

The background of the cover is a photograph of a wetland or marsh area. In the foreground, there is a body of water with tall green reeds. In the middle ground, a small wooden boat with three people is on the water. The background is filled with various green trees and vegetation, all reflected in the water. The overall scene is peaceful and natural.

ANNUAL REPORT

2009

**DHI** 

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## ABOUT DHI

DHI is an independent, international consulting and research organisation established in Denmark and today represented in all regions of the world. Our objectives are to advance technological development, governance and competence within the fields of water, environment and health.

We offer a wide range of consulting and policy services as well as leading edge technologies, software tools, chemical/biological laboratories and physical model test facilities including, field surveys and monitoring programmes.

DHI is a member of the GTS - Advanced Technology Group, a network of independent Danish research and technology organisations authorised by and collaborating closely with the Danish Ministry of Science, Technology and Innovation on technology based promotion of trade and industry.

DHI works with governmental agencies and authorities, contractors, consulting companies and a wide range of industries. We are approximately 950 staff working worldwide and on all continents.

## BOARD OF DIRECTORS

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Researcher, DHI

### **Gitte Lindholt\***

Accountant, DHI

### **Vibeke Salmon\***

Secretary, DHI

*\* Employee representative.*



River Niger in Niamey  
Front page: Jens Kristian Lorup, DHI  
p3: Corbis  
p4: Jens Kristian Lorup, DHI  
p5: iStock  
pp15: Lennert Carlsen  
p18: Ole Søndergaard  
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DHI stands stronger than ever before – ready to meet the challenges and opportunities related to the increased importance of water on the global agenda, and the environmental and health aspects of water use, of climate change and of industrial production and products.

We continued on a very healthy growth path in 2009 – and we had a record financial performance, amidst a global financial crisis. We were not immune to the ramifications of the financial crisis – it did have a negative impact on our business in some areas - but there were plenty of positive outcomes from other quarters to compensate for the crisis effects.

In our solutions business DHI experienced a very busy year at the headquarters in Denmark because of a number of large and long term contracts, which included:

- Marine environmental studies to support the planning, design and construction of the Fehmarnbelt Link (a 20 km bridge/tunnel crossing of the Baltic Sea between Denmark and Germany).
- A World Bank financed contract to develop a decision support system for the nine riparian countries in the Nile River Basin
- Development and implementation of two large river basin planning, management and forecasting systems for applications in India (likewise financed by the World Bank).

The two contracts in India are also generating substantial activity for DHI India. Furthermore, we experienced the stabilising effects of having globalised our organisation. Some countries in Asia continued to have solid economic growth in 2009.

This included Singapore, China and India where we had a very impressive performance.

Furthermore, our software sales, dominated by the DHI product family MIKE by DHI, performed better than anticipated.

All in all it was a very satisfactory year with a gross growth in revenue of 22% to 724 million DKK, and an operational profit increase from 12 million DKK (2008) to 35 million DKK. Profit after tax was 29 million DDK in 2009.

We are continually expanding our global network of offices and - in our further development of DHI's knowledge and technology - we continue to improve our ability to derive benefits from the growing network of offices and the expanding competent global staff (now approaching 1,000 people). With the setup and registration of DHI Brazil we now add local production to a long project based presence in the country, and in South Africa we acquired the ownership of a company, which had been DHI's local partner for a number of years, CPH Water - now known as 'DHI SADC.

At the time of writing this summary we are a couple of months into 2010, which started on a very positive note – and we are looking forward to another good year for the DHI Group.

Asger Kej  
CEO



The DHI policy unit assists governments and institutions to address their challenges through improved governance and integrated management. The assistance is often rendered in a partnership arrangement and covers areas such as diagnostic water resources assessments and institutional analyses, policy dialogues and formulation, legislation and overall sector reforms.

In 2009 the unit was involved in numerous projects related to the implications of climate change, for instance in Ghana and Cambodia.

**Ghana adapts to climate change impacts on water resources**

Ghana foresees significant decreases in water resource availability as a consequence of climate change. The already dry north with many small scale farmers depending on traditional irrigation for their livelihood is in particular threatened. DHI has been retained to look at potential impacts and the consequences for irrigation in the northern dry areas. A strategy for providing adequate water for irrigation at small farm level and, at the same time, looking at various water conservation methods is under preparation. Further, Ghana’s Water Resources Commission receives assistance to involvement of communities in development of adaptive measures and coping strategies. Flooding is one of the areas where adaptive measures are proposed, in particular relating to responses and information services. At the larger scale Ghana receives assistance from DHI in modelling the White Volta River Basin to study availability, variability and demands under different climate change scenarios.



**Coastal vulnerability in Cambodia**

The overall goal of this programme is to reduce coastal vulnerability to climate change impacts from flood, drought and changes in precipitation on agricultural systems and ecosystems in the coastal area. This will be done by providing policy advice at the national level, scientific tools for proper adaptation planning, and demonstration through resilience strengthening at the community level. The programme seeks to implement top priorities identified in the National Adaptation Programme of Action to Climate Change (NAPA) in Cambodia. This was developed to prepare an achievable country-driven programme of action and priority activities, which address the needs of Cambodia to adapt to the adverse effects of climate change. Consistent with the multisectoral nature of the adaptation challenges as well as with the orientations of the government with regard to coordinated development assistance a programmatic approach was employed. The Programme will function at national, provincial and community levels in the four coastal provinces of Cambodia. The Programme implements the Cambodian NAPA priority number 3G, 4B and 2. The Programme proposes to do so by strengthening national policy regarding the coastal area, regulatory and institutional coordination for managing climate change adaptation, by preparing a vulnerability assessment and adaptation planning for coastal zone adaptation programmes, and by demonstrating coastal flood control measures and ecosystem based resilience measures for livelihood improvement.

The programme implementation will strengthen the National Climate Change Committee and Climate Change Department and other key stakeholders focusing on the coastal area. It will be supported by funds from the Least Developed Countries Fund and the newly established trust fund under the Cambodian Climate Change Alliance (CCCA), with this programme representing the coastal adaptation and resilience planning component. The CCCA Partners are the European Commission, Sida, Danida, UNDP and UNEP.



Our North American, Australian and New Zealand operations work across all three arenas of DHI (projects, products and policy). We work in technical governance and river basin management, projects addressing long term climate hydrology and hydraulics through to offshore and urban wastewater. We represent major software markets for the group and have a dedicated software sales and support team.

Across our region, our fields of endeavor are broadly similar, along with the cultural, regulatory and business environments. With approximately 80 staff spread across 10 main offices and 11 hours of time zone, we face considerable challenges in coordinating our efforts but many projects and staff exchanges have been successfully undertaken through 2010.



Looking forward, this interaction and support is certain to increase as we offer our combined expertise in DHI's unique blend of technologies and knowledge to our clients and partners.

A few of our highlights from 2009 are presented below:

#### **Technical governance - Risk MAP (USA)**

DHI is a subcontractor to Accenture, LLC on the FEMA Risk MAP Program Management Contract, providing technical and program expertise along with regional leads in New York, NY (Region II), Atlanta, GA (Region IV), and Denton, TX (Region VI). We are supporting Accenture to deliver oversight and management from the project level all the way up to a programme-wide view, supporting the establishment and maintenance of mutually beneficial partnerships, improving efficiencies, assisting in the establishment of a national Risk MAP outreach strategy, assisting with developing and implementing internal and external communication strategies, and supporting the implementation of a risk management oriented business architecture.

#### **Estuarine outfall management - Gold Coast Seaway Smart Release (Australia)**

Gold Coast Water is responsible for the management of the water, recycled water and wastewater assets of the City of the Gold Coast on Australia's east coast. Excess treated recycled water is released at the Gold Coast Seaway, on an ebbing tide in order for the recycled water to be dispersed out to sea before the tide changes and re-enters the Broadwater estuary. The Seaway Smart Release Project was designed to optimise the release of the recycled water from the Coombabah WWTP in order to minimise the impact to the receiving estuarine water quality and maximise

the cost efficiency of pumping. In order to achieve this, DHI has undertaken the development of a real time Decision Support System which optimises the release on a daily basis. The study involved intensive hydrodynamic and water quality monitoring, numerical modelling and a web-based decision support system. An intensive monitoring campaign provided information on water levels, currents, winds, waves, nutrients and bacterial levels within the Broadwater. This data was then used to calibrate and verify numerical models using the MIKE by DHI suite of software. The Decision Support System collects continuously measured data such as water levels, interacts with the WWTP SCADA system, schedules numerical models and provides an optimal time window to release the required amount of recycled water from the WWTP within the licence specifications.

#### **River entrance flood and morphology - Opotiki River Entrance Study (New Zealand)**

The township of Opotiki is located at the confluence of the Waioeka and Otara Rivers in New Zealand's Bay of Plenty, about 1 km from the coast. The township has been subjected to flooding in the past and is currently protected against a 100-year flood by high embankments on both rivers. Water levels near the confluence are elevated due to the alignment of the two rivers which approach each other head on, causing significant turbulence and head losses at the junction. Increasing the level of flood protection could be realised through the construction of a bend cut channel, that will streamline the flow. The construction of such a channel may, however, lead to undesirable morphological changes. A MIKE 21C curvilinear hydrodynamic model with morphological bed updating was used to investigate the confluence. Several bend cut channel layouts were tested with different widths and invert levels, and the design flood level reduction was identified for each layout along with the long term morphological impact.

#### **Climate change - Okanagan Basin Water Accounting Model (Canada)**

The Okanagan Basin is located in the interior of British Columbia and spans almost 200 km (~125 miles) from the Osoyoos in the south to Armstrong in the north, covering an area of 21,600 km<sup>2</sup> (~8350 mi<sup>2</sup>). The climate is generally dry because the basin lies in the rain shadow of the coastal mountains, and due to natural environments and competing water demands, only a small fraction of the precipitation that does fall will make it to the lakes.



The goal of the project is to provide a best estimate of present and future water need and availability, taking into account population growth, climate change, land use change, preservation of the environment and other factors. As part of this project, the Okanagan Basin Water Board is conducting a Surface Water Hydrology and Hydrologic Modelling Study with DHI's MIKE SHE model. The final results of the model will be uploaded and available through the OK Water Database, a central repository of water data for the basin. The results of the future modelling scenarios will be used to help shape water resources management policies for the Okanagan Basin, and the model results will be made available via a web portal as a public communication tool to support the policy development process.

### **Large scale wetland management - Macquarie Marshes (Australia)**

DHI has recently undertaken a number of modelling studies of semi-arid wetland systems in the Murray-Darling basin using the MIKE suite of hydrodynamic models. These studies are helping decision makers to better manage these systems using limited available supplies of water to improve ecological outcomes. One such study concerns the Macquarie Marshes, which is a semi-arid wetland system on the Macquarie River in western New South Wales. Parts of the wetland system are listed under the RAMSAR convention and are of international importance. In the Macquarie Marshes study DHI is developing a large scale linked 1D/2D MIKE FLOOD model of the whole marshes, which covers approximately 180,000 ha. The MIKE 11 1D model represents the main flow channel network,

while the MIKE 21 2D model represents overland flooding on the floodplain. MIKE FLOOD provides a dynamic coupling between the 1D and 2D models. The model will be used to increase understanding of the complex hydrodynamic behaviour of the marsh system, test a range of water delivery scenarios and provide data for the development of a long term hydrology model of the marshes.

### **Wet weather wastewater - City of Los Angeles Wet Weather MIKE URBAN Model (USA)**

As part of the ongoing commitment to protect the public health and environment, the City of Los Angeles is initiating proactive measures to minimise and mitigate spills from the wastewater collection system network. The City is working with DHI to develop a dynamic hydraulic model of the City's entire primary sanitary sewer system. The City has a large, complex wastewater collection system serving close to 4 million people in 550 square miles of service area. When completed, the model will contain over 10,000 pipes. The model has been calibrated to both dry and wet weather flow. The completed model of the City's collection system is a valuable decision-making tool for assessing system response to current and future loading conditions, and for identifying problems such as areas of insufficient capacity.

We foresee a greater need for technology-based solutions as clients and partners look to smart ways of managing water and environment, from smart cities to smart agriculture and lowering of health risks. DHI is well positioned with our unique blend of people and technologies to meet these emerging demands across our regional markets.



Despite the financial crises in 2009 DHI experienced many promising market developments.

## Fehmarnbelt Link between Germany and Denmark

In September 2008 Femern Bælt A/S appointed three DHI lead consortia for the hydrography, marine biology and bird aspects of the Environmental Impact Assessment (EIA) work for the fixed Fehmarnbelt Link between Denmark and Germany. Furthermore, DHI is partner in the consortium addressing marine mammal EIA aspects.

The work in 2009 focused on providing baseline information for the EIA, including the launch of an advanced fixed station monitoring system with three main stations. These stations include complete hydrographic instrumentation and are supplemented by 10 nearshore stations with turbidity sensors. Furthermore, monthly hydrographic cruises, dedicated sea bed form, benthic fauna and flora and habitat mapping are carried out. Also acoustic methods, image analysis and remote sensing, and bird observations using telemetry, traditional observations and radar technology were applied.



Extensive work was undertaken to assess the effect on the fixed link structures on flow and mixing, affecting conditions on a local and Baltic Sea scale. For this purpose a combination of physical laboratory tests, observations at other bridge structures and CFD modelling was applied. The results are now being built into 3D models to assess potential impacts on the local and regional scale.

## REACH

DHI was awarded a large number of projects related to the EU REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals).

## Decision Support Systems

DHI developed the ES Modifier software tool, which can be used by companies to formulate industry to scale and generate exposure scenarios for mixtures. The tool has been developed in cooperation with the confederation of Danish Industry and the Dutch institute TNO and is financially supported by the Danish EPA.

In 2008/2009 DHI was awarded three large scale Decision Support System (DSS) projects funded by the World Bank. Two projects in India and one for the Nile Basin in Africa. The countries along the Nile have embarked on the Nile Basin Initiative (NBI). The NBI is governed by the Council of Ministers of Water Affairs of the Nile Basin states and seeks to develop the river Nile in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security. The vision is to achieve sustainable socioeconomic development through the equitable utilization of, and benefit from the common Nile Basin water resources, leading to a Strategic Action Program (SAP) to translate this vision into concrete activities and projects. As a first step in this process, transparency in data, information and decision making is crucial. To this end DHI is developing the Nile Basin Decision Support System to support water resources planning and investment decisions in the Nile Basin, especially those with cross-border or basin level ramifications.

The system comprises an information management system, a regional river basin modelling system, and a suite of analytical tools to support multi-objective analysis of investment alternatives.

### **FEFLOW conference**

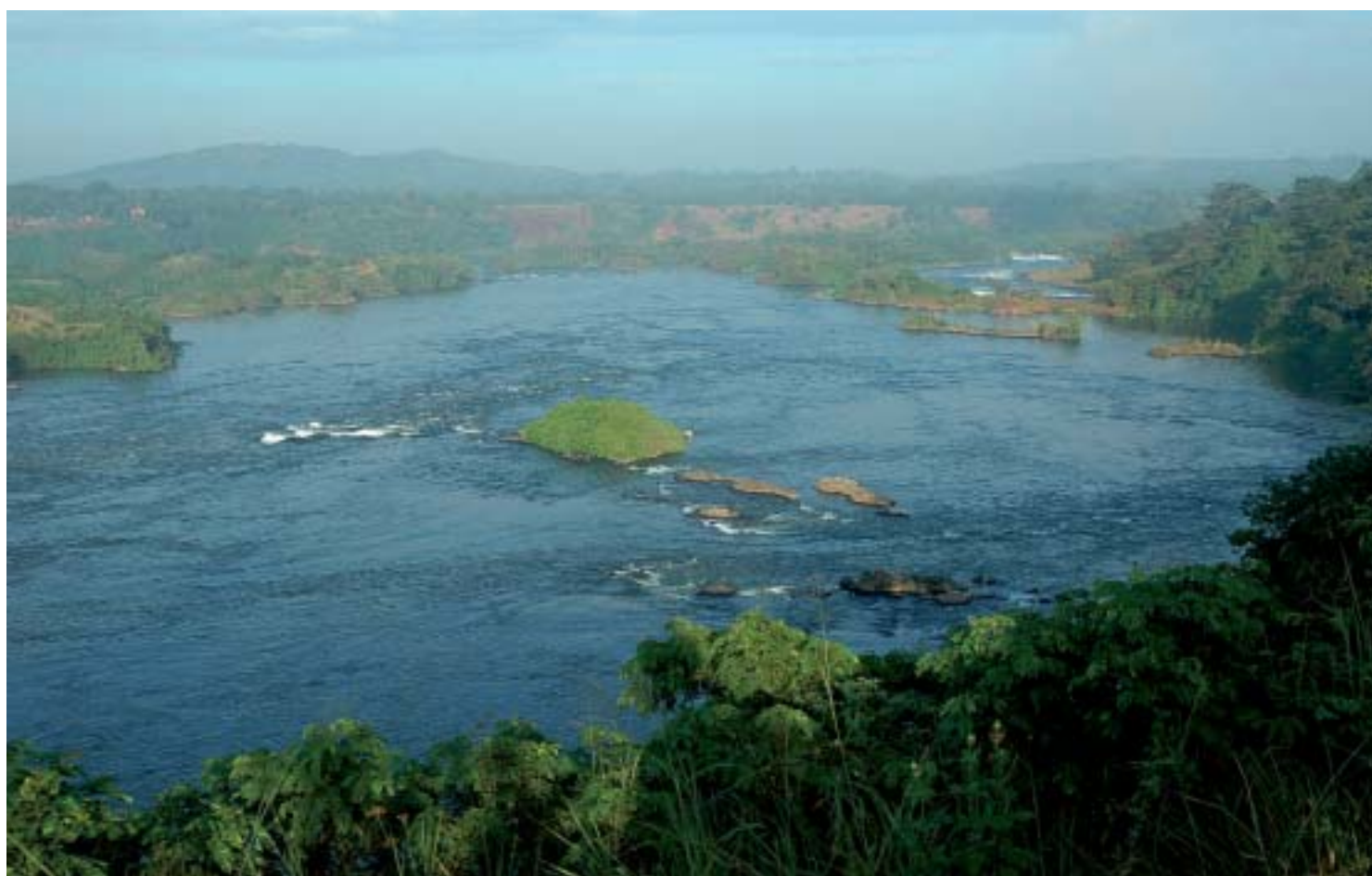
The 2nd International FEFLOW Conference, which was held in Germany, got positive feedback from users. A new and significantly improved version of FEFLOW was released in connection with the Conference as well as a new Elbe-Expert-Toolbox for decision support for the Elbe river basin. Furthermore, important contracts covering implementation of the EU Water Framework Directive and the EU Flood Directive in Germany were signed.

### **Climate change adaptation project, Romania**

A climate change adaptation project for the management of one of Romania's most important rivers, the Mures, was carried out in Norway together with the Czech business unit. This research project helps, among other things, the Romanian authorities to adapt to climate changes. The methodology will be used elsewhere in Romania.

### **Decision making tool for Dubai**

In Dubai one of the important projects was to support the Dubai Waterways Committee with developing a decision making tool for planning, coordination and permitting process of new projects to ensure that Dubai's waterways and shores are sustainable, safe and healthy.





Despite the impact of the economic recession, DHI offices within the Central and Eastern European Cluster (DHI CEE) performed well in 2009. Over the past decade DHI revenues in Central and Eastern Europe have increased by about 100% and all DHI business growth in the territory has been achieved organically.

The Prague office - centre of excellence for several business areas for the CEE region and managing unit for the entire cluster - has remained sound and stable. We have developed and introduced a new concept dealing with reduction of nonrevenue water in water distribution systems, leakage and network rehabilitation processes.

Our solution is used for complex data collection and tasks connected with leakage detection procedures evaluation and optimisation of the networks linked to water utility information systems. We completed and successfully delivered the Urban Drainage Master Plan for the city of Brno and won the contract for implementation of Information System on Urban Water Infrastructure Evidence for the city of Prague, the largest IT project related to asset management and water related infrastructure evidence in Czech Republic. Further, we continued to maintain our dominant position as the preferred consultant for Water boards in both the Water Framework Directive (WFD) and Flood Directive implementation process.



### **Flood management, Slovakia**

Two large flood management projects are now being carried out in Slovakia, ie flood hazard mapping of the city of Banska Bystrica or Enhancement and Flood Management Planning of the Hornád River basin project. Both studies are the first of its kind in Slovakia. Our experts were invited by the Slovak Ministry of Environment to contribute to Vishegrad Four Meeting on flood defence coordination as well as being a member of harmonising group for modelling in a project Danube Flood Risk can surely be considered as a sign of good reputation of DHI Slovakia.

### **MIKE URBAN and training, Bulgaria**

Several contracts on delivery of MIKE URBAN and training to Bulgarian Regional Water Companies were finalised within the last year. The outcome of this comprehensive programme resulted in the 23 largest Bulgarian cities being equipped by MIKE by DHI software for urban water modelling.

### **Flood risk mapping, Poland**

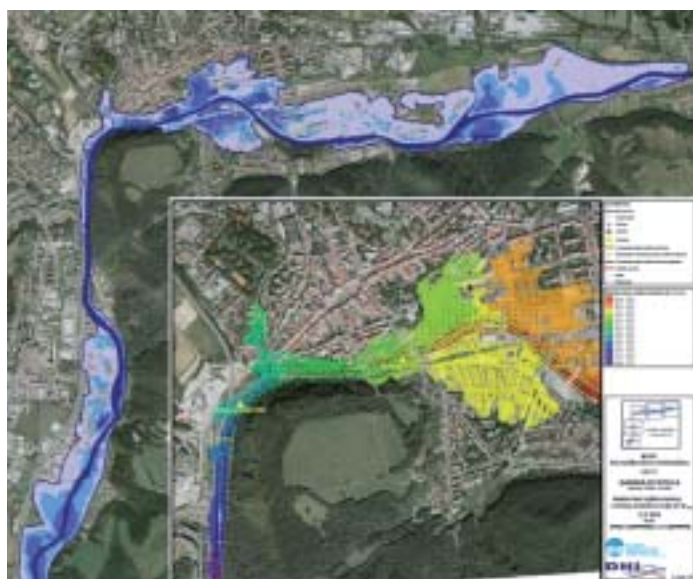
2009 strengthened DHI's position in Poland. Most significant was the development of flood hazard and flood risk mapping methodologies for the Polish National Water Board. In the Urban area DHI successfully completed the first leakage reduction project in the city of Bedzin using an advanced approach which combines hydraulic modelling and a tailor-made monitoring campaign. Our technological research lab in Bydgoszcz was busy throughout the second half of the year running continuous biological

reactor tests in order to develop the conceptual foundation for the future pretreatment and treatment facilities in the Zachem industrial area.

### **Activities in Hungary and Romania**

We continued to spread our local presence across the region and established a DHI project office in Hungary in the second half of the year. Together with the project office in Bucharest, Romania, it became our focal point for DHI software users and the local support centre for DHI projects being executed in both countries. We ran several important business activities in Hungary and Romania, for instance the development of a complex mobile IT centre for life-long learning. The programme is supported by EU Life-long learning programme. This has resulted in a training network for urban water management in Hungary and flood risk mapping projects in Romania.

We remain confident that market demand for our services will rebound with improving economic conditions. In our view, the basic market fundamentals remain unchanged and DHI CEE's network and service advantages are as robust as ever.



For more than 10 years DHI has been a leading player in southern Europe's water market, contributing to a shift in paradigm. The demand for advanced applications such as online modelling and decision support systems is steadily growing. In 2009 DHI supported several major players in the energy sector, which increasingly needs fast, reliable and accurate information on design conditions and environmental impacts of their fossil fuels, nuclear power and renewable energy operations.

### **Online forecasting on the Urumea River, Basque Country, Northern Spain**

The main purpose of this system is to serve as early flood warning. The online system is based on the modelling system MIKE SHE. The system runs in real time on DHI's computers and the client (the Basque Water Agency) accesses the results via the internet. The system enhances significantly the possibility of predicting floodings and permits optimisation of measures to remediate the consequences. The system is a pilot project for implementing similar real time systems for all the rivers in Basque country.

### **Water resources management on La Vilaine, Brittany, Western France**

The Vilaine catchment management must deal with two priorities: mitigate the flood risk and ensure the distribution of drinking water. DHI provides the operators with a flood forecasting system for the river and reservoir optimisation. Operators and forecasters are trained to use these tools to ensure a sustainable development and to improve communication. DHI's flood forecasting systems comprise innovative algorithms allowing models to match observations in order to improve the forecasts accuracy.

### **Ligurian Sea 3D model, Upper Tyrrhenian Sea, North Italy**

In Italy DHI is now completing the 3D hydrodynamic and water quality model for the Ligurian Sea. The work is carried out for the regional agency for the protection of the environment of Liguria Region (ARPAL). The model will be used by the local authority as a decision support system for the bathing water quality monitoring, spill management and local wave forecasting.

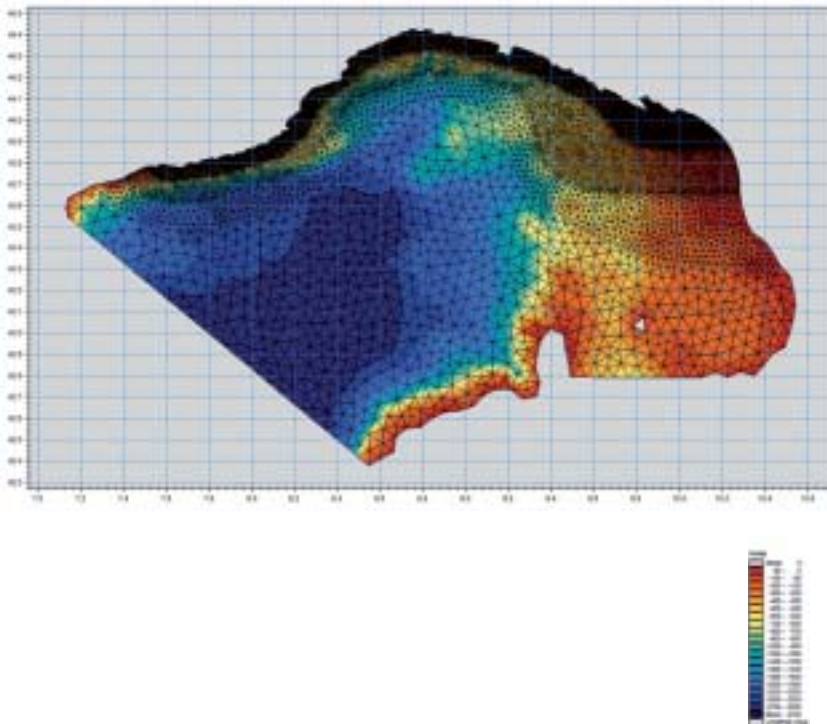
The Ligurian Sea model represents an important milestone for the process of integration of the oceanographic processes within the simulation of coastal hydrodynamics, with a downscale in resolution down to 500 meters.

In 2009 DHI was fully engaged in addressing the water related challenges in southern Europe, including water scarcity, flood management and environmental impact assessment. The energy sector in particular was an important market. As the demand for reliable, accurate and well designed information continuously increases, our Spanish, Italian and French customers are pushing for even more technology.

### **Offshore windmills emerging in France**

The onshore wind energy production capacity is now saturated and companies are preparing to build offshore farms. The best sites have been identified and operators now need detailed information on hydrographic conditions and accurate assessments of the environmental impacts of the farms. DHI was commissioned to support several of these projects.

We provide our clients with accurate and reliable data to design the foundations, the scour protection and to choose the layout of the windmills. Furthermore, clients are provided with hydrodynamic and sediment modelling, environmental impact assessment procedures and technologies.





### **Outlet types for brine dispersion, Spain**

Spain is on the forefront with respect to desalination technology, which is being installed worldwide. One of the environmental problems related to desalination is the discharge of brine. DHI has participated in several studies related to brine dispersion and is at the present participating in a research project concerning discharge technologies, together with, amongst others, the Canarian Institute of Technology and CEDEX (the Spanish national research institution on public works).

Any improvement of the brine dispersion efficiency would be important for the implementation of this technology, which in many places seems to be the only source of freshwater. This work involves optimisation of diffuser geometry to enhance the dilution of the brine plume. The study is based on 3D modelling.

### **Nuclear power plant in Aqaba, Jordan**

The Jordanian Atomic Energy Commission investigated a location near Aqaba to establish the Kingdom's first nuclear power plant expected to be built within eight years. DHI's French office supported Tractebel-GDF Suez, Bureau Veritas and Arab Consultants Bureau with the environmental and feasibility studies.



### **Coastal zone risk maps, Atlantic coast, France**

Urbanisation and population are increasing on the French Atlantic coast, which is exposed to erosion and flooding risks. The Xynthia storm, which hit France in February 2010 combining winds in excess of 160 km/h, a very high tide, torrential rainfall and a storm surge, dramatically reminded us of the power of nature. More than 50 people died and the cost to the insurance companies is estimated at 1 billion EUR. DHI is helping French authorities to assess the coastal risks by producing high quality maps taking into account the possible impacts of climate change. Furthermore, DHI is advising on sustainable and cost efficient solutions to protect against erosion and wave topping.

### **Po basin flood forecasting system, North Italy**

The Italian civil protection system for flooding risk is organised in regional centres named Centri Funzionali. These centres use MIKE 11 for real time hydrological and hydrodynamic modelling. Piedmonte Region, in particular, has used a MIKE Flood Watch based system for more than 10 years. This system has recently been extended to cover the entire Po catchment (71,000 km<sup>2</sup>) within a strategic project coordinated by ARPA Emilia Romagna for AIPO, the national agency for River Po.

Data are collected from the entire North Italy and results are presented for the whole river network, which is one of the world's most complex systems (410 branches, 6,830 km in terms of total length and more than 10,000 cross-sections).

The Po catchment provides the most concrete example of the ongoing tendency, which is moving from alert based management routed in rainfall forecasting to an approach based on modelling the effects of the rainfall.

DHI's offices in South East Asia experienced an excellent year in 2009 with strong growth in project and software turnover as well as a continued increase in staff, which was just shy of 200 at end of 2009.

The region enjoyed a high level of cooperation with other DHI offices in the Asia Pacific area, exemplified by activities in the aquaculture sector where DHI Malaysia carried out a challenging study on the sustainability of salmon culture in Macquarie Harbour, Tasmania.

Research and development has begun to play a key role in the region with over 50 R&D projects underway at the DHI-NTU Research Centre in Singapore, spanning fields as diverse as urban water management and environmental impact assessment (EIA).

DHI's consulting strength in South East Asia remains rooted in the coastal, marine and energy sectors as exemplified by the following key projects.

### **Sentosa Integrated Resort, Singapore**

The Sentosa Integrated Resort promises to be a world class resort comprising Universal Studios theme park, the world's largest oceanarium, a marine museum and five-star hotels amongst other attractions and is set to open in 2010.

DHI had a major role in this project which covers 49 ha, including the EIA for the marine reclamation component of the works. As part of the environmental compensation measures, DHI's marine biologists relocated corals along the northern shore of Sentosa from the reclamation footprint to a new site in order to preserve the marine heritage and biodiversity of the area. DHI's coral relocation efforts were applauded by many environmental observers in Singapore.



### **International Cruise Terminal, Singapore**

With the increasing number of cruise vessels calling at Singapore, the Government of Singapore gave go ahead for an International Cruise Terminal at Marina South to be completed in 2011.

DHI was instrumental in carrying out an EIA, which was recently disclosed to the public by the Government of Singapore.

By the end of the year, DHI was contracted to carry out the environmental monitoring and management plan (EMMP) for the construction phase of the project. Due to the high marine traffic in the area, the EMMP incorporates a comprehensive current monitoring and forecasting system with direct dissemination to marine operators in order to facilitate the safety of large vessel movements in the area.

### **Upper Padas hydroelectric project, Sabah, Malaysia**

The proposed 210 MW Upper Padas Hydroelectric Project in Sabah, Malaysia, comprises a 120m high dam with a reservoir area of 1,885km<sup>2</sup>. A special environmental impact assessment was carried out to satisfy local regulations as well as the requirements of international lending organisations. DHI performed impact assessments of river hydrology and water quality, reservoir water quality and sedimentation, dambreak flood assessment and riverine ecology as well as overall technical review to ensure that international EIA standards were met. The assessment combined soil erosion and pollution load modelling from the catchment, which is heavily logged, with 1D river hydraulic and water quality models and 3D flexible mesh modelling of the reservoir.



### **Mersing laguna reclamation, Malaysia**

Mersing is a small town located on the east coast of Peninsular Malaysia and is a small scale tourist destination with access to a series of small islands in the adjacent Marine Park. It includes a ferry terminal and a fishing port in a small river mouth, to which access is presently only available at high tide. It is proposed to expand Mersing into a major resort development on a series of reclaimed nearshore islands adjacent to the river mouth with a total area of 800 ha.

DHI conducted the EIA for this reclamation. The work included significant modifications to the reclamation layout to minimise the impact on sensitive habitats, including sea grass and mangrove, and to ensure that the channel through the reclamation could be safely navigated in all tidal conditions. Other key issues included long term water quality in the channels between the reclaimed islands, and the impact of sediment plumes during construction on adjacent corals and fishing grounds.

### **Master plan for the right bank of the Narmada River, India**

The special economic zone established at Dahej by the Gujarat Industrial Development Corporation provides a unique mix of land availability and developed infrastructure. In this regard the Narmada Estuary is set to play an ever increasing role, by providing the necessary waterway for launching of new maritime industries.

DHI was awarded a study to examine the feasibility of the location and prepare a master plan for the development of the right bank of the Narmada River. The study included a 25km stretch starting from the river mouth on the Gulf of Khambhath.

As part of the study an environmental sensitivity map was prepared. The change in shoreline was mapped using satellite images and other site data collected.





The DHI China office performed well in 2009. With a staff of about 70 and an increase of 10% compared to 2008, we worked on software sales, projects and software development. Software sales increased by 35% compared to 2008, and China became DHI's largest software market.

As a new service we now offer tailored systems or solutions and by the end of 2009 the DSS R&D team totalled 10 persons.

A number of interesting projects were completed in 2009.

### **Shanghai Expo 2010 - urban water supply scenarios analysis using MIKE URBAN**

The theme of Shanghai Expo 2010 is 'Better city, better life'. DHI China was commissioned to model the downtown water distribution network in Shanghai to ensure clean, safe and sufficient water supply during the period of EXPO.

The client, which is the largest local water supply company, already has a capacity of 2.58 million m<sup>3</sup>/day, which is nearly the same as a middle-sized European country. Three waterworks managed by the company provide water from three directions with interconnected and looped pipes, and 13 booster pump stations to raise the pressure. Through the project, it is expected to get a clearer picture of the water supply system and to do some 'what-if' scenarios analysis.

### **Eco-environmental rehabilitation - Taihu Lake**

Due to the rapid industrial development and agriculture nearby, the water quality of the Taihu Lake has deteriorated dramatically since 1990s - especially in 2007 when algae spread in the northern end of the lake, which eventually resulted in a water supply crisis for the city of Wuxi.





About 45 million people depend on the lake for their drinking water and livelihood. However, the poor water quality has resulted in this area becoming the place in China with the highest level of tumour incidents.

A Worldbank financed project assigned DHI to assess the effect of dredging works, and a number of models were developed for the Taihu project, eg the basin hydrological model, the basin river hydrodynamic model, the basin nonpoint source model, the hydrodynamic model and the eutrophication model.

### Renewable energy - offshore renewable energy development in China

Being one of the world's biggest carbon emission countries, China is moving towards clean renewable energy instead of fossil sources. Along the Chinese coastline more than 10 offshore wind farms have been planned, including the largest offshore wind farm in the world. It is expected that the total offshore wind turbine capacity will exceed 1,000 MW by the end of 2010 year.

We cooperated with a local institute to carry out the feasibility study and planning for the 200 turbine Dafeng offshore wind farm offshore the Jiangsu province. DHI's involvement in this ongoing project includes the establishment of design waves, water levels and currents; large scale sediment analysis and modelling; foundation scour protection optimisation; and environmental impact analysis encompassing pollutants, dredging sediment and oil spills.

### Water environmental management in Chongqing City

A pilot project on the water environmental management within the Liangtan River catchment west of Chongqing City was carried out based on an agreement between Chongqing Environmental Protection Bureau (CQ EPB) and the Danish Environmental Protection Agency (DEPA). The aim of with the project, financed by DEPA, is to promote cooperation on energy saving and environmental protection technologies.

DHI provided pollution estimations and modelling studies. The recommendations included detailed technologies such as 'BioKube' which was strongly recommended for the environmental investment and management measures implemented.

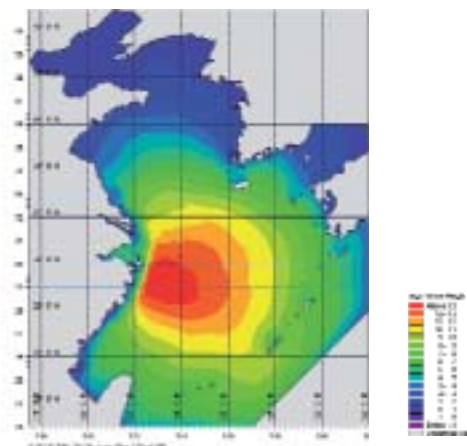
### Water resources allocation and distribution system - the Songhua River Basin

The Songhua River Basin is located in North-East China, where there are several large cities and heavy industry. In some regions water is scarce during periods of the year. The aim of this project is to create an integrated water resources planning and management system in order to optimise the use of the limited water resources.

The ongoing project includes 20 cities, 10 rivers, 39 existing or planned reservoirs and more than 1,000 water unit users. To complicate the issues each water unit user has 16 different kinds of water users/sectors, eg urban, rural, livestock, power station, high water exhausted industry, wet and dry field, vegetation, fishing, etc.

### Decision support system for real time flood forecasting and reservoir operation

In collaboration with Guangxi Hydraulic Research Institute, DHI was commissioned to establish a decision support system for real time flood forecasting and reservoir operation. The objective was to improve flood control efficiency in the project area. The study basin area covered 9 cities and a total area of about 89,667 km<sup>2</sup>, including Nanning, the capital city of Guangxi Province. Based on this case, DHI developed an integrated DSS for flood forecasting and management of a middle sized river basin including large cities. The system for the middle sized basins were also established in the Weihe River Basin (Shaanxi Province) and in the Wenzhou River Basin (Fujian Province).





### **Building expertise**

In 2009 more than 2,500 users took part in our training courses – or 10% more than in 2008. The feedback from the participants is almost uniform – "it's great value for money".

The MIKE by DHI products are more than just the software. Building skills as a modeller requires training, and DHI offers regular public standard training courses in more than 25 countries. In addition, DHI also offers customised in-house training courses, where the client can specify exactly the products and topics to be covered.

Only certified MIKE by DHI trainers are allowed to conduct the official MIKE training courses. This guarantees that the participants get real value for money, when selecting one of the MIKE by DHI courses. Most of the trainers are also experienced and skilled practitioners, who can offer real engineering insight – rather than just run through the manuals and standard exercises.

### **Corporate agreements**

An increasing number of large consulting groups enter into corporate agreements with DHI in order to get the best possible value out of their investment in MIKE technology. Flexibility, easy access to additional software during peak loads, systematic training of staff and priority support are among the benefits that are typically built into these agreements.

The different modelling packages cover not only the physical processes (flows, water levels, waves), but also a range of chemical and biological processes relevant for describing the water quality, ecology and morphology of the areas of interest.

While other modelling tools only cover a subset of the relevant processes, the MIKE family is unique in offering engineers and scientists access to truly holistic water modelling.



DHI Solution Software provides the framework for implementation of sustainable and adaptive solutions designed to meet clients' needs.

Solution software tools and components provide the platform for building cost-efficient, flexible and custom-made decision support systems. DHI DSS supports water management planning and real time operations for urban, marine and water resources solutions.

Some larger projects launched in 2009 were:

**Water resource planning in the Nile Basin area**

The Nile Basin Initiative commissioned DHI to develop and deploy a decision support system that will allow the Riparian countries to monitor and manage the water in a transparent and sustainable way. DHI's solution is a Decision Support System for water resource planning and investment decisions in the Nile Basin area. This system creates a shared knowledge base allowing the stakeholders to interact which in turn can promote stability, reduce poverty, and optimise the use of water resource in the region.

**Urban water information management in South Africa**

The City of Cape Town selected DHI solutions to develop and deploy a web-based information management system. The information system will allow city staff to centralise collection, quality check, uniform data storing and visualising of information from all water bodies ranging from reservoirs through distribution and sanitation networks to treatment plants, treated effluent networks and recipients. The web based system represents a virtual revolution within the data handling and knowledge sharing in the greater Cape Town area.

**Operational management of reservoirs in North-West India**

In the north-west part of India, the large Bhakra and Beas dams play a central role in supplying drinking water, hydropower and irrigation to large agricultural areas. DHI was commissioned to deliver a Decision Support System, which will assist operational planning and management of the reservoirs. The system will enable owners to optimise the hydropower production and water supply for irrigation. Further, flooding caused by melting snow from nearby mountains and heavy rain can be better managed by a subsystem relying on real time flooding forecast.

**Integrated water resources development and management in India**

Another Decision Support System is being developed for nine states in the central/southern part of India focusing on integrated water resource planning and management. The system takes into consideration the different challenges faced such as groundwater pollution, flooding and drought. The Upper Bhima basin was selected as the pilot basin and will later be customised to the remaining twelve basins.

**Capacity building and technology transfer**

The described solutions are all developed in close collaboration with the customer and end-users. The collaboration also includes dedicated training and technology transfer programmes. Through these programmes the staff in client organisations is trained and mentored to master the technologies and take ownership of the solutions. Together, these efforts ensure sustainability and long term use.



2009 was a very successful year for Research, Development and Innovation (RDI) at DHI. A high number of RDI proposals were submitted and won. Examples of the news RDI projects are:

- Danish coasts and climate adaptation - flood risk and coastal protection funded by the Danish Strategic Research Council
- A national Danish research center on climate change research: 'Centre for regional change in the Earth system'. The centre is funded by the Danish Strategic Research Council
- An innovation consortium with the objective to eliminate the channels of infection in children's institutions using realistic and effective cleaning methods. The consortium is funded by the Council for Technology and Innovation
- An 'Innovation Network' ie a strategic partnership related to how Danish cities can adopt to climate changes. The name of the partnership is 'Water in cities' and is funded by the Council for Technology and Innovation
- PREPARED – an EU FP7 project. The project is about development of integrated real time, monitoring and control systems for water supply and wastewater. The project runs from 2010 to 2014
- CORFU – an EU FP7 project. The project is a collaborative research on flood resilience in urban areas and runs during 2010 - 2013

Furthermore, DHI submitted a successful proposal for new a platform research grant (Performance Contract) to the Danish Ministry of Science, Technology and Innovation. In addition to the traditional research areas at DHI, the following new research areas are defined in the next Performance Contract:

## **Information and communication technology**

- with focus on:

- High Performance Computing – significantly improved computational speed of selected MIKE by DHI products
- OpenMI – ie provision of open and documented interfaces to the MIKE By DHI computational engines
- Web and decision support systems, which integrates the DHI Software in the daily management of the water systems

## **Water and health**

- with focus on:

- Quantitative microbial risk assessment for pathogens and chemicals
- Water safety planning
- Protection of drinking water resources
- Evaluation of the health risk associated with hospital wastewater, wastewater treatment effluent, sewer overflows and urban flooding

## **Impacts of climate change and adaptation**

- with focus on:

- Reduction of flood damages in urban areas
- Decision support for management of Danish water resources
- Danish coasts and climate adaptation
- Changes in water levels, waves and currents in Danish waters
- Risk based decision support

Nanyang Technological University, Singapore and DHI continued the research in the joint interdisciplinary water and environment research centre and an education hub supported by the government of Singapore. One of the promising activities is the development on CityLab – a framework for analyses of the water and energy fluxes on the city scale.

During 2009 DHI strengthened its strategic collaboration with selected high level universities in order to carry out joint research projects. DHI gave classes to students at UNESCO IHE, NICE-SOFIA University and the Technical University of Denmark. DHI enjoyed international collaboration with more than 70 universities worldwide, and about 50 MSc and 20 PhD students visited DHI to work on dedicated projects.

## **RDI on adaptation to climate change**

In 2008 DHI and the Danish Technological Institute were awarded a two-year 1.5 million EUR research and development project from the Council for Technology and Innovation. The focus of the project is to develop knowledge and information aiming at protection of the population and the aquatic environment and infrastructure against impact from climate changes in a timely and cost efficient way.

## **Outputs from the projects in 2009**

- Prototypes for downscaling climate change projections, ie the development of methods for statistical downscaling for precipitation from global climate models and regional climate models to local conditions
- A prototype of a Decision Support System for climate change adaptation in relation to water
- A methodology for estimation of design events for coastal flood studies under climate change
- Danish case studies on:
  - assessing climate impacts on the marine facilities and infrastructure
  - coastal flooding of low lying areas behind sand dunes
  - impacts from climate changes on storm surges and subsequent flooding of coastal city areas

## Management's Statement

The Executive and Supervisory Boards have today considered and adopted the Annual Report of DHI for the financial year 1 January – 31 December 2009.

The Annual Report is prepared in accordance with the Danish Financial Statements Act, adjusted to reflect the fact that DHI is an independent company and an approved technological service institution.

In our opinion, the Financial Statements and the Consolidated Financial Statements give a true and fair view of the financial position at 31 December 2009 of the parent company and the Group.

## Auditor's report

We have audited the annual report of DHI for the year, which ended 31 December 2009, from which the below summarised Group Profit & Loss and Group Balance Sheet were derived, in accordance with Danish Auditing standards. In our report, dated 20 April 2010, we expressed an unqualified opinion on the DHI annual report from which the summarised Group Profit & Loss and Group Balance Sheet were derived.

In our opinion, the accompanying summarised Group Profit & Loss and Group Balance Sheet are consistent in all material respect with the DHI annual report, from which they were derived.

For a better understanding of the DHI Group's financial position and results of its operations for the period and of the scope of the audit, the summarised Group Profit & Loss and Group Balance Sheet should be read in conjunction with the complete DHI annual report, from which the summarised Group Profit & Loss and Group Balance Sheet were derived and our auditors' report thereon.

Date: 20 April 2010

Place: Hørsholm

## PricewaterhouseCoopers

Statsautoriseret Revisionsinteressentskab

Auditor: Jacob F Christiansen  
State Authorised Public Accountant

Auditor: Ulrik Ræbild  
State Authorised Public Accountant

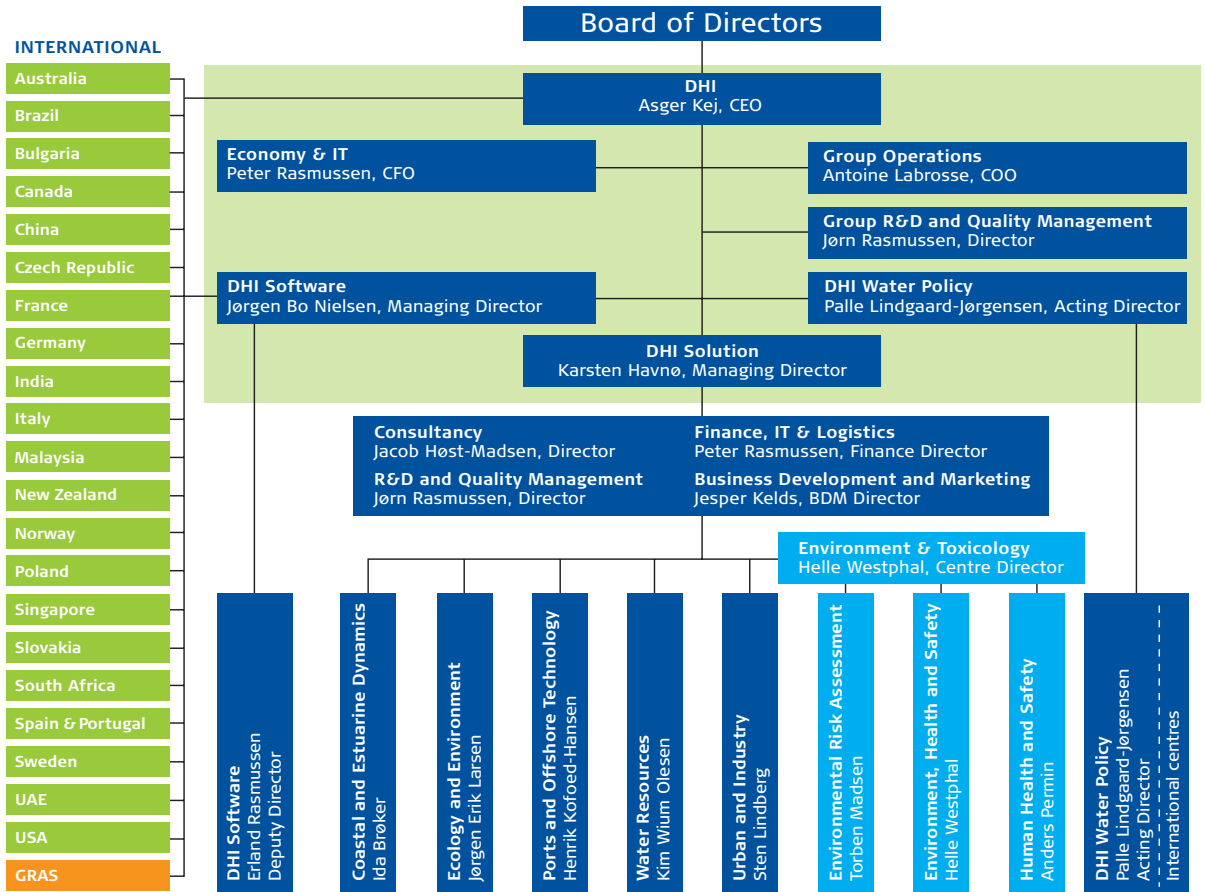
## DHI

Asger Kej  
CEO

Peter Rasmussen  
CFO

PROFIT & LOSS / DKK 1,000	GROUP		PARENT	
	2009	2008	2009	2008
REVENUE	723,661	593,805	451,147	354,479
Salaries & expenses	(690,745)	(576,176)	(442,972)	(346,562)
RESULT BEFORE FINANCIAL INCOME & EXPENSES	32,916	17,629	8,175	7,917
Result of investments in related companies	0	0	17,216	5,693
Financial income & expenses	2,022	(5,223)	4,556	(2,373)
RESULT BEFORE NONRECURRENT INCOME	34,938	12,406	29,947	11,237
Nonrecurrent income	0	13,825	0	13,825
RESULT FOR THE YEAR BEFORE TAX & MINORITY INTERESTS	34,938	26,231	29,947	25,062
Tax	(5,802)	(867)	(1,355)	(382)
Minority interests	(544)	(684)	0	0
RESULT FOR THE YEAR	28,592	24,680	28,592	24,680
<b>ASSETS</b>				
Fixed assets	49,786	43,463	86,326	59,572
Contracted work in process	103,377	65,682	49,629	42,534
Receivables	165,672	187,124	130,587	141,444
Cash in bank and in hand	151,073	100,547	89,954	57,758
ASSETS	469,908	396,816	356,496	301,308
<b>LIABILITIES</b>				
Equity	157,730	127,828	157,730	127,828
Minority interest	6,217	5,335	0	0
Provisions	411	387	903	387
Long term debt	46,593	18,686	28,712	18,686
Short term debt	258,957	244,580	169,151	154,407
LIABILITIES	469,908	396,816	356,496	301,308

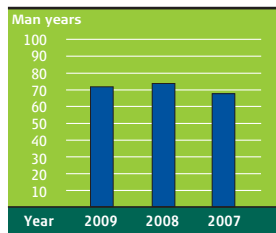
# DHI HEADQUARTERS



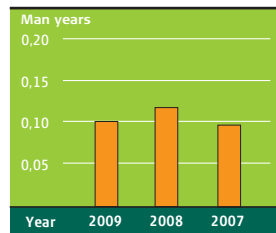
Members of the 'DHI Management Team' together with Tom Foster (DHI Singapore), Qian-Ming Lu (DHI China), Evzen Zeman (DHI Czech Republic) and Robert Carr (DHI USA)

# KNOWLEDGE DEVELOPMENT

R&D EFFORT



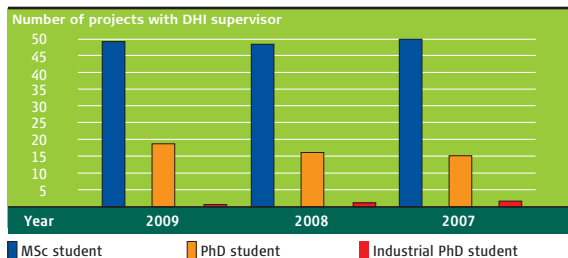
R&D OF TOTAL MAN YEARS



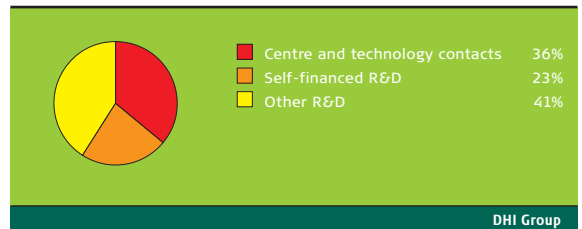
REVENUE DISTRIBUTION



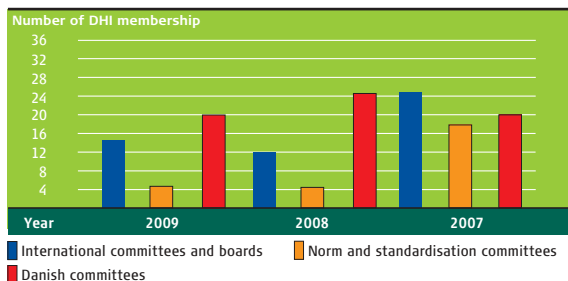
CONTRIBUTION TO EDUCATION



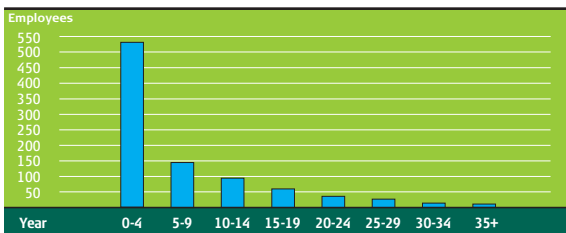
R&D FINANCING



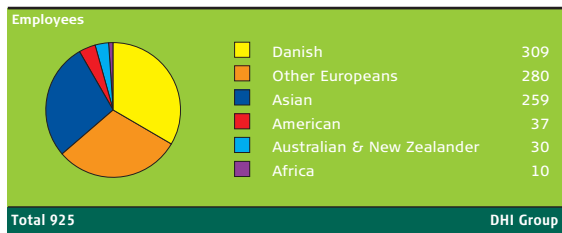
COMMITTEE PARTICIPATION



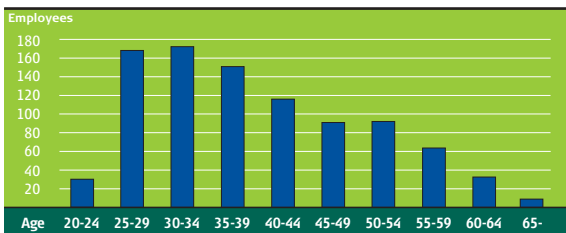
## SENIORITY AT DHI



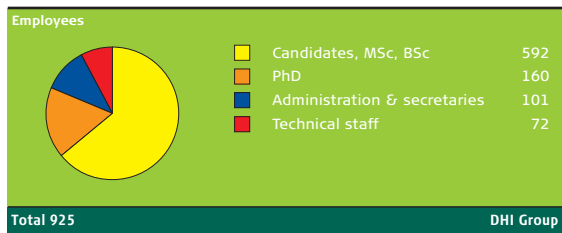
## NATIONALITY



## AGE DISTRIBUTION



## EDUCATION



# ENVIRONMENTAL ACCOUNTS

The paper consumption dropped by almost 7% as compared to 2008. This drop follows the trend of the last five years. The paper consumption as such has dropped by 25% since 2004.

The total amount of waste was the same as in 2008, while the recyclable amount has dropped from 35% to 15% in 2009.

Water consumption rose by 5% relative to 2008 due to increased consumption by offices and laboratories. The water consumption was at the same level as in 2006.

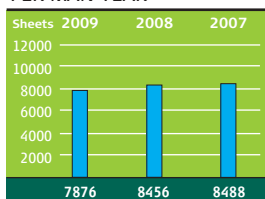
Power consumption was at the same level as in 2005-2006. The consumption in 2007 and 2008 was 12-14% higher than the 2005-2006 level presumably due to the erection of a new canteen and office building.

Heat consumption per square metre has dropped by 1% relative to 2008 and thereby continuous the trend since 2006. The consumption has dropped by 8% since 2006. Adjusting the heat consumption relative to the number of degree-days the consumption has decreased 11% relative to 2006.

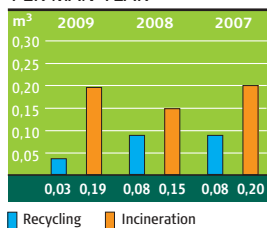
The changes in consumption of power and heat are reflected in the emissions of CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>2</sub>. CO<sub>2</sub> emissions from air-travel have since 2008 been included in the environmental accounts. Air travel related emissions accounted for 30% of the total emission per employee.

Late 2008 DHI established a Green Committee. The role of this committee is to find ways in which consumption and emission can be reduced at the Danish offices. The committee has defined the targets and devised a strategy to achieve these. Some of the targets for 2010 include a 50,000 kWh reduction in power consumption, investigate the possibility of using gutter collected water from the roofs in the laboratories and for flushing toilets, extend video conferencing facilities to reduce air-travel and investigate the possibilities of recycling heat from the server rooms. In addition a number of employee focused initiatives will be launched to reduce the consumption of resources and emissions.

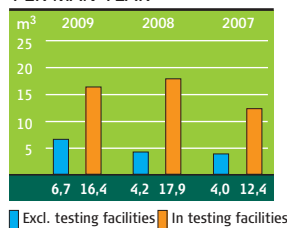
## PAPER CONSUMPTION PER MAN YEAR



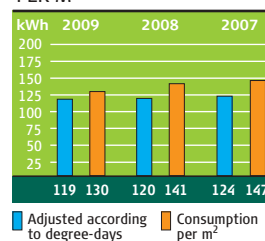
## WASTE PER MAN YEAR



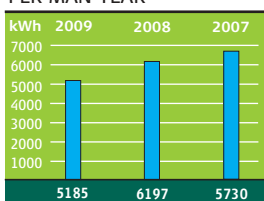
## WATER CONSUMPTION PER MAN YEAR



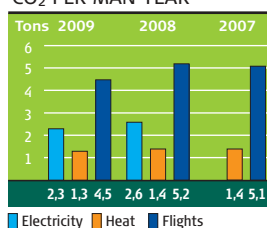
## HEAT CONSUMPTION PER M²



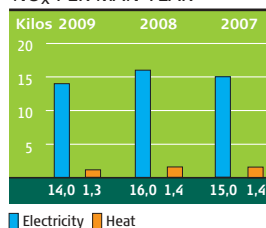
## POWER CONSUMPTION PER MAN YEAR



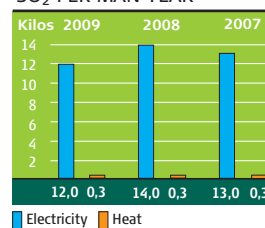
## CO<sub>2</sub> PER MAN YEAR



## NO<sub>x</sub> PER MAN YEAR



## SO<sub>2</sub> PER MAN YEAR



**DHI OFFICES**  
around the world

Australia  
Brazil  
Bulgaria  
Canada  
China  
Czech Republic  
Denmark  
France  
Germany  
India  
Italy  
Japan  
Malaysia  
New Zealand  
Norway  
Poland  
Portugal  
Romania  
Singapore  
Slovakia  
South Africa  
Spain  
Sweden  
Thailand  
UK  
United Arab Emirates  
USA  
Vietnam

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