, disruptions in port operations will occur. In the last century, the average temperature has risen by approximately 0.7 degrees Celcius in the southern Baltic Sea region and may arise up to four degrees until the end of this century. As a result, the amount of snow will decrease and days with a frozen ground and icy roads will become a rarity, implicating mostly positive effects for the reliability of port operations in winter. Sea level rise will remain the biggest risk for a trouble free future port operation. A rise of 14cm in the last century and predicted additional 20 to 60cm until 2100 will necessitate adaptation measures.

Climate change will also entail changes with regard to freight structure. Warmer temperatures in the Baltic Sea region will intensify tourism, especially in the coastal zones. This means more ferries and more transportation of touristic goods but also more traffic of tourists on the access infrastructures.

As one component of the vulnerability analysis, CPL - Competence in Ports and Logistics assesses the consequences of climate change for the ports supra- and infrastructure as well as the influence on freight flows. Especially port facilities and equipment with a long average length of economic life need to be checked. This includes breakwaters, quay walls and the quays itself. It is currently still difficult to develop an exact quantification of the necessary adaptation measures due to the wide range of the expected future climate trends. The life span of many port facilities and the planning horizon for port planner are mostly restricted to the next 20 years, but the projected climate trends mainly aim at the end of the century. As a consequence, future climate impacts do not play any role in investment decisions of port planners so far. However, climate changes are included in building regulations and safety requirements. The height of the quay walls in Lübeck-Travemünde with approximately 2.5 m can be seen as an example, as the assessment of the walls includes a storm surge, an additional wave and 20 cm as a buffer.

Heiko Wenzel & Niko Treptow
CPL - Competence in Ports and Logistics

Terminal Scandinavia Quay, © Lübecker Hafen-Gesellschaft mbH

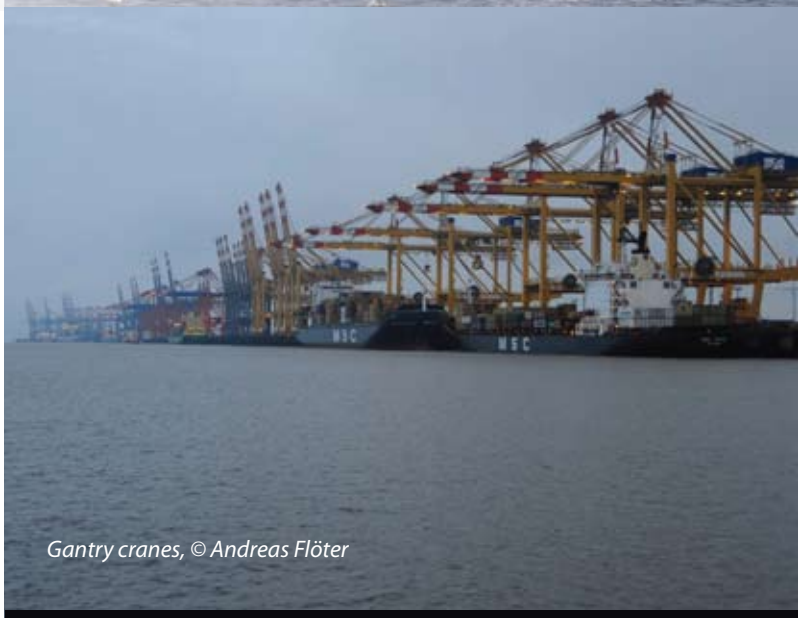


Wind engine being transported via cargo-ship, © Dörte Salecker

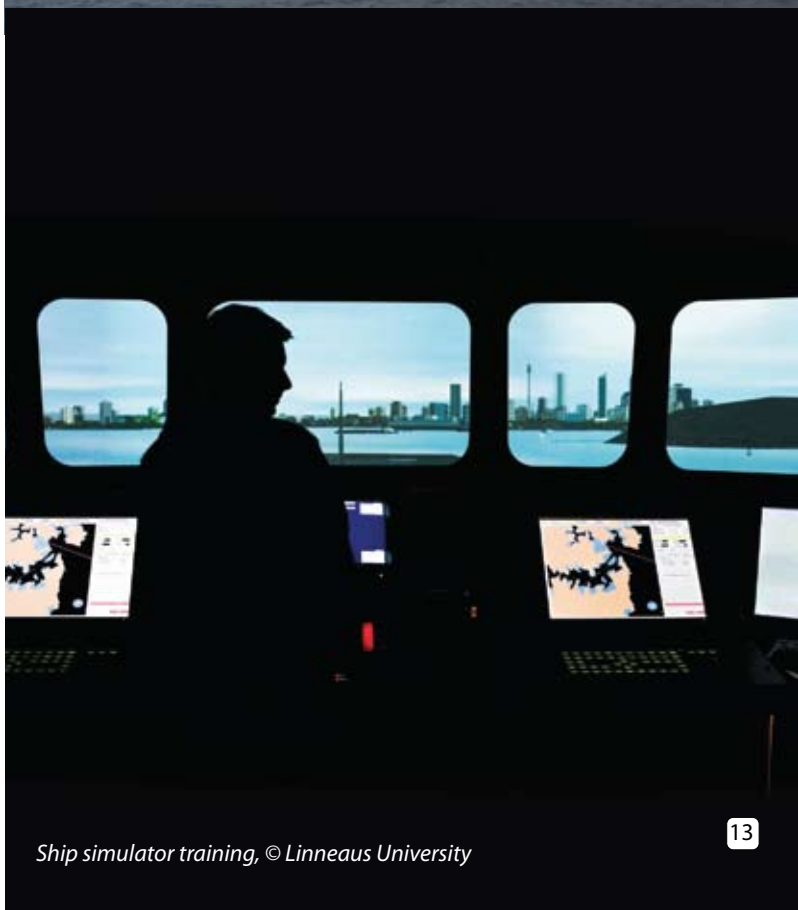
Maritime Economy in the Baltic Sea Region - Smart Solutions for a Changing Labour Market

The Baltic Sea Region (BSR) constitutes a living environment as well as an important economic zone, which is intensively used e.g. for shipping or related services, exploitation of natural / energy resources or for recreation. In coastal regions, the maritime sector is a driver for the present and future economy, and hence for employment ('Blue growth'). But the BSR also has to cope with severe challenges. An increasing utilisation of this ecologically vulnerable region requires common regulations and management strategies for sea- and land-based activities. Further challenges result from globalisation of markets and consequences from global climate change (coastal protection, utilisation of renewable energy sources). Besides traditional segments such as shipbuilding, navigation and fishery, new maritime segments emerge. Segments such as 'offshore wind energy', 'offshore supply' or 'seaport and logistics' have enormous economic potential and will develop fast in the next years. Currently, eight wind parks are operated in the Baltic Sea, more than 30 are under construction or planned, for example a huge offshore park in Blekinge (SE), with 500-700 windmills which shall produce as much energy as one of the most powerful nuclear reactors. The boom in the offshore wind energy segment results in new job opportunities in the Baltic Sea states, not only for engineers and constructors, but also for seaports and logistics (suppliers). Offshore supply is one reason for the increase in traffic in the Baltic Sea. Increase in maritime traffic requires the development of innovative technical solutions, e.g. in wastewater management, green shipping, green harbour management and smart logistical solutions. This shift from industry to knowledge- and innovation-based economy has consequences for the labour market and its educational requirements. Obviously, most of the current academic programmes in the region seem not to prepare their graduates for these challenges and opportunities sufficiently: despite the need for highly qualified personnel, many marine-related graduates have to face unemployment or work in non-maritime related jobs after their study. The development of innovative solutions also requires understanding of multidisciplinary approaches and knowledge on holistic thinking. The EU project 'Generation BALT' provides a chance to close this gap and will give recommendations to improve the existing educational programmes. Based on the results from the study "Foresight of the South Baltic Maritime Labour Market 2017", compiled by the project consortium by acquisition of expert knowledge and desktop research, a pilot supplementary study programme is being developed. Its aim is to improve the existing educational programmes, to harmonise and optimise higher education in maritime-related studies, and hence increase job opportunities in the Baltic Sea Region. Information on the 'Supplementary study programme' and the 'Foresight study' is available on the project website (www.generationbalt.eu).

Manuela Görs & Frank Hansen
University of Rostock



Gantry cranes, © Andreas Flöter



Ship simulator training, © Linneaus University

RENEWABLE ENERGIES

Offshore wind turbines, © Stefanie Maack

How climate change influences the potentials of renewable energy

The natural resources of fossil fuels, such as oil and natural gas are dwindling increasingly because of the rapidly growing energy hunger of our modern society. They are melting like the polar caps and glaciers due to global warming. In view of the finite supplies of fossil fuels and of course from the perspective of climate protection, the development of renewable energy resources needs to be pushed forward. For this reason, the German government initiated a change in energy policy towards sustainable and renewable energy systems. On federal state level, the government of Mecklenburg-Western Pomerania aims for an energy supply being sourced 100 percent through renewable energies by the year 2050. The government of the federal state of Schleswig-Holstein plans a 100 percent renewably sourced electricity supply already by 2020.

Many renewables appear as an infinite source of energy which we never can use up. But just a few promille (solar, wind power) to percents (biomass, geothermal energy) of their natural potential can be used as electricity or heat. The potentials of renewable energies are mainly affected by technological progress and changing political and economical conditions. They are thus being classified as the natural or theoretical, the technical, and the economical potential. The natural potential of a renewable energy source like geothermal, wind or solar energy is defined as the usable part of the energy resource over a period of time and a region according to the physical principles. The technical potential is the part of the natural potential which can be used with state-of-the-art technology considering structurally and ecologically restrictions and legislative regulations. The economical feasibility is excluded. The economical potential is the part of the technical potential which can be used economically competitive. It depends of competitive systems and prevailing conditions of energy prices.

The influence of climate change can change the parameters which are used to specify the different energy potentials. Taking the example of the near-surface geothermal energy, this renewable energy source can be used best if there is water in the underground. Regional climate impacts will - for instance in the south Baltic area - potentially bring less rain in summer and more rain in winter. As a result, near-surface geothermal conditions will worsened in summer whereas in the months of winter, milder air temperatures and more rain will favour conditions for the use of near-surface geothermal energy, allowing for a regional increase of the natural potential of geothermal energy in this period of the year. The technical potential of geothermal energy depends, inter alia, from the laws of water protection. For example, it is not allowed to use geothermal energy collectors in groundwater protected areas. Climate impacts might bring about changes and resulting conflicts for the groundwater balance, forcing the government to establish additional groundwater protection areas. Such a measure would, as a consequence, reduce the number of potential areas for geothermal energy use. Anticipating such a scenario, it could be advisable to explore alternative areas for the use of near-surface geothermal energy, also looking at coastal areas and coastal waters.

Cindy Dengler
GICON Ingenieur Consult GmbH

Coastal underground as a thermal energy source

Geothermal energy is defined as stored heat energy below the solid surface of the earth and is traditionally used for heating purposes. However, the earth or rather the underground offers more options for thermal use as it can also be used as a cold source and even as a thermal energy storage.

Global climate change will presumably increase the mean air and underground temperatures. Geothermal applications can take advantage of these changing temperature regimes by using the stored heat in the ground for a very efficient heating with a heat pump. As not only summers but also winters in the northern part of Germany will most likely become warmer, the overall heating demand will probably be reduced. As a consequence the balance of heat input into the ground in summer and heat extraction from the ground in winter will increase even in northern German climate (today the heat demand is bigger). Therefore a seasonal use of the underground as a thermal storage will become increasingly important.

Heating or cooling with a thermal use of the ground is typically being realised with geothermal heat pumps that are installed within the respective building. For the most efficient geothermal use of the geothermal source system, a good thermal conductivity of the underground is indispensable. Within porous substrates like sand, the presence of groundwater is essential to operate a heat pump cost-effective.

Coastal areas with water saturated sandy undergrounds in direct proximity to the sea fulfill these requirements in an ideal way. For this reason, current research elaborates the geothermal potential of coastal areas. In addition, the possibilities of a direct thermal use of ground- or seawater as well as the possibilities to integrate geothermal technology into coastal protection measures are looked into.

In the frame of such a pilot study, five monitoring wells have been installed at the beach of the German coastal town Warnemünde/ Rostock to acquire hydrothermal parameters of the coastal area (temperature, water level and water salinity). Based on the collected data, a feasibility study and a cost-efficiency study for the combination of a coastal protection measure with technologies for thermal use of the underground will be prepared.

Monitoring data for the period from April 2011 to August 2012 shows the interaction of sea- and groundwater and the seasonal influences at different depths. Those data allows direct conclusions about the feasibility of a thermal use and of the intrusion of sea water into the coastal aquifer.

Furthermore, the monitored temperature and hydraulic data have been used for the calibration of a three-dimensional underground model of the Baltic Sea coast in the region of Warnemünde. With this numerical model, thermal simulations of selected geothermal source systems like horizontal ground loop collectors, vertical spiral heat exchangers and horizontal wells have been conducted.

The first simulation results point towards a very good heating performance of horizontally loop ground collectors placed near surface in the beach area. According to further simulation runs, the best place for a seasonally balanced thermal use (heating and cooling) is in a depth of approximately 2.5 to 4.5 m below a dune. Because of the relatively inexpensive production costs of ground loop collectors, a very good cost-benefit ratio is forecasted for this geothermal system.

The full evaluation of the measured data will be published in a feasibility and cost-efficiency study at the end of 2013.

Cindy Dengler
GICON Ingenieur Consult GmbH
Björn Oldorf & Jan Kuhlmann
H.S.W. GmbH

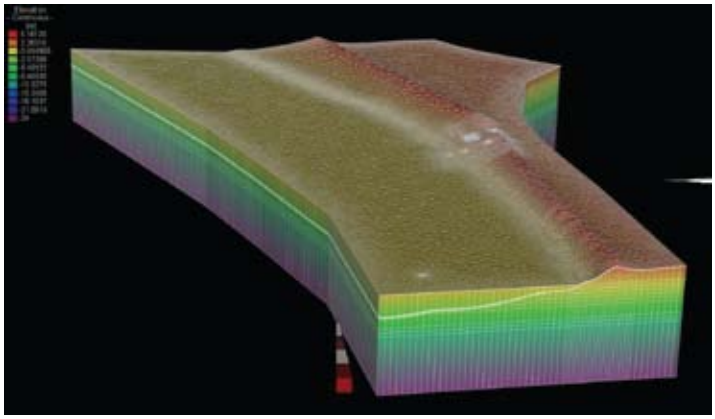


Figure 1: 3d-numerical underground model of the coastline at Rostock-Warnemünde

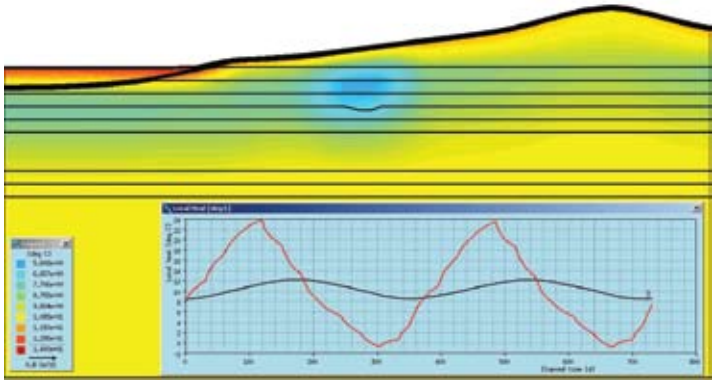


Figure 2: Simulation results for a near surface ground loop collector (timestep: end of heating season)

© Cindy Dengler

Coastal Waters as profitable Renewable Energy Sources

Extensive research on renewable energy is the main object for a clean future. Solar energy, wind and biomass are the most popular candidates being considered, together with geothermal energy source as the main focus for large heat pump installations. Only minor consideration has been given to water with its high heat capacity index as an alternative heat source. However, from a geophysical point of view the heat transfer ability of moving waters is simply unbeatable. The specific characteristics of water initiated a new business, extracting heat from coastal water by a patented heat extraction probe technology. When combining this technique with modern heat pumps, heat can be supplied at low cost to house holdings, industry and municipalities.

Yet, exploitation of heat from water requires large surface areas with high thermal conductivity. Metal sheeted pile walls provide these characteristics in a perfect manner, allowing dual benefit: they guarantee structural stability and can extract heat, and thus generate profit. Coastal infrastructure like seaports, docks, quays and commercial waterfronts are the traditional fields for sheet pilings, worldwide installed by millions of tons and hundreds of square kilometres every decade. Hence, in port areas, the virtually inexhaustible heat source of the marine water body - heated from sun, moved by thermohaline forces, wind and tidal power - meets the giant exchanger of sheet pilings. Such pilings, if perfectly adopted as thermal probes, enable to exploit the energy in the sea and provide clean power for heating economically, at low cost, with unsurpassed durability, and last not least virtually invisible. The front of quays, embankments or seaports remain unchanged, while their thermal probe containing backside is hidden and protected inside the soil body, giving the lowest possible impact on ecosphere and environment (see top picture).

A first river based small scale pilot project has been erected by SPS Energy GmbH for technical optimisation, delivering the design fundamentals for large scale installations (see bottom picture). Numerical simulation delivered excellent results for the concept (see figure).

Heat exploitation rates of more than 800 W/m^2 of sheeted pile walls are reputed to be achievable, which has already been backed up and even beaten by measured data at the mentioned pilot project. Yet it is clear: seaport infrastructure has the ability to easily provide clean heat, well above mega watt scale. Newest calculations show the competitiveness of the specific SPS-Energy sheet pile probes, combined with state-of-the-art heat pump technology, supplying the heat to an appropriate district heating system. For a typical Baltic seaport with recently flourishing harbour activities and a modern district heat system (60°C at 1.5 MW peak power request), the commercial benefit can be well above 10% internal rate of return (IRR). This comprises already the complete combined system and its total installations. Based on SPS-Energy probes, the German company BIXX Renewables GmbH currently designs a district heat grid with a peak load of 1,5 MWth in Northern Germany.

Bernhard Puttke
SPS-Energy GmbH

Quay Wall at Rhine River Port , © iStockphoto.com

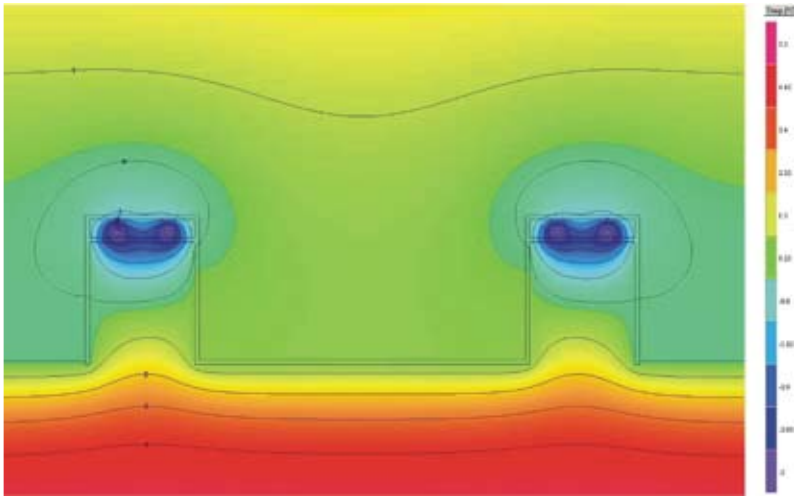
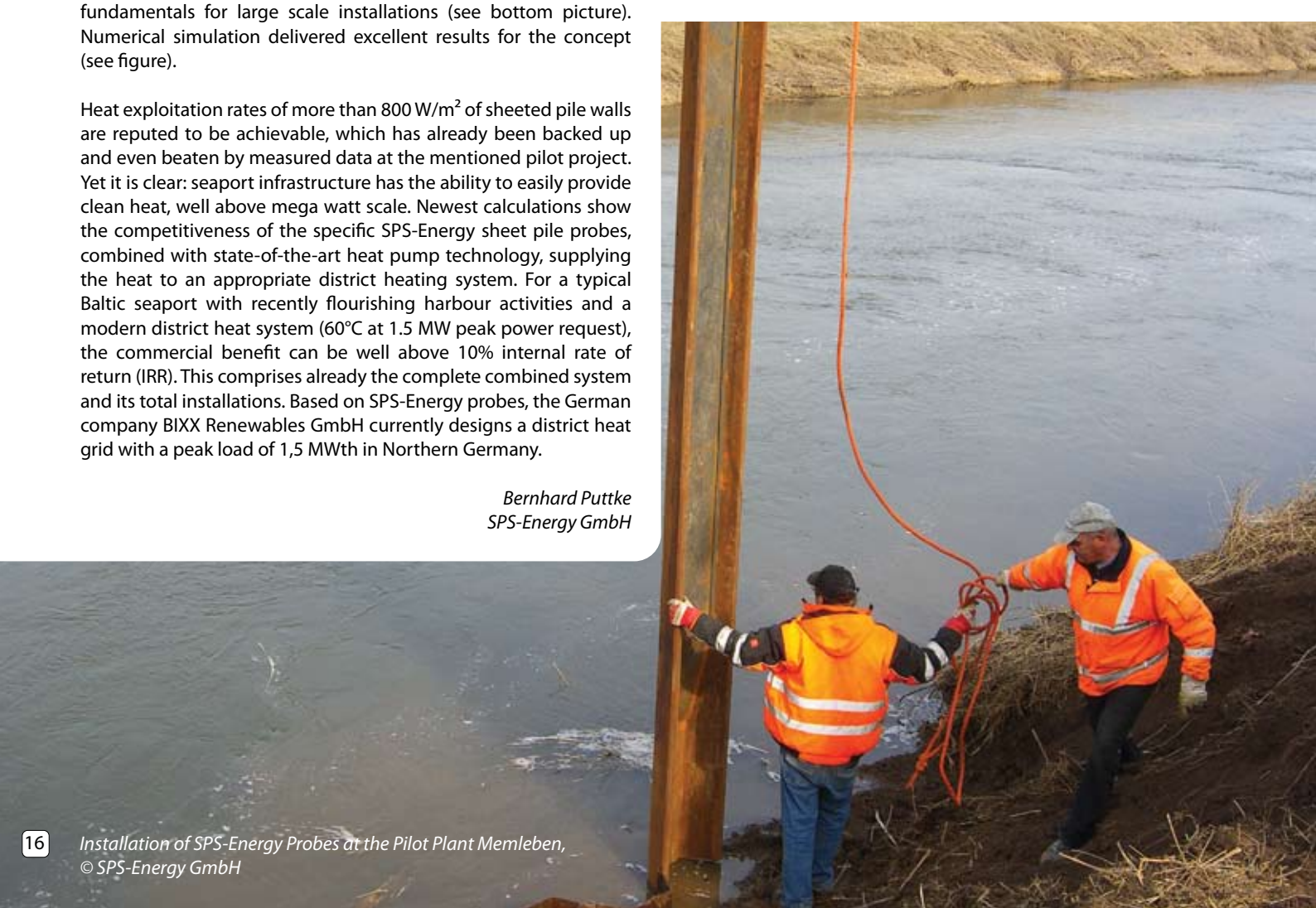


Figure : Temperature distribution around SPS- Energy Probes at river banks, computed by numeric simulation [lower part representing the soil with low thermal conductivity, upper part demonstrating the unsurpassed ability of flowing waters to provide optimum heat transport mechanism (Source: H.S.W. Rostock)]



Installation of SPS-Energy Probes at the Pilot Plant Memleben, © SPS-Energy GmbH

Wave Power: New opportunities for the Baltic Sea Region

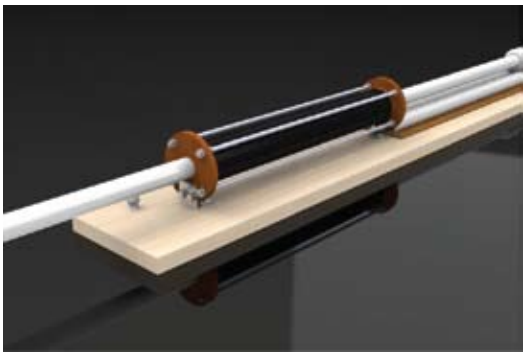
The European Ocean Energy Roadmap for 2010-2050 provides estimations that 300 kg of CO_2 could be avoided by each MWh generated by ocean energy. Therefore, for 20 GW (49 TWh/year) of installed ocean energy, the CO_2 emissions avoided could be 14.5 Mt/year. In addition, as wave energy devices have the potential to absorb energy generated by waves, they can reduce the destructive power of waves on unsheltered sandy coasts, and thus coastal erosion.

In general, wave energy is being recognised as suitable for steadier and more predictable energy production, high power density, a relatively high utilisation factor, low visual impact and presumably lower impact on the environment compared to other renewable sources. The gross European wave energy resource is estimated to be approximately 300 GW.

Even though quite a number of technologies for electricity production from wave energy have been tested since the end of the last century (e.g. in the UK, Portugal and Norway in Europe, Australia, Canada and USA), wave power remains difficult to utilise due to technological risks and high costs. The key issues affecting wave power devices are survivability in violent storms; vulnerability of moving parts to sea water and fouling; capital cost of construction; costs of connection to the electricity grid; operational costs of maintenance and repair.

Though the Baltic Sea is a basin with relatively low wave power density, it is nonetheless still auspicious for wave energy developers focusing specifically on local energy markets or on the combination of wave energy with other sea uses. For rough weather conditions (wind speed ~ 25 m/s, mean wave height of 3.5 m, mean wave period of 8.4 s) the wave power density in the Baltic Sea can reach more than 50 kW/m or an annual average wave energy density of 2 kW/m^2. Estimations prove that the potential energy generated by Baltic Sea waves is sufficient to be utilised at both small and large scales. However, the amount of wave energy that may be utilised in an economic way is dependent on a number of additional factors, not only wave regime and potential: technology selected/developed; energy transmission distance; possibility to combine with other sea uses, i.e. using the same grid system and infrastructure.

If talking about Baltic Sea Region experience, a Danish pilot project was among the first wave energy pilots in the world. Sweden, Finland and recently Germany have also made attempts to test and install wave energy prototypes. However, with the Danish and Swedish pilots being placed in the North Sea, only Finland (WaveRoller) and Germany (prototype at the island of Usedom) have made attempts to test wave energy prototypes offshore in the Baltic Sea. Thus, no substantial testing has been undertaken or is available in Baltic Sea conditions. So far, the knowledge developed in the Baltic Sea Region is mainly being exported outside.



The heart of small scale wave energy systems (A. Pašilis

Submariner (http://submariner-project.eu), a project within the EU Baltic Sea Region Programme, aims to cover the knowledge gap concerning the wave energy potential for the Baltic Sea. A new concept and prototype of a linear energy generator is being developed and tested in Baltic waters. Newly developed technical concepts and proposed implementation solutions prove that even relatively low wave energy basins such as the Baltic Sea are suitable and commercially profitable for electricity generation from this source of renewable energy. New low cost and high capacity factor generators (single and arrays) prove to be of great practical importance when providing electricity to offshore installations, hydrographical boys and navigation signs. The concept is intended to meet small-scale utilisation projects, which have not yet been sufficiently covered. This might unlock the opportunities for other 'low wave energy' basins in Europe and worldwide.

Nerijus Blažauskas
Klaipėda University Coastal Research and Planning Institute

Barnacle Geese, © Axel Schulz

Birds and offshore wind farms – a double-edged sword?

Scenarios predicting a loss of biodiversity through global warming are among the most convincing arguments why man-kind should be drastically cutting carbon emissions. Offshore wind power holds great promise for climate change mitigation. However, as offshore wind farms increase, so do concerns that wind turbines could pose a threat to the marine environment, including birds. Researchers are beginning to answer basic questions about what may happen to migratory birds crossing the open sea. The sheer abundance and diversity of birds combined with their unrivalled abilities to fly and migrate mean that there is hardly a spot on the globe where no birds are found. From the wilderness of the polar regions, across arid deserts and vast oceans, over the highest mountain tops, into the centres of our cities – birds, especially migrants, are adapted to an amazingly wide range of environmental conditions.

Bird migration has evolved under the influence of seasonal fluctuations in food availability, resulting in behavioural routines and physiological adaptations that perfectly match the timing of the seasons and the geography of suitable habitats. Human-caused climate change is rapidly altering this delicate balance. Migratory birds are particularly sensitive indicators of climatic change. In fact, advances in the timing of spring migration, as witnessed on the island of Heligoland in the North Sea, are among the best documented biotic responses to recent climate change, and mismatches between migratory birds and their prey are becoming evident in some breeding populations. The combined effects of changes in resource availability and spatio-temporal changes in species distributions will determine the viability of populations and species as global warming continues.

Climate change concerns and the need to reduce carbon emissions are driving considerable growth in the renewable energy sector, spurring plans for large-scale offshore wind farms. At the same time, there is growing awareness that offshore wind turbines will affect birds in one way or the other.

Birds crossing or inhabiting the open sea may be affected by offshore wind farms in three basic ways:

1. Collision – Birds may be injured or killed by colliding with wind turbines. The risk of birds colliding with vertical structures is predicted to be higher in environments that lack anticipatory visual cues. Birds crossing the open sea may be particularly prone to collisions at night when visibility is low. Because searching for carcasses beneath wind turbines is unfeasible under offshore conditions, most impact assessments are based on indirect measures of collision probability. Moreover, conventional visual, acoustic and radar-based surveys do not accurately account for the number potentially affected individuals at the species level, which is decisive information for assessing species-specific vulnerabilities and population effects.

2. Avoidance/Displacement – Migratory birds may avoid flying through wind farms, resulting in longer flight routes, which can incur higher energetic costs. Radar surveys have shown that marine ducks may circumvent offshore wind farms, but the energetic consequences and cumulative effects remain to be investigated. The avoidance of wind farms by staging or wintering water birds is termed displacement. Displacement can be temporary (e.g. during construction) or permanent.

3. Attraction: Nocturnal migrants may become attracted to artificial lights on wind turbines, leading to a higher collision risk. Moreover, staging water birds may be attracted by habitat changes, e.g. through improved food availability in wind farms.

Empirical evidence for the order of magnitude of these effects is still circumstantial, and many open questions remain to be answered.

Most birds migrate at night. To assess avian collision risk in an offshore setting, birds need to be quantified within the rotor swept zone and set into proportion to overall migration rates. A dedicated avian radar system funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and installed on the research platform FINO 1 next to Germany's first offshore wind farm in the North Sea (and on FINO 2, near the second Baltic wind farm) operates on the basis of defined detection volumes, allowing continuous quantification of different groups of night-migrating birds. The design of this ongoing long-term study includes alternating measurements within and outside the wind farm, enabling the analysis of avoidance rates and phototactic aggregations of migrants under various weather situations. The presence and performance of birds within the rotor swept zone can be detected with motion-controlled infrared cameras system mounted onto the nacelle of a wind turbine. Through this approach, disoriented birds can be ground-proofed and set in relation to migration rates detected by radar. First results combining data collected by radar and night-vision cameras show that birds may get attracted by wind farms at night when visibility is low. However, these events seem to be relatively rare. Moreover, this phototactic attraction seems to be offset to some extent by micro-avoidance in response to running turbines. More long-term data are needed to test the effectiveness of mitigation measures such as operational controls (shutting down wind turbines during peak migratory periods) to limit potential impacts on birds.

Unbiased, reliable information is a powerful tool for promoting acceptance of renewable energy technologies. Station-based surveillance of birds' presence in conjunction with information on bird signals derived from large-scale weather radar networks has the potential to create base-line data that can be effectively used to inform policy makers and to improve planning, approval and mitigation processes. However, without a detailed picture of bird migration throughout the annual cycle and an in-depth understanding of migratory connectivity, we will not be able to predict how human activities will impact populations. It is likely that mortality of birds caused by collisions with offshore wind turbines will rarely exceed mortality caused by other generally accepted human activities (e.g. traffic, agriculture) and structures (e.g. windows, power lines). Nevertheless, new wind farms need to be carefully planned to minimize additional pressure on wildlife in a rapidly changing world.

Timothy Coppack, Tobias Dittmann, Axel Schulz, Alexander Weidauer
Institute of Applied Ecology (IfAÖ GmbH), Rostock, Germany

BirdScan radar at wind park alpha ventus, © Timothy Coppack

Migrating cranes, © IfAÖ GmbH

REGIONAL PROJECTS INVOLVED

RADOST (2009 – 2014)
Regional Adaptation Strategies for the German Baltic Coast

Climate change is confronting the German Baltic Sea coast with the challenge to develop suitable adaption strategies. RADOST aims at developing these strategies in cooperation with science, economy, administration and the public. The project is equally about minimising damage to business, society and nature as well as about making use of the development opportunities provided by the change. It further strives for the permanent establishment of stakeholder networks and communication structures in the region and beyond. Regional implementation projects in cooperation with partnerswill demonstrate exemplary adaptation measures, compromising amongst others the following topics: Innovative coastal protection, adaptation measures for tourism and ports, aquaculture, optimisation of ship hulls, combination of coastal protection and use of geothermal energy. RADOST is one of seven projects funded by the German Ministry of Education and Research within the ministry´s initiative KLIMZUG ("Regions adapt to climate change"), which supports selected regions in Germany in the development of innovative approaches to climate adaptation. A central goal is the creation of long-term, sustainable cooperative networks for regional stakeholders. **www.klimzug-radost.de**

Baltadapt (2010 – 2013)
Baltic Sea Region Climate Change Adaptation Strategy

Adaptation strategies are needed to cope with the inevitable consequences of climate change. The EU Strategy for the Baltic Sea Region (EUSBSR) recognizes this necessity and calls for the development of a macro-regional climate change adaptation strategy for the Baltic Sea Region. Focussing on the marine and coastal environment, the project Baltadapt is developing such a transnational strategy and an action plan as the operational basis for implementation. By involving decision makers on the transnational, national and regional level into the elaboration of the strategy as the basis for a subsequent political endorsement, the project facilitates a knowledge-brokerage process between research and policy, thus contributing to improved institutional capacity. Furthermore, the project is developing the Baltic Window, an information portal connected to the CLIMATE-ADAPT platform. **www.baltadapt.eu**

Part-financed by the European Union (European Regional Development Fund)

GenerationBALT (2011 – 2014)
Linking maritime education with the changing job market for a new generation of Baltic Sea experts

The EU-project GenerationBALT is a cooperation of higher education institutions and maritime business associations from Germany, Lithuania, Poland, Sweden and Russia. Its objective is to boost the South Baltic Region's maritime economy by upgrading and harmonising the maritime curricula. Based on a foresight study defining the maritime sectors with the largest development, GenerationBALT is launching a supplementary training programme to meet the demands of an innovative maritime labour market. The programme is designed in collaboration with trade experts and business associations. Besides taking courses on maritime topics, participants will be able to explore internship and career opportunities with a number of private and public sector maritime organisations. **www.generationbalt.eu**

Linking maritime education with the changing job market for a new generation of Baltic Sea experts

Part-financed by the European Union (European Regional Development Fund)

nordwest2050 (2009 – 2014)
Prospects for Climate-Adapted Innovation Processes in the Metropolitan Region Bremen-Oldenburg in North-western Germany

nordwest2050 develops climate adaptation strategies for the model region Bremen-Oldenburg in the northwest of Germany. The project analysed the climate vulnerability for the economic sectors food industry, energy production & distribution and port management & logistics. The assessment provided knowledge about innovation opportunities and led to 16 implemented projects. nw2050 now develops so-called sector-oriented roadmaps of climate adaption being consolidated into a long-term roadmap of climate adaptation strategies until 2050 for the Bremen-Oldenburg region. Practical adaptation measures are going to be developed in response to current and approaching climate changes until 2020. A participative approach was used to include different interests of various stakeholders and expert knowledge. nw2050 further supports regional policy processes by offering advice, building networks and demonstrating possible solutions. **www.nordwest2050.de**

SUBMARINER (2010 – 2013)
Sustainable Uses of Baltic Marine Resources

The Baltic Sea Region faces enormous challenges including new installations, fishery declines, excessive nutrient input, and the effects of climate change as well as demographic change. But novel technologies and growing knowledge also provide opportunities for new uses of marine ecosystems, which can be both commercially appealing and environmentally friendly. Through increased understanding and promotion of innovative and sustainable new uses of the Baltic Sea, SUBMARINER provides the necessary basis for the region to take a proactive approach towards improving the future condition of its marine resources and the economies that depend on them. **www.submariner-project.eu**

Part-financed by the European Union (European Regional Development Fund)

EUCC - The Coastal Union Germany (EUCC-D)

EUCC-D was established as a non-governmental association in 2002, forming the German branch of the Coastal & Marine Union (EUCC), the largest European coastal and marine organisation. The main objective of EUCC-D is to strengthen German activities within the field of Integrated Coastal Zone Management (ICZM) by bridging the gap between coastal science and practice. EUCC-D provides relevant information, consults and educates coastal practitioners, hosts workshops and conferences and runs demonstration projects in the field of coastal and marine management. We develop information systems, create tools (e.g. databases, learning modules) for international networks and disseminate coastal and marine information via our German Küsten Newsletter or in shared media with our international colleagues. EUCC-D offers memberships for professional and private individuals, and other non-profit organisations. The German membership also includes membership with EUCC International. Please visit **www.eucc-d.de/mitgliedschaft** for more details.