



DANISH
TECHNOLOGICAL
INSTITUTE

IT'S ALL ABOUT INNOVATION

Annual Report 2013

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The Danish Technological Institute is an independent and non-profit institution approved as a technological service institute by the Danish Ministry of Higher Education and Science.

Her Majesty the Queen of Denmark is patroness of the Danish Technological Institute.

The Danish Technological Institute's cooperation with the Danish corporate sector rests on confidentiality and professional secrecy.

The companies mentioned have all authorised publication.

Read more at www.dti.dk



**CLIMATE
COMPENSATED
PAPER**



IN

It's all about



INSPIRATION

We are ambitious on behalf of Denmark.

We look ahead and pave the way for technological development.

We inspire our partners to seek new avenues and embrace technological opportunities.



INSIGHT

We have unique insight into the needs of society.

We are aware of the challenges faced by our partners.

We create solutions by applying our multi-disciplinary competencies and high-technology facilities.



IMPACT

We are ambitious on behalf of our partners.

We deliver technological solutions that work.

We ensure that our partners use technology and knowledge that have visible and measurable effects.

NOVATION

Full speed ahead for growth – and technology

Executing our new strategic course was an ambitious step in the right direction

Our 2013-15 strategy shows our intent to play a central role in re-establishing the competitiveness of Danish businesses. We are committed to creating value-adding innovation and spurring it on through advanced technological uptake in enterprises, which can lead to growth for businesses and society as a whole.

Developments in 2013 showed that the Institute has set the right course. The annual report shows a revenue level of EUR 145.0 million and net profits of EUR 4.3 million. Commercial turnover, which comprises direct client-based activities, rose and constituted EUR 95.3 million, an increase of 6.8% compared to 2012. Our financial performance is in turn reflected in a growing number of employees, currently at 1,051 man-years.

2013 was characterised by growing demand for technological services as the economy began to pick up.

As a small and open high-wage economy, Denmark's competitiveness, job creation and welfare depend on advanced technological services and knowledge being offered in such forms and through channels that enables it to be absorbed by Danish businesses. The deployment of advanced technology spurs productivity. It forms the cornerstone of advanced products and services that can contribute to solving some of the challenges facing the world today, and it is the key to retaining advanced manufacturing in Denmark, which in turn can kick-start job creation and growth.

In 2013, the Institute collaborated with 9,201 Danish customers to deploy and develop technology and knowledge.

Our customers include some of Denmark's largest enterprises in foodstuffs, medical technology and energy – areas where advanced technological solutions are in demand due to their ability to counteract Danish cost levels and improve efficiency in materials and energy consumption as well as their ability to positioning Danish firms in global value chains.

The 2013-2015 strategy also sets out for an increase in international activities. Participation in international Research and Development projects is an important part of building up the Institute's advanced technological services to Danish businesses – and has so far contributed to creating a unique multi-disciplinary competence platform supplemented by Denmark's most advanced laboratory facilities and strong partnerships with international knowledge institutions.

In 2013, we therefore continued our impressive performance in the EU's 7th Framework Research Programme (FP7) as we were ranked no. 4 in Denmark in terms of attracting EU funding by EU Research Rankings. Significantly, we are also ranked first in terms of our research diversity. This demonstrates our ability to provide comprehensive depth in expertise and value added for our partners. We are also ranked highly among the top research organisations in terms of the quality of our project leadership.

To sum up, while continuing our investments in technological research, we have in 2013 focused on transferring our investments in R&D into state-of-the art technological uptake and development in businesses to generate renewed competitiveness.



Clas Nylandsted Andersen

Søren Stjernqvist

As Denmark's primary innovation institution, we see it as our key responsibility to improve Danish competitiveness and safeguard the Danish welfare society by means of a technological boost.

If we are to live up to our ambitions of developing and implementing innovative and high-tech solutions that create growth, jobs and welfare in Denmark in the next three to five years, then society needs to take on a leading enabling role through investing in and creating access to technology and through the uptake and use of advanced technological solutions in partnership models.

There are currently changes underway in the Danish innovation system to create a more simplified and flexible research and innovation infrastructure which can accelerate innovation in Danish companies as the basis for job creation and growth. The new Innovation Fund will have a significant impact on the entire Danish innovation system and how Danish firms engage with it and its different players in the years to come.

EU's new framework programme for research and development, Horizon 2020, basically contains the same ambitions and focuses on creating closer collaboration between knowledge centres and the business community on technological development. A strategic alignment between the Danish Innovation Fund and Horizon 2020 can be a central lever to internationalising research and innovation efforts in Danish companies.

A central element in such a strategy is that diffusion and uptake of R&D in the form of innovation are embedded in

programme and project design in order to enable uptake of the latest technological advances at scale and among the many Danish SMEs that characterise the Danish business sector. A study we have undertaken this year as a contribution to the Danish Growth strategy about "Danish Firms in Global Value Chains" clearly shows that advanced uptake of technology is a driver of increased specialisation and is a precondition to positioning Danish firms as strategic sub-suppliers in global value chains.

In the coming years, we must therefore not only quicken the pace of technological development and innovation and their internationalisation, we must also assure that technology is accessible and used by enterprises and by society as a whole as a basis for growth and measureable impact.

As the leading provider of advanced technological solutions, the Danish Technological Institute is looking forward to its role in accelerating growth and technological development; and the results already achieved with our customers and collaborative partners indicate that we have set the right course.

Clas Nylandsted Andersen
Chairman of the Board

Søren Stjernqvist
President

“ With seven divisions housing some of Denmark’s leading specialists and state-of-the-art laboratories for testing and development, the Danish Technological Institute has everything it takes to deliver technological expertise and knowledge that strengthen the Danish business sector.

This is essential at a time where technological opportunities are almost infinite and at a time where Danish businesses must be technologically innovative in order to compete internationally.

Søren Stjernqvist, President

Divisions

Technological advances are increasingly created by connections that transverse conventional specialist fields and technology areas. At the same time, specialised insight into industry and trade-specific matters is required to ensure that technological advances are applied where they have an impact.

The Danish Technological Institute is divided into seven divisions each representing specialised technological and industrial knowledge – and together they constitute a multi-disciplinary competency platform offering world-class development, testing and pilot production facilities.

Combined with the close collaboration between the divisions and the business community, our high-technology platform is decisive for our ability to create innovative and technological solutions that work.

In our 2013 annual report, the divisions and our subsidiaries Danfysik, Teknologisk Institut, Sweden and DTI Polska provide insight into how they work to develop and exchange knowledge and technology in cooperation with Danish and international partners.



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Vice President



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Managing Director

Technology to ensure Danish production – now and in the future

If Danish manufacturing businesses are to be competitive in a global market, we need to develop and implement state-of-the-art technologies in three main areas in the coming years: products, the production line and the quality assurance of both production and products. Technology should do more than reduce production costs. It must also ensure that we can offer intelligent, customised products and on-demand production that are top quality. These are the keys to keeping production in Denmark.

A Danish study from 2013 concludes that at least 70% of all processes in Danish manufacturing businesses are manual. This number also reveals that Danish manufacturing industry has a massive potential for using technology to streamline production and reduce production costs.

Automation used to be cost-effective only for companies that mass-produce products, as huge investments are required to develop and adjust the technological solutions entailed in handling and processing a specific product. Unfortunately, the lack of flexibility in existing technologies is a major obstacle preventing most Danish businesses from exploiting the advantages of automation.

If automation is to ensure Danish businesses' competitiveness, it must not only lower production costs, but also support the production agility by entering into a production set-up that involves producing several different products in small volumes.

The division intends to meet this challenge through its ambitious focus on Robot CoWorkers. Robot CoWorkers allow us to apply the concept of automation to a technological paradigm in which the solutions become flexible and configurable and where the return period on investments is significantly shortened. In practice, this will make technology accessible, cost-effective and relevant for many Danish businesses.

Another success factor for Danish manufacturing businesses involves developing new advanced product properties aimed at future products and growth industries. An important parameter in this respect involves the integration of new enabling technologies such as micro and nano production technologies. These technologies will allow us to support small and large businesses alike in developing state-of-the-art products with new and unique properties. We have in-depth material and process knowledge, which we apply in developing new products and product properties. Micro and nano production technologies are also essential to meet the expected demand regarding the development of smaller and more efficient components that can be integrated with electronic products, either as part of energy storage systems or as an energy source.

Danish manufacturing businesses often act as one of many suppliers in an international supplier chain – an area in which success depends on processes and methods being documented. For instance, we ensure that products manufactured via new manufacturing methods like 3D printing and micro and nano technologies can be documented and traced by applying advanced characterisation technologies such as CT scanning, X-ray diffractometer and various electron microscope technologies.

The division's key task is to ensure that Danish businesses have access to technologies that increase their competitiveness and keep production in Denmark.

Seen from a growth and welfare perspective, having a well-tuned and high-technology industry in Denmark is paramount for the country. Similarly, the technologies and the know-how we build in optimised production can help support a technology-oriented welfare society.

Service production in major welfare areas still involves a high degree of manual work. In the coming years, the healthcare and welfare sectors, in particular, will face demands for automation solutions that can resolve future demographic challenges. We cooperate with international experts in robot technology to develop services strongly focused on nursing and care.

PRODUCTION

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Anne-Lise Høg Lejre
Vice President



PRODUCTION

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AGILE ROBOTS AS COWORKERS

Robot CoWorker

As a concept, Robot CoWorker is the next evolutionary step in industrial robots for the future. To maintain production and manufacturing jobs in the western world, we will have to create competitively priced agile robots that can easily be reconfigured for new tasks and trained by existing staff as natural co-workers – or robot co-workers.

The Centre for Robot Technology cooperates with KVM-Conheat, which, like many other Danish businesses, did not previously use robots in its production. Like most other Danish businesses, KVM-Conheat also has a “high mix, low volume” production, for which reason it could not make a business case using existing automation solutions.

KVM-Conheat is now in the process of training a Robot CoWorker. The robot is to fix nuts to a pipe and flange the pipe ends.

“ The flexibility of the Robot CoWorker allows us to convert it or even train it to assemble new products in no time. It will certainly help us become a more efficient industrial business and thus ensure that we can maintain much of our production in Vissenbjerg.

Martin Schwartz, Production Manager, KVM-Conheat

OPTIMISED, AUTOMATED AND FLEXIBLE PRODUCTION

From series production to order production

The Centre for Robot Technology has developed a new method that will strengthen Danish industry. The method is called Lean Automation and combines the best of Lean and automation.

Traditionally, optimising processes through Lean has been seen as a holistic approach, and optimising through automation as a measure taken with individual processes in the total production. However, developments and the tools available today enable Danish businesses to integrate Lean processes throughout the production environment, while also equipping employees with the tools to spot automation potentials.

BM Silofabrik optimised its processes using Lean Automation

BM Silofabrik in Holstebro offers a prime example of implementation of Lean Automation. The company wanted to improve production capacity and contacted the centre about purchasing a robot. However, once the Centre for Robot Technology had uncovered the company's needs, it was clear that it would most benefit from using Lean to streamline production before any automation activities were considered.

The company's production flow was changed from series production to order production, which has helped reduce stocks and increase flexibility.

Process optimisation proved a quantifiable success for BM Silofabrik, which was therefore prepared to invest in a robot that would allow production to be automated.

PRODUCTION OF INTELLIGENT PRODUCTS

Pilot production of nanoparticles

DTI is set for large-scale pilot production of nanoparticles for catalytic materials, including fuel cells. Centre for Nano and Microtechnology has developed a reactor for the production process, which thus facilitates the production of kilos of nanoparticles per hour. The process has been developed in cooperation with Aarhus University as part of the MicroPower project, co-financed by the Danish National Advanced Technology Foundation.

From nanoparticle to the hearing aids of the future

The nanoparticles from the pilot production are to be included as a catalytic element in the fuel cells DTI develops together with microcomponent manufacturers Sonion A/S and AH Metal Solutions A/S as well as hearing aid makers Widex A/S and GN Resound A/S. In the long term, the fuel cell, which is currently at the prototype stage, will replace conventional batteries in hearing aids. The objective is to introduce a hearing aid with a small, rechargeable and more efficient energy source.

The next step is to launch the large-scale production of the actual fuel cells. This is to be realised via development projects co-financed by the Danish National Advanced Technology Foundation and the Ministry of Higher Education and Science. In addition to the above-mentioned bodies, the project also includes groups of researchers from the Technical University of Denmark and iNANO at Aarhus University.

TECHNOLOGY ENHANCES SERVICE PRODUCTION IN THE WELFARE SECTOR

CareLab establishes the link between technology and welfare

The Agreement on Local Government Economy 2014, which the local authorities concluded in 2013, made technology implementation in major welfare areas a key priority. At CareLab – Information Centre for Welfare Technology – local authorities can learn more about technologies and gain the inspiration to implement and choose those that can streamline service production in the welfare area in the individual local authority. Visitors can try e.g. technologies for lifting, eating assistance robots, bidet toilets and advanced aids to enhance rehabilitation and support citizens' autonomy. Visitors also gain insight into the newest telepresence and sensor technologies, which promote safety in the home. Joining forces with leading European researchers and businesses, e.g. under the R&D platform 'Patient@Home', CareLab also provides a space for developing and testing the technology for future service production.

HIGHLIGHTS 2013

Produktion.dk

The Ministry of Higher Education and Science funded the 'Production in Denmark' project. The vision for this initiative is to show small and medium-sized Danish manufacturing businesses the technological paths they can take to increase production and make it more flexible and adaptable. This initiative is expected to strengthen employment, productivity and the competitiveness of Danish production businesses. Priority areas include the use of advanced materials and processes as well as the development of production technologies that support flexible and competitive production.

R5-COP – modular robot components for service robots

DTI is a partner in the international research project R5-COP funded in 2013 under the EU's Seventh Framework Programme ARTEMIS Joint Undertaking. As part of this project, DTI is in charge of developing both a generic concept for and demonstrations of how to link commercially available mobile robot platforms with innovative, modular software and hardware components. This is meant to enable them to act as flexible units in service production and logistics and to be used for actions like moving, collecting and grasping objects. As a Danish participant, DTI receives financial support from the Danish Council for Technology and Innovation.

Measuring laboratory in Aarhus

Danish manufacturing businesses west of the Great Belt will now find it easier to meet the high measuring requirements that ensure optimum products and production. Centre for Metrology and Quality Assurance has extended itself with a laboratory in Aarhus equipped with both a coordinate measuring machine and a CT scanner that, in terms of equipment, puts the centre at the forefront when it comes to the latest measurement technology.

DTI wants to create a sector rich in technology, using state-of-the-art materials and goods with integrated service to keep our production in Denmark.

We are on the verge of the third industrial revolution

The Materials division focuses on products and manufacturing processes in the industry. We make it possible to change the properties of materials through functionalisation, e.g. when heat exchanger plates in titanium become totally resistant to deposits or when fuel cells are given a barrier layer that turns them into the world's best-performing fuel cells. We create the basis for ensuring that the pre-cooked food of the future can be heated in the microwave oven in a way that keeps the salad cold, heats the steak and enables both to stay crisp in the same package. And we offer our expertise to large car factories, assisting them in making cars from composite materials that reduce their weight by hundreds of kilos.

We do this because Denmark and Danish manufacturing businesses need to seize the opportunities inherent in intelligent and high-technology materials if Danish production is to stay in Denmark in the future.

After decades of mass production, the trend is now moving towards mass individual production – i.e. Mass Customisation. The demands placed on production are short delivery times, considerable ability to change and full cost reduction. This opens new vistas for Danish manufacturing businesses and in no way signals a country about to close down its production.

New technologies and material properties are bringing us on the verge of the third industrial revolution. The greatest obstacle lies in the fact that new technologies require a basic confrontation with conventional industry thinking – similar to the radical changes required when the assembly line and the concept of mass production were introduced during the second industrial revolution. Businesses must embrace all the potential rather than merely substituting individual processes in their production set-up.

A prime example is the implementation of Additive Manufacturing or 3D printing technologies in production. If a 3D metal printer simply replaces a milling machine or a lathe in a conventional production, production will be slower and more costly. To obtain a positive effect,

the technology must be incorporated during the design phase, at which point the new possibilities offered by a 3D printing production process will affect design and production as well as flexibility in cost-efficient batch sizes.

This is where our imagination is truly put to the test. How can we stop ourselves from thinking along conventional engineering-design lines constantly guided by the question "can it be done?" and start inventing entirely new products that perform tasks or meet undreamed of demands?

Giving conventional materials new properties creates new opportunities for product properties, product design and production processes: Some small examples from everyday life include the anti-vibration properties or controlled heat-conducting zones that are given to printed rustproof steel or titanium. Or the way that structural elements are designed and printed so that only the necessary material is present to withstand the impact, thus achieving a strength/weight ratio several hundred times better than possible during traditional chip cutting.

In addition to risk willingness it takes inspiration, specialist competencies and flexible possibilities to test new concepts before a business ventures into major investments.

The Materials division has foreseen the coming paradigm shift and is making every effort to support Danish industrial businesses. We aim to show the way and offer the services required to support Danish manufacturing businesses in becoming frontrunners in the third industrial revolution. To this end, we are making our knowledge and competences available to Danish industry by cooperating with the industry on targeted pilot production that tests and tries out new concepts before they are put into full-scale production in Denmark.

The objective is to ensure future growth of Danish manufacturing businesses and thus promote job creation and welfare.

MATERIALS

< Insight 2013



Mikkel Agerbæk
Vice President



MATERIALS

Impact 2013 >

PILOT PRODUCTION – A KEY STEP IN THE REVOLUTION

The transition from prototype to pilot production is difficult, uncertain and often expensive. New businesses in particular risk breaking their necks in this endeavour. DTI is therefore focusing on establishing a cross-divisional and flexible focus area in high-technology pilot production. Until 2015, this is to aid in ensuring business sector growth, creating workplaces and maintaining production in Denmark.

High-technology pilot production in focus

The activities are mainly based on DTI's vast experience in product and materials development. In addition, strong cooperation with a host of leading Danish and international research institutions and universities on developing new technologies also provides a strong starting point.

The target group of the new activities includes start-up businesses that need access to various advanced production pilot-scale processes. Even small technology-intensive businesses can seek help creating the technological infrastructure required to start the pilot production of high-tech products.

“ Other European countries have come far in terms of supporting businesses through pilot production of high-technology, advanced components and high-tech products – we must strive to do the same.

Jens Christiansen, Team Manager, DTI

NEW PRODUCTION PROCESSES REQUIRE NEW MATERIALS

As 3D printing gains a foothold in the market, more SMEs obtain their own 3D printers, in which a polymer powder is melted or welded together in layers to make a product. Both polymer powder and printers are relatively cheap. However, the young technology needs to be developed and tested, and the polymer material needs to be adjusted to the business' needs.

Needs analysis for 3D printer manufacturer

DTI teamed up with 3D printer manufacturer Blueprinter to optimise its printing processes and material use through a development process. Consequently, Blueprinter acquired greater theoretical and measurable knowledge about the polymer material it uses for 3D printing. The sophisticated thermal and chemical analyses and μ CT scanning in DTI's analysis laboratory provided the business with a solid data base for developing the reproducibility and optimising the printing process.

Development through innovation consortia and projects

DTI continuously performs research in materials and often conducts needs analyses and consultancy to develop and qualify material properties. DTI largely ensures this constant development through the experience gained from participating in consortia like 'Expanding the welding compatibility of polymers' and 'Extreme materials for extreme environments'.



RESOURCE CONSCIOUSNESS IS A COMPETITIVE PARAMETER

Today huge amounts of plastic waste end up in flames at Denmark's incineration plants instead of being converted into new products.

From plastic waste to new raw material

As part of an EUDP project, Amager Ressourcecenter has asked DTI to investigate the possibility of producing a new plastic raw material from household waste. Through analyses, DTI has demonstrated that a usable plastic raw material can be made from mechanically sorted domestic waste. During the study, a total of 10 kg of plastic raw material was produced. The material has subsequently been shown to have potential use in injection moulding. The results provide Amager Ressourcecenter and the entire plastics industry with a sound basis for continuing the work to find a use for the new plastic raw material.

Reuse of plastic composites from obsolete wind turbine blades

The amount of composite waste from the wind industry increases year by year. Today, wind turbine blades are usually deposited instead of being reused. The GenVind Innovation Consortium is to identify and use environmental and financially viable avenues for reusing obsolete composite components. DTI manages a sub-project aimed at developing process technologies that will allow new products to be produced from recycled fibres, e.g. chipboards, extenders in paint and reinforced concrete.

HIGHLIGHTS 2013

Danish high technology for European super-telescope in Chile

DTI and the high-technology business Polyteknik A/S from Østervrå in Northern Jutland have joined forces to analyse the equipment that maintains the telescope mirrors in the European astronomy flagship. The European Southern Observatory depends on the telescope mirrors being shiny enough to catch light from stars and galaxies billions of light years away. Wear caused by dust particles and surface oxidation reduces the telescope's reflective abilities over time. The mirror surface therefore needs to be recoated with aluminium at suitable intervals – the quality of the coating obviously depends on proper mapping and analysis of the condition of the coating equipment.

Bottles made of recycled paper may replace plastic bottles

The paper company EcoXpac and DTI have developed bottles made of recycled paper. The bottles, which are biodegradable, can replace plastic bottles and be reused as paper waste. A coating developed by DTI makes the bottles waterproof. As a spin-off, the paper company has developed a pilot production system, which can produce the fibre bottles in connection with the filling system at the manufacturer's plant.

3D printers to make aircraft and space industry repairs

Every minute an aircraft spends on the ground is a waste of time and money. The aircraft industry is keenly interested in reducing the time spent on both ordinary regular inspections, and not least, actual repairs. DTI is partner in a project under the EU's Seventh Framework Programme which develops methods for quick and efficient on-site production of aircraft components by means of 3D printers. The project is called RepAIR.

■ DTI helps businesses implement the latest production methods and materials in the high-technology products of the future with a view to turning Denmark into a world-class producing country.

Knowledge, innovation and competent employees are the way out of the crisis

The 2013 report from the World Economic Forum showed that Danish competitiveness has dropped further. This is a sign that, despite having a comprehensive innovation system and a knowledge-based society filled with ingenuity, we are unable to translate our strengths into strong competitiveness.

The Business and Society division collected and processed the Danish data for the report – but we also work proactively to provide new empirical knowledge that will improve the framework conditions of businesses and make public innovation activities more effective.

Our starting point is the technological insight created through our advisory services and business collaboration on innovation. Through our knowledge about business and competition dynamics, we can make a substantial contribution to understanding and streamlining the overall structures that help businesses grow.

Above all, the financial crisis has shown us how growth and development in Danish businesses are interconnected with globalisation. As a result, we need to start looking at the possibilities and challenges facing Danish businesses in the global value chains.

In 2013, Denmark realised the true importance of creating jobs and growth by keeping advanced production in Denmark. We have played a central role in putting this on the agenda. And we have created new knowledge about Danish small and medium-sized manufacturing businesses and their growth, innovation and competition conditions. This is a relatively unexplored area even though this intermediate layer of

businesses is a salient feature of the Danish industry structure.

To compete internationally, Danish manufacturing businesses must operate production efficiently, have close customer and market relations, continuously develop their products using cutting-edge technologies and be capable of recruiting and retaining competent labour.

If Denmark is to be competitive and see job creation growth again, we need not only apply technology, but also apply it in the best possible way. Both the private and public sectors face the challenge of reorganising their work and processes when implementing new technology and of creating closer relations with customers, users and partners.

Whereas technology holds the potential to improve efficiency and create products with unique properties in the private sector; in the public sector, we consider welfare technology and telemedicine to be key areas that, if correctly implemented, will be hugely beneficial for people, employees and society at large.

However, competitiveness is not just about technology and its implementation alone – it also concerns employee competencies, work organisation and employee welfare. These parameters are crucial to businesses' productivity and future job creation. We have conducted various analyses regionally, nationally and internationally to uncover the demands that will be placed on tomorrow's labour when the crisis turns. We have contributed to this work by providing supplementary training to more than 6,000 people in 2013.

BUSINESS
AND SOCIETY

< Insight 2013



Jane Wickmann
Vice President



BUSINESS AND SOCIETY

Impact 2013 >

INNOVATION: FROM IDEA TO PRODUCTION

The Business and Society division helps innovation and ideas become reality by conducting innovation checks in companies and long-term innovation processes or by qualifying, developing and providing licences for inventions made by private inventors through the Consultancy Service for Inventors and the DTI FabLab.

CIS – innovation process with results

Creative Idea Solution – CIS is an innovation method that brings creativity into play and realises innovation projects aimed at generating tangible business development and value to the company.

Through CIS, cardboard packaging manufacturer Greif Denmark has been able to develop new products and market potential that draws on the company's 50 years of experience in cardboard packaging. Among other results a fibre drum that is excellent for storing vegetables was developed. It was launched in autumn 2013 in collaboration with Samsø Grønt and DTI.

“ We had become a bit blind and needed outside input, so we started working with DTI and its CIS model. This has resulted in new markets and products as well as some ideas that we immediately started to implement.

Ole Jørgensen, Factory Manager,
Greif Denmark

WORK PROCESSES AND OCCUPATIONAL HEALTH AND SAFETY

DTI has been approved as an authorised Occupational Health and Safety consultant (OHS). Our consultancy is based on a combination of in-depth knowledge and safety and our vast industry know-how.

Development and innovation process

In 2013, Business and Society conducted 20 development and innovation processes to improve work processes and OHS. During the process, managers and employees worked closely together to improve OHS through competency-developing jobs, efficient work processes and better use of new and existing technologies.

RockSafe: Accidents in the workplace prevented via video and e-learning module

ROCKWOOL is working continuously to reduce the risk of injury and accidents through preventive safety work. The company partnered up with DTI's occupational health consultants between 2011 and 2013. The 'RockSafe' project challenged the safety awareness and responsibility of factory and storage workers as well as managers. The process engendered significant results. The number of accidents has been more than halved, safety awareness has increased, and the knowledge level regarding risk conditions and safety behaviour has been boosted. DTI performed the analyses, studied the safety culture and involved the employees. Moreover, we created a storyboard that formed the basis of recordings and the production of both e-learning material and safety video.

TECHNOLOGY-BASED WELFARE AND HEALTH

As the number of elderly people grows and public welfare resources dwindle in most advanced economies, interest in health services based on information and communication technology (ICT) has increased.

TechnoAGE:

Market study of ICT and elderly people

The market for ICT-based health services is still young, and new businesses in welfare technology are finding it hard to attract seed capital. A recurring argument on this issue is that knowledge is still scarce on business models that can help give the entire market for welfare technology an international kick start.

Against this backdrop, DTI has joined forces with Ernst & Young Europe to conduct a market study for the European Commission concerning ICT and welfare for elderly people. The project is called TechnoAGE and will serve as a solid stepping stone for welfare technology as a potential international business and growth area in new types of partnerships.

■ The market study on ICT and elderly people's welfare, TechnoAGE, is based on 20 detailed international case studies validated by a range of international key stakeholders.

COMPETENCY DEVELOPMENT

Employee competencies are essential to a business' bottom line. More than 6,000 employees and managers from the Danish business sector have boosted their competencies through participating in training activities conducted by Business and Society. Of these, more than 2,500 have upgraded their knowledge on information and communication technology (ICT), which is a must in order for businesses to use digital technologies optimally.

Retraining 80 developers from the mainframe of the 1970s to modern-day systems

During 2013, DTI cooperated closely with Danske Bank to develop a unique training programme for Danske Bank's mainframe developers that enabling them to handle the bank's Microsoft technology data. This culminated in a smooth implementation of the banks online banking concept.

HIGHLIGHTS 2013

Innovation Agents

Business and Society heads the initiative 'Innovation Agents', which was extended for another three-year period in 2013. The Innovation Agents offer annual checks of the innovation potential of more than 700 businesses and provide recommendations for businesses' further development through cooperation with universities, private consultants or the GTS Institutes.

Telemedical pioneer

In 2013, four GTS institutes started collaborating on a major joint, three-year project in telemedicine. The project will lead to the development of intelligent solutions that can kick start Denmark as a telemedical pioneer. DTI is to focus mainly on developing intelligent solutions for homes, hospitals, local authorities and general practitioners.

FabLab: From idea to prototype

The fabrication laboratory FabLab TI opened in April 2013. This is a place where models and prototypes are produced using various machines and technologies: 3D printing, laser cutting, foil cutting, CNC-cutting, etc. FabLab TI is open to the general public, students and businesses as a product development and prototype facility.

We create knowledge for the growth initiative

The government and the regions have agreed to establish a growth programme for small and medium-sized production businesses. DTI has conducted a background analysis on behalf of the Danish Ministry of Economic and Business Affairs. The analysis considers aspects like international experience and results and the impacts of targeted growth initiatives.

■ DTI translates empirically based knowledge about development trends, technologies and best practice to generate development in businesses and industries through consultancy services and development projects, courses and training.

Knowledge and technology produce outstanding Danish foods

Denmark is among the world's largest exporters of healthy and safe quality foods, and we are widely recognised for high adaptability to change and reliability on the export markets. Customers trust that Danish foods are produced according to the latest know-how and with the optimum, sustainable production methods. This applies in respect to health, shelf-life and consumer quality. Moreover, the exponential rise in food demand generated by a growing global population and its increasing affluence gives Denmark an unprecedented business opportunity to increase not only the food export but also the export of production technology, knowledge and system solutions.

A key prerequisite is that Danish food manufacturers and related businesses remain competitive internationally. This includes competing on the costs of raw materials, labour and production facilities.

For almost 60 years, the Danish Meat Research Institute (DMRI) has created the required and practical solutions that have underpinned the highly successful Danish meat industry, and we now stand as a central and interdisciplinary development partner for the international food industry. The development in the food sector accelerates, and the growing complexity of the technology developed and applied calls for innovative thinking in the large established value chains. DMRI therefore focuses on boosting the competitiveness of the Danish food sector by constantly seeking new and often high-tech paths in the industrial production of foods.

Our highly specialised laboratories and equipment fully meet the multifarious needs of the international meat industry. Our core competence is how to transform a living animal into a good meal in a highly efficient value chain. We help ensure that raw materials, production processes and the final consumer quality of foods interconnect. We have an export-authorized pilot plant with

process equipment to conduct research into processing, preservation and packaging as well as sensory laboratories with trained panels who are experts in assessing the smell and taste of the final products.

We ensure efficient integration of manual processes through sophisticated automation technology. The results from 2013 show that, in practice, robot technology both saves labour and increases product yield, ensures improved production hygiene and boosts the production efficiency in businesses. We have a fully equipped robot workshop with test rig and test facilities at our disposal at the Danish Meat Trade College and at Danish Crown, where we can conduct full-scale tests of newly developed robots and equipment.

When Danish food manufacturers export their goods, they must be able to document and measure food quality to meet export markets' requirements. We therefore develop objective measuring systems based on advanced sensor technology and have microbiological and chemical laboratories as well as two mobile CT scanners at our disposal.

We constantly develop, renew and adjust our activities to maintain our position as the world's largest and leading knowledge centre for research and innovation in the field of animal food.

In 2013 the foundation of DMRI's new research facilities took shape. When these open in 2014, they will be the world's most sophisticated development facilities for the meat industry.

We are determined to boost knowledge, technology and, above all, innovation in the sector as we have always done, thus helping the Danish meat industry to maintain its advantageous position in the export of quality foods, technology, knowledge and system solutions.

DMRI

< Insight 2013



Lars Hinrichsen
Vice President



DMRI
Impact 2013 >

HIGH PRECISION TECHNOLOGY SECURES EXPORT MARKETS

A unique partnership between DMRI, machinery manufacturer Attec Food Technology and abattoirs Tican and Danish Crown has secured the development of a new, state-of-the-art robot cutter that uses high-precision to cut the fat on pork loins. This results in more uniform, higher quality products with less waste. Moreover, the technology allows Danish abattoirs to make customised products in line. The result of this high-technology process is better and more competitive export products – a key to keeping workplaces in Danish abattoirs.

New 3D technology in abattoirs generates high-quality export meat

Previously, abattoir workers had to evaluate the thickness of the fat layer on pork loins manually. Now, the new robot generates an accurate 3D image of each individual pork loin and determines where the fat meets the meat. A patented knife system consisting of eight individual knives automatically cuts the rind of the porks loin. The process is extremely rapid – it takes the robot a mere four seconds to trim each pork loin. The 3D derinding robot was developed and installed at the Tican abattoir in Thisted, and Danish Crown is currently installing machines in its abattoirs throughout Denmark. The robot has also attracted international interest.

AUTOMATION TECHNOLOGY IMPROVES HYGIENE AND SAFETY

DMRI's detailed knowledge of slaughter processes, hygiene and robot technology has created the basis for developing a simple, automated process for handling the fatty part of carcasses.

Less manure contamination and improved health and safety

Pork abattoirs face a challenge when it comes to ensuring that meat is not contaminated with pathogenic bacteria from manure during slaughtering. Contamination typically occurs when the intestines are removed. DMRI has developed automatic equipment that catches the fatty parts and places them in a natural bag consisting of mesentery membranes, a procedure that substantially reduces the incidence of manure contamination. Since the integration of this equipment replaces a physically straining, manual operation, it also impacts health and safety of the workers positively. In developing the mechanical solutions and the prototype, DMRI sought the assistance of CCM-Teknik. Following a trial and run-in period, the prototype was taken over by the abattoir in which it had been installed. The equipment has a capacity of more than 600 carcasses per hour and is expected to be implemented at all Danish pork abattoirs.

“ In the long-term, the new cutting robot will help keep the production of highly specialised abattoir products in Denmark. It's an excellent example of Denmark as a developer of the world's most advanced abattoir technology, which creates jobs in small and medium-sized businesses in the Danish engineering industry.

Jens Ulrich Nielsen, Director, DMRI



FROM RAW MATERIAL TO FINAL PRODUCT

Together with the pork sector, DMRI is working to provide new documentation of the relationship between feed composition, fat quality, shelf-life and consumer response. This work will result in new guidelines for feed composition in pig production.

“DTI’s work to optimise fat quality in Danish meat helps ensure that Denmark maintains its large market share in the East European markets.

Jens Rahbek, Export Manager, Danish Crown

DMRI ensures fat quality

Fat quality poses new challenges to the Danish abattoir industry. Pig farmers want to use cheaper raw materials like corn in their feed, but this could compromise fat quality because it results in softer fat, a lower melting point, shorter shelf-life and problems during cutting.

Together with the Danish Pig Research Centre, DMRI has produced pigs with a large variety of fat quality. Fat tissue from these pigs has been analysed, and consumer surveys have been conducted to test the various meat products produced in terms of eating quality and shelf-life. The survey results form the basis for the new guidelines. The objective is to ensure a win-win situation whereby pig farmers can compose their feed economically without risking losing market shares.

HIGHLIGHTS 2013

World meat industry met in Frankfurt

142 countries were represented at the world’s largest equipment fair IFFA in Frankfurt, which was visited by more than 60,000 stakeholders. For the first time, DMRI took part with its own stand and encountered overwhelming interest. This brought many contacts and leads, many of which have already resulted in specific orders.

DMRI abroad

Poland is a strong meat-producing nation, and in 2013 DMRI Poland was established in partnership with DTI Polska to cater to this market more efficiently. Spain is another major player in the meat industry, and DMRI has engaged into an agreement with a Spanish partner to establish DMRI Spain. The first orders have been received, and, particularly in Spain, things are moving fast.

Knowledge-sharing across continents

In 2013, DMRI hosted the popular international symposium Future Industrial Meat Production in which 15 countries took part. With 40 international articles in scientific and technical magazines, DMRI contributed with significant new knowledge to the international food sector.

Technology in a practical world – new record

Five brand-new and revolutionary robots were put into operation in 2013. This record number proves that a focus on real needs, an understanding of the challenges and in-depth technological insight is the recipe for success. The robots are used at several different production stages, but they all increase production efficiency, improve product quality and optimise health and safety.

■ DTI is the world’s largest and internationally leading knowledge hub for research and innovation in animal food. DMRI’s specialists develop solutions for the international meat industry and offer consultancy nationally and internationally.

Technology maximises the return on building and construction investments

For most people, building and construction equals the massive wood, concrete, brick and asphalt structures that provide the framework of our indoor activities and the logistics of our daily routines. However, our building stock and constructions are, in fact, dynamic social parameters crucial to the economy. In Denmark alone, we have 2.5 million buildings representing an economic value of DKK 3,700 billion.

Every time we build roads, houses or bridges, we invest in the growth of society. However, every building and construction can also impact the economy and environment adversely: With every new building comes greater maintenance costs, energy consumption and CO₂ emissions. As much as 40% of our energy consumption and a third of our CO₂ emissions relate to buildings.

We can and must reduce this negative impact so that our buildings and constructions become an asset to society. We do this by applying technology to develop the materials, designs and methods for construction, maintenance and renovation that improve the performance of constructions, reduces maintenance costs and creates energy-efficient, sustainable buildings.

In the coming years, Denmark will invest DKK 300 billion in new infrastructure and construction projects.

To realise the full value of these investments, we need to intensify technology development – and minimise the maintenance burden. This is why we have expanded our activities in the “Danish Expert Centre for Infrastructure Constructions” beyond a sole focus on concrete structures like bridges and tunnels to include roads, asphalt, composite structures, membranes, surfacing, etc.

We can also do better when it comes to energy and the environment. In this area, we experience strong political focus on reducing the environmental and energy impacts of the construction industry. This places new demands on construction as well as on the sustainability and energy consumption of the individual materials.

We ensure that the construction industry optimises sustainability in constructions and we help it to understand and implement the rules, meet standards and ensure the documentation. For instance, we make sure that construction products are labelled with environmental product declarations.

When we reuse building and construction waste, we also consider the green and sustainable aspects. Building and construction waste constitutes about 25% of all waste generated in Denmark. Reusing construction waste not only saves the environment, but can also create considerable savings in construction costs for new building contracts.

A considerable amount of waste can be reused, but only if we make sure that environmentally harmful and health-harming substances such as lead, PCBs, asbestos, etc. are not spread unnecessarily via our waste. We invest heavily on this front to support the construction industry in meeting the government's requirements in the area – and not least to develop the knowledge and methods to remove hazardous substances from buildings still in use.

The increasing requirements also mean that the industry must become increasingly innovative in its renovation methods and use of green materials in construction. We therefore increasingly focus on innovation, research and development projects conducted together with small and large businesses. For instance, we have developed a new method improving the energy performance of facades on single-family homes, which we believe will give the energy renovation of existing buildings a real boost.

Overall, we intend to ensure that investments in new buildings, renovation and maintenance generate a technological development that minimises the undesirable impact the building industry can have on the economy and the environment. However, we also see a clear opportunity where technology development can offer access to a potential market in which the Danish industry can compete on innovative methods for energy renovation, sustainable building materials and new construction projects. In this way, building and construction can become an even greater asset to the Danish society.

BUILDING AND CONSTRUCTION

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Mette Glavind
Vice President



BUILDING AND CONSTRUCTION

Impact 2013 >

INVESTMENTS IN CONSTRUCTION

Steel fibre reinforced concrete benefits the environment

DTI is the project manager of the Steel fibre reinforced concrete Consortium, which is tasked with making it possible to use less steel in concrete reinforcement. The consortium has prepared a design and implementation guide, a simulation tool and carried out two full scale demonstration projects, including an underpass connected with the bypass by the town of Slagelse. Steel fibres in concrete generate financial, CO₂, and OHS savings.

High concrete quality in Metro Cityringen

As part of the major construction project Metro Cityringen (city circle line), the Building and Construction division is using its vast experience in concrete technology to ensure that the Italian consortium of contractors CMT understands the technical requirements, norms and standards for concrete stipulated by the Danish authorities. In this way, Building and Construction ensures the optimum safety and lifetime of the concrete.

“ When large sums are invested in concrete structures for infrastructure, as we have seen in recent years, much money can be saved by making high demands for optimum performance and thus low renovation costs. This is what we want to ensure.

Dorthe Mathiesen, Director, DTI

THE HEALTHY BUILDING

Simple and efficient PCB renovation

Use of the environmental toxin PCB in building materials has been illegal for many years. PCB renovations are typically comprehensive and expensive to complete. They also produce massive volumes of waste and release toxins to the environment. DTI has invented a simple, efficient and gentle method for curbing PCB emissions to the environment. The method is currently being tested.

“ Energy renovations can generate significant heating bill savings for homeowners, but it is important not to compromise on indoor climate during energy renovations, as we and our children spend most of our time indoors.

Thomas Witterseh, Senior Consultant, DTI

Avoid indoor climate problems caused by energy renovation

DTI and Enemærke & Petersen have prepared a report for the Danish Energy Agency to help building owners prevent renovations from deteriorating the indoor climate.

Experience in resident behaviour and results from more than 3,000 consultancy projects and building surveys performed between 2009 and 2012, has resulted in a report that offers important recommendations and proposals for improvements.

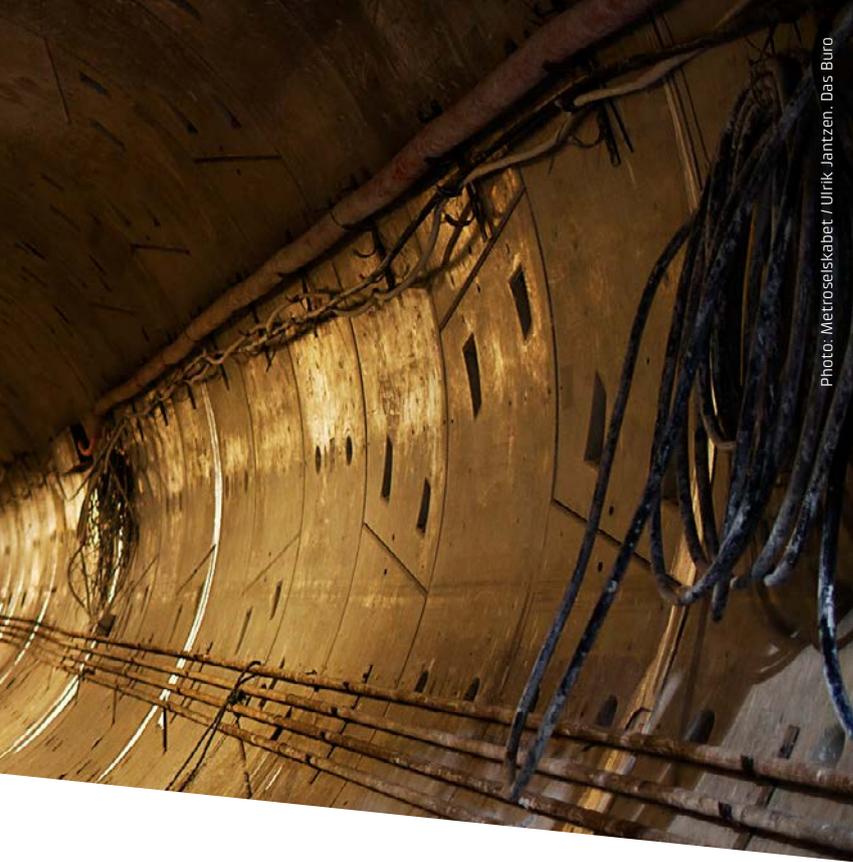


Photo: Metrosekskabet / Ulrik Jantzen, Das Büro

SUSTAINABLE BUILDINGS

Danish construction industry in green gear

The construction industry accounts for more than 40% of Europe's total energy consumption. With resource consumption and sustainable development on the agenda, an increasing number of manufacturers now see the advantage of preparing an environmental product declaration that makes the environmental profile of products clear and transparent.

The EPD (Environmental Product Declaration) scheme serves as a pivot for the development and application of environmental product declarations. In Denmark, the scheme is called EPD Danmark and is run by DTI. The scheme enables construction product manufacturers to document resource and energy consumption as well as any environmental impact associated with the production, use and disposal of a construction product.

Environmental impacts such as global warming, ozone layer depletion and diminishing natural resources are just some of the parameters included in an EPD.

From jeans to insulation and acoustic panels

Even if your old jeans are worn out, they still have not completed their life cycle. DTI is conducting research into bringing e.g. worn-out jeans back to life by reusing the fibres as reinforcement in fibre panels used for, say, more sustainable insulation or sound-absorbing acoustic panels.

HIGHLIGHTS 2013

Exciting concrete architecture at competitive prices

The prestige project TailorCrete, which is part of the EU's Seventh Framework Programme, has developed and demonstrated technologies that make it possible to produce free-form concrete structures. The result is a number of exciting and innovative methods that use robot technology, for instance, to make double-curved and smooth aesthetic surfaces.

Focus on construction waste

As a result of the government's resource strategy and the construction industry's challenges in terms of the environmentally harmful substances contained in construction waste, Building and Construction established a new team to provide consultancy in waste sorting and handling.

Microwaves take the tile industry from "black" to green production

Danish building tradition is synonymous with beautiful tile roofs. However, the fact that tileworks are among the most energy-intensive businesses in Denmark poses a challenge. Building and Construction has won an EUDP project headlined 'Sustainable Manufacture of Bricks and Tiles with Microwave Energy'. The main objective is to halve energy consumption in brick and tile production, while also changing the energy source from fossil fuel to electricity, which could potentially come from renewable energy.

InnoBYG sets the agenda

The Danish Ministry of Higher Education and Science extended the licence of the innovation network for sustainable construction – InnoBYG – which is facilitated by DTI, by another four years. InnoBYG also succeeded in setting the building renovation agenda on the Danish governments innovation strategy.

DTI boasts substantial industry network and is involved in most major development and innovation projects in both Denmark and the rest of Europe.

Smart energy is the key to continued growth in society

The world demands more and more energy. Both because the world's population is exploding and because living standards are improving rapidly. As a result, energy must be used efficiently throughout the chain, and new energy types and sources must be optimally introduced. This is the challenge the Energy and Climate division is trying to meet.

Denmark is world leader in integrating renewable energy. In 2013, 33% of our electricity consumption stemmed from wind, and in December 2013, the share of wind power had reached 55%. An efficient use of the increasing amount of fluctuating renewables in our energy system requires that the produced energy is consumed the second it is available. We are working to ensure that energy is more efficiently used throughout the chain from production and distribution to consumption in buildings, industry and transport. In addition to the use of solar and wind energy, we are researching the efficient use of biomass as an alternative resource in energy production. The transport sector, for instance, is an area that is beginning to shift from traditional fossil energy sources to electric transport as well as new biofuel applications.

The new energy types pose new requirements to the development of energy storage and energy conversion technologies. In 2013, the division focused on making thermal energy storage more efficient and on improving existing energy conversion technologies.

Energy retrofitting has been a focal point in the past years. Energy consumption in buildings accounts for 40% of total energy consumption, thus holding a massive savings potential. Building renovation combined with the integration of photovoltaics and heat

pumps is an important and notable area for Energy and Climate, and in 2013, we focused mainly on municipality buildings and the renovation of residential properties.

Denmark holds a unique leading position when it comes to developing the green, flexible and intelligent energy system of the future. The new smart energy system heralds a revolution in how we produce, distribute and consume energy. An energy system where the production, distribution and consumption of electricity, heat and gas are integrated intelligently – where the energy system employs communication and information technology to ensure that energy is provided only when and where it is needed. And where consumption is adapted to production.

We call it "smart energy". Our division is extremely active when it comes to introducing the intelligent energy system of the future, for which purpose we are participating in a wide range of development and network activities in Smart Grid and Smart Energy.

In 2013, we reinforced our exceptional position as the Nordic region's largest energy laboratory for research and development as well as component testing. We have extended our facilities in the areas of biomass, batteries, buildings, heat pumps, flow and engine technology.

Obviously, converting the way in which we use and produce energy today poses major political and industry-related challenges. To realise our vision, we need to include the entire production chain and ensure that the development process results in energy products that in every respect can be integrated into a large and comprehensive production, distribution and consumption system.

ENERGY AND
CLIMATE

< Insight 2013



David Tveit
Vice President



**ENERGY
AND CLIMATE**
Impact 2013 >

**CLIMATE CHANGE
AND CLOUDBURSTS**

Water Balance in Urban Areas

Flooding caused by cloudbursts and heavier rainfall frequently make the headlines. Massive investments in larger sewers can reduce the extent of the resulting damage. However, DTI is also involved in developing cheaper and more intelligent alternatives.

The Energy and Climate division is the project manager of the innovation consortium 'Cities in Water Balance'. The objective is to adapt urban areas to future cloudbursts, while also creating green and robust urban areas that do not overload or pollute their fresh water resources. This is an environment-friendly approach with immense global market potential.

During 2013, the City of Copenhagen established roadbeds. Roadbeds are a solution favoured by local authorities and utility companies alike, as they reduce the load on the sewers and curb traffic. If roadbeds become a success, they will have a considerable market in Denmark and internationally.

“ Already today, climate change causes greater and more frequent rainfall. We therefore need to find other rainwater solutions besides channelling water directly down the sewers. We should consider it a resource that can be delayed, stored, seeped down or evaporated.
Hanne K. Jørgensen, Senior Consultant, DTI

ENERGY RENOVATION

Screening can save local authorities millions on their energy bills

One of Denmark's key challenges is to energy renovate the building stock, it accounts for about 40% of total energy consumption.

A detailed energy screening of each building is needed to obtain financial and sustainable viable solutions.

■ Energy screening maps out the most viable technological solutions for each building and how to achieve energy-optimised operations. The screening also provides an estimate of how much money and how much CO₂ can be saved overall, resulting in a well defined basis for an optimal renovation process.

To meet the political objectives, Danish municipalities, among others, have to make investments in retrofitting ventilation and heating systems, building envelope, establishing photo voltaic and optimising the operation of heat and electricity-consuming installations.

The good news is that municipalities will not only reach their ambitious CO₂-targets, but also save millions. DTI participates in a project in the city of Aarhus to energy renovate some 650 buildings.

FUTURE ENERGY TYPES

The world's most sophisticated heat pump laboratory

Heat pumps are one of the most essential technologies for the fossil-free society. The recent years' fluctuating energy prices and new oil tank requirements, etc. have given the heat pump industry an opportunity. New requirements and standards for the market for cooling and heat pump systems come in the wake of this renewed involvement. Energy and Climate has taken on the task of keeping the industry abreast of developments by holding theme days on ecodesign, energy labelling and new standards.

The new requirements have prompted DTI to establish a world-class heat pump test centre. The test centre enables the testing of properties that have thus far not been possible to test in Denmark or the other Nordic countries. The facilities boast 700 m² and can test heat pumps of up to 40 kW. In addition to meeting the latest EU standards, the laboratory has also been EHPA certified, meaning that the noise level of the heat pumps can be measured according to international standards.

Sustainable ferry services

Ether-based fuel is a brand new bid for a CO₂ neutral diesel engine fuel. Together with the shipping company Stena Line, DTI has rebuilt auxiliary engines in one of the company's ferries to use the new fuel. The fuel is a spin-off of one of DTI's previous research and development projects. The maritime area is regulated by the International Maritime Organization, which requires a reduction in sulphur and NO_x emissions from ships in Nordic waters. This technology will therefore also be interesting to similar shipping companies in the near future.

ALTERNATIVE RESOURCES IN ENERGY PRODUCTION

Frontrunner in marine biomass

Algae are the largest, unexplored biomass resource and hold promise in such diverse areas as sustainable energy, food, animal feed, chemicals and pharmaceuticals. DTI is the project manager of the Nordic Algae Network project. The objective is to pool small and large industrial businesses in Iceland, Norway, Sweden and Denmark working with micro- and macroalgae. The 18 industries that have joined the network make either equipment for alga production or alga-based products. This comprehensive network ensures DTI a strong Nordic profile and position in the rapidly growing area of marine biomass.

HIGHLIGHTS 2013

From waste to sustainable fuel

Each year, several tonnes of organic waste end up in the landfills of Africa. DTI is the project manager of the EU project Biowaste4SP, which aims to find the most efficient methods of transforming waste into usable products. In June 2013, DTI was visited by researchers from three out of five participating countries – Ghana, Egypt and South Africa. During their stay, the researchers learnt the most basic methods needed to convert organic waste to bioethanol.

Operation of Smart Grid district heating systems to be optimised

The Smart Grid concept is commonly used in connection with intelligent control of the power supply grid. Now it will also be associated with the district heating network that provides heat to more than 60% of Danish homes. Under the EUDP project, DTI will cooperate with Danish companies on creating a district heating system so intelligent, flexible and dynamic that the fluctuating energy production from renewable energy sources can be integrated and exploited optimally without requiring the consumer to compromise.

DTI contributes to Denmark's first, new CO₂-neutral town, Vinge

Vinge is a future-oriented town where the interplay between photovoltaics, heat pumps and heat accumulators ensures CO₂-neutral operations and sustainable energy supply. DTI has been in charge of analysing, calculating and simulating the local supply scenario, which focuses on individual supplies to each housing unit and housing block. Focal points have been security of supply, economy, flexibility and energy systems' potential for energy storage and energy savings as well as the use of renewable energy technologies.

DTI assists in developing new energy-efficient products and processes. We ensure that society is able to apply sustainable energy technologies and improves energy efficiency in buildings, industry and the transport sector.



A growing number of people will live better and longer lives

A steadily increasing and more affluent population means that the global middle class is growing rapidly. This raises demand for products that promote a long and healthy life.

In the area of food, the growing middle class in places like the BRIC countries is expected to increase the demand for healthy and sustainably manufactured quality food.

The Life Science division ensures that technological development is translated into practice and that Danish businesses have a market advantage. It is necessary to supply high-value food based on knowledge that makes them difficult to copy and to produce food with special nutritional properties that cater to individual consumer needs as regards personal nutritional strategies.

The rise in lifestyle diseases challenges our welfare and calls for new solutions that can solve these problems efficiently and inexpensively. Biotechnological development plays a pivotal role. Individual treatment is the aim, and Life Science plays a key role in selected areas in e.g. cancer research.

The escalating demand generated by a growing population that lives better and longer creates serious environmental challenges and puts increasing pressure on the world's limited resources.

In terms of the environment, the key action areas are sustainability and greater resource utilisation throughout the value chain.

With 'The bio-based society' initiative, Life Science is accelerating the development of new technological solutions in e.g. biogas, reduced water consumption and efficient use of residual products from food and animal feed.

Today, only 30% of the oil in a North Sea oil-field is extracted. Advanced biotechnology can increase this yield significantly, while also reducing the environmental impact.

Life Science works in a high-technological, advanced and knowledge-intensive world. In every respect, this requires state-of-the-art facilities in the form of high-technology laboratories that have analysis equipment as well as process and pilot-scale equipment and where new technological solutions can be put into practical use.

Fortunately, our activities are targeted at everyday life and are relevant: they support a good, long and healthy life while ensuring that sufficient resources are available even though a growing number of people are living longer, better lives.



Bo Frølund
Vice President



LIFE SCIENCE

Impact 2013 >

BIOSCIENTIFIC RESEARCH

Individualised cancer treatment

With approximately one million annual new cases worldwide, colon cancer (colorectal cancer) is one of the most widespread cancer types in the world.

New and effective drugs, so-called antibodies, have been developed. However, they only work in 10-20% of the cases where the cancer cells do not carry one or more mutations. By identifying the mutations before choosing the drug, patients can be spared ineffective treatment and instead start a treatment targeting their specific needs.

Together with the small-scale biotech company PentaBase, DTI has developed a diagnostic analysis kit that allows some of the most common mutations related to colon cancer to be detected.

The new kit makes it easier to identify the right candidates for the new antibody treatment, of benefit to patients and the healthcare sector. PentaBase is currently introducing the diagnostic kit in the market.

“ We’re looking forward to boosting our growth even further via this project, and we expect to hire more staff.

Ulf Bech Christensen, CEO, PentaBase

HEALTH AND ENVIRONMENT

Reducing hazardous chemicals in hair dye

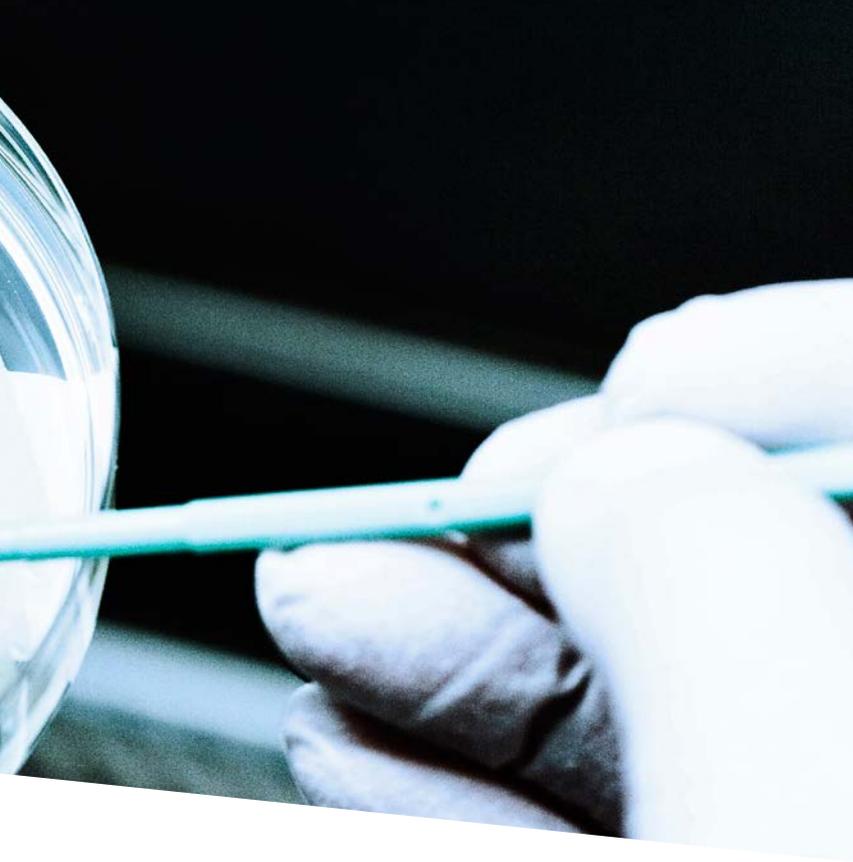
On average, occupational health and safety hazards, including various chemical substances compel hairdressers to change their line of work after just nine years in the trade. Hair dyes constitute a particularly problematic group of cosmetics as they often contain hazardous chemicals like potent allergens. These substances particularly affect those hairdressers who work with them on a daily basis. After ten years in the trade, hairdressers' relative risk of skin and breast cancer increases 70%.

DTI is working with hairdressers to develop hair dyes with less harmful chemicals that still produce the intended result. In addition to improving the occupational health and safety of hairdressers, this work is expected to result in the development of products with considerable market potential.

DTI strengthens its position in the oil industry

Reservoirs may contain up to 70% residual oil, which is not cost effective to recover. DTI has established a new centre that will cooperate with oil companies to develop, test and implement technologies and methods to help increase oil recovery and thus extend the lifetime of existing oil fields in an environmentally safe manner.

One of the centre's core competencies is to use tracers to map out water flows between oil wells and identify areas with inefficient recovery. The measurements can also be conducted offshore to allow immediate use of the data generated from the measurements.



“We are working to develop new technologies to ease the oil flow. We are also enhancing the possibilities of controlling water flows in reservoirs. This allows us to expend less water in relation to the oil produced.

Allan K. Poulsen, Director, DTI

THE BIO-BASED SOCIETY

Improved resource utilisation of fish waste

Along with an increasing focus on using waste as a source of value creation, interest has also been shown in the potential economy in fish waste – i.e. offal. Today, fish offal, which constitutes about 50% of all catches, is used for fishmeal, oil, mink feed and biogas or it is discarded. A rise in the value of offal will have a significant financial impact on the fish industry.

DTI heads a major initiative in North Jutland on the use of high-value products from fish and crustaceans. The idea is to use products not normally used for consumption. Ideally, utilisation can be increased from approx. 50% to more than 70%. During 2013, work involved developing and selling high-value products made from fish heads, skin and scales, establishing direct distribution and sales channels for fresh fish and introducing gut ensiling to small and medium-sized boats.

HIGHLIGHTS 2013

Breaking the biocorrosion code

Submarine pipelines daily transport oil and gas worth more than DKK 100 million from the North Sea. Biocorrosion caused by bacteria constitutes one of the greatest threats to free flow through the pipeline. So far, it has been difficult to predict where in the systems biocorrosion would occur. DTI and Maersk Oil have developed a modelling tool based on DNA analyses of the bacteria involved. The tool is able to predict where the risk of corrosion in the pipelines is highest. This means that the right measures can be taken in time to maintain production and protect the environment.

Project on lung cancer no. 1 in Eurostars

Eurostars is a European research and development programme aimed at development-oriented small and medium-sized businesses. With its SensiScreen Lung project, Life Science scored a no. 1 ranking among 510 project applications from all over Europe. The SensiScreen Lung project deals with improving lung cancer treatment. Together with a small Danish biotech company, DTI will develop new analysis methods for predicting if a given treatment will be efficient for a given patient. The project will also develop a method for monitoring whether or not the individual patient's tumour is becoming resistant to treatment.

Life Science expands with new laboratories

In 2013, Life Science established new laboratories, and now has more than 2,500 m² of laboratory facilities. This includes process laboratories fitted with pilot-scale equipment for testing new technologies for utilising bioresources and treating water as well as high-pressure facilities for developing technologies for preventing biocorrosion and ensuring enhanced oil recovery. Moreover, the molecular biology laboratories were expanded with facilities that will enable bacteria, fungi and bacteriophages to be grown. The analysis/chemical laboratory facilities have also been developed and extended with new equipment.

DTI is at the forefront of high-technology development in environment, healthcare and food.

Accelerator technology constantly developing – we realise the market needs

The most famous particle accelerator is, without doubt, the 27-km-long Large Hadron Collider at the European Organisation for Nuclear Research (CERN) in Geneva. The key objective of the particle accelerator is to make atomic nuclear particles collide at an extremely high energy and thus to be able to document the existence of one of the smallest building blocks in the universe, i.e. the Higgs boson, predicted by the most recent recipients of the Nobel prize in physics.

Although CERN's particle accelerator is the world's largest, it only represents a small fraction of the field of particle accelerators. Thousands of particle accelerators are used for entirely different purposes in research, healthcare and industrial production. Worldwide, investments in new accelerator equipment reach around DKK 10 billion.

In the research segment, accelerators are used not only in the field of physics, but also extensively in areas as diverse as environmental technology and biotechnology, the development of new materials and pharmaceuticals and archaeology. To conduct research of the highest international calibre, researchers are posing ever-greater requirements to accelerator performance in their desire to attain a technical standard beyond state-of-the-art. One of our challenges is to continuously meet the exacting and insatiable market demands for technological progress. We work closely with our customers to deliver the solutions they require.

During the past year, we have developed new magnetic technologies that drastically improve the quality and intensity of accelerator particle beams. This produces outstanding research results in much shorter time and with fewer investments and operating costs than before. Focused on solving long-term objectives, we have joined a pan-European network cooperation that aims to explore the potentials of combining laser and accelerator technology.

In the past years, the use of particle accelerators for efficient, sophisticated cancer treatment has also increased dramatically in the healthcare sector. Particle therapy applies accelerated hydrogen and carbon ions to attack and effectively kill tumour cells in cancer patients, without damaging healthy tissue around the tumours. It takes huge and expensive accelerator facilities to accelerate the particles at energies sufficiently high for this purpose. Only about 30 facilities of this type are used clinically at hospitals around Europe, the US and Asia, and the cost of such facilities lies in the DKK 0.5-1 billion range.

More cost-optimised facilities need to be developed to increase the use of this ground-breaking treatment technology. In 2013, we established a department for particle therapy accelerators to explore the business prospects in this area and develop a new and more compact particle therapy accelerator system.

The most comprehensive industrial use of accelerators in industrial processes involves ion implantation in thin silicon discs for electronic components, computer chips, flat screens and solar cells. Worldwide, 200-300 accelerators are produced annually for this purpose at a total investment value of DKK 2-3 billion. Operating and maintenance costs are among the competitive parameters for these facilities, which must be able to run 24/7 for at least 10 years.

During the past year, we have successfully completed and commercialised our Green Magnet™ development project, which is aimed at the ion implantation market.

In view of the past years' considerable growth in our revenue and staff and investments in large production facilities and new test facilities, we are well prepared to meet the challenges this demanding market poses in respect of our products and services. We want to help build the world's best and largest particle accelerators for research, healthcare and industry.

** Bjarne Roger Nielsen turned over the position as managing director to Frank Ebskamp on 1 March 2014.*

DANFYSIK

< Insight 2013



Bjarne Roger Nielsen
Managing Director*



DANFYSIK
Impact 2013 >

GREEN MAGNETS HELP INDUSTRY LOWER THE ELECTRICITY BILL

Power and water-saving magnets gain footing

Together with Aarhus University, Aarhus University School of Engineering, Aalborg University and the company Sintex A/S, Danfysik has been designing green magnet technology for particle accelerators. The results fully meet the performance targets set at the beginning of the project, and two demonstrations have been prepared for various market segments. A +95% reduction in energy consumption has been demonstrated, as well as massive savings on the actual installation.

The Green Magnets™ technology aroused considerable interest when it was launched at the international particle accelerator conference IPAC13 in Shanghai. From an international perspective, this technology holds a lot of promise.

“ The Green Magnet™ is running in our MICADAS. We had no problems tuning the system with the new magnet and subsequently operating the system in this configuration. From our measurements, we can conclude that the magnet is behaving very nicely and we have a performance that is very similar to the conventional magnet.

Hans-Arno Synal, ETH, Zürich

PARTICLES IN THE HEALTHCARE SECTOR

Huge success when the installation in Shanghai was approved

Danfysik’s giant leap into the Asian healthcare sector reached a milestone when the installation of the first particle therapy facility for combined hydrogen and carbonate ion treatment in China was approved.

Danfysik has managed the installation work and participated in the on-site run-in, testing and commissioning of the facility in Shanghai. The experience gained from the project will be used in future tender processes regarding particle therapy hardware, operation and service.

! Danish politicians have discovered particle therapy and the advantages of this gentle treatment method. Accordingly, particle therapy was included in the 2013 Danish Finance Act as part of the government’s new welfare initiatives.

Beamlines in India to help doctors in Kolkata with advanced diagnoses

Two accelerator beamlines for a medical cyclotron in Kolkata, India, will be used in research, development and production of radioactive markers used in state-of-the-art medical diagnostics devices called PET scanners. The two beamlines are delivered as one system. The physicists have completed the development work, and engineers are fully engaged in the detailed design of the system, which will be ready for the doctors to use in 2014.

RESEARCH

Super compact magnets for ultra-brilliant synchrotron light source

Accelerator physicists at the MAX-lab in Lund, Sweden, have devised a method by which their new synchrotron, MAX IV, can become the world's first ultra-brilliant synchrotron light source. The art is to equip the accelerator with as many bending magnets as possible. Previously, this would have called for a huge accelerator, but equipping the accelerator with super-compact magnets offers an alternative that can keep the accelerator within reasonable dimensions.

Danfysik has won the contract to make this type of magnet for the MAX IV project. Three different prototypes were tested and approved in the spring, and series production is well under way with final delivery slated for spring 2014. Danfysik is at the leading edge as a supplier of this technology, which some of the most renowned laboratories in Europe, the US and Japan are now contemplating using.

“It is a fantastic opportunity being able to work in the Oresund Region with a new, unique magnet technology that has also attracted considerable interest in other accelerator laboratories in Europe and the US.

Bjarne Roger Nielsen, Managing Director, Danfysik

LA³Net - Laser Applications at Accelerators

Danfysik is one of the leading industrial members of the LA³NET (Lasers Applications at Accelerators) network, which is one of the EU Seventh Framework Programmes, the 'Marie Curie Initial Training Network'. The network focuses on applying laser technology to produce ion beams in ion sources and on accelerating and diagnosing ion beams. One result of this membership is that Danfysik is hosting an industrial Ph.D. student working on accelerator-based intense x-ray light sources of the future the so-called Free Electron Lasers.

ESS – A massive Danish investment in research infrastructure

Denmark and Sweden host the joint-European accelerator facility in Lund, European Spallation Source (ESS). Together with the Centre for Storage Ring Facilities under Aarhus University, Danfysik has developed the conceptual design of the magnets and power supplies of the accelerator system. At the same time, proposals for controlling the imprint from the 5 MW-intense proton beam have been developed.

HIGHLIGHTS 2013

First accelerator with Green Magnets™

Even before the initial project involving green magnets was complete, Danfysik won the first contract to equip an accelerator with sustainable magnet technology. The accelerator will be used by ETH Zürich for ultra-sensitive C14 dating. This new technology is expected to generate potential savings in energy consumption of 90% over a 10-year period.

The magazine 'Nature', September 2013: Ultimate upgrade for US synchrotron

In the September issue of the scientific magazine 'Nature', an article described how the US' leading synchrotron radiation laboratory, Advanced Photon Source at Argonne National Laboratory, is planning to upgrade the existing accelerator system with compact magnetic systems similar to those Danfysik made for MAX IV in Lund.

Get Involved – ESS' in-kind contribution process started

In autumn 2013, European Spallation Source (ESS) invited businesses and institutions from the ESS member states to submit their expression of interest for contributions to the large-scale accelerator facility. The prospects for Danish high-technology deliveries to this large-scale, Danish-owned accelerator project should be good.

Danfysik sprints ahead to become Gazelle company

Boasting revenue growth of 199% over the past four years and a positive bottom line for all years, Danfysik was named Gazelle company at Børsen's and KPMG's annual award ceremony. To become a Gazelle, a company must have revenue that has at least doubled in the past four years, and overall performance in the four years must be positive.

■ Danfysik combines high-technology knowledge with specialised production in mechanical processing and electrotechnology to secure Denmark's stronghold in accelerator technology.

Competence as an enabler in an ever more challenging world

Sweden has a long tradition of continuing education and training in which private education and training businesses have played an essential role in developing the workforce and Swedish businesses.

Society is engaging in an on-going dialogue on the value of competence development, but at Teknologisk Institut, Sweden, we are convinced of its importance. The pool of skills and competences available in the companies positively affects the ability of the companies to realise their full potential. Also awareness of the individual person's own competencies and development is decisive to being employable in an increasingly tougher labour market.

Teknologisk Institut, Sweden offers a unique platform on which our three core businesses in the areas of 'open and customised training', education and training conferences' and 'Higher Vocational Education' position us as one of the most comprehensive providers of courses and programmes in the Swedish market in our chosen niche – training conferences of high topical value, management and basic technology courses targeting different industries.

With nearly 9.000 people taking part in the courses, programmes or conferences we provided in 2013, we have increased the skills and competences of the participants and contributed to making businesses more competent.

We offer about 250 courses, programmes and conferences annually, some of which are organised several times a year. The courses impart knowledge to professionals, the conferences focus on topical issues. Moreover, we ensure the availability of courses and programmes in the framework of the public Swedish Higher Vocational Education system (HVE).

The intensified competition in the market challenges the ability of businesses to invest in education and training initiatives. We continue to provide the courses and programmes demanded and assist companies in increasing awareness of the vital importance of competence for long-term progress.

Today, the public system in Sweden and the European Union provide and promote funding for education and training. The need will be massive in the future, which places demands on the education and training businesses wanting to contribute to this development.

Future requirements, besides a high quality level, will include technological development where the format of education and training services will change as will the requirement for the impact in the companies.

In 2013, Teknologisk Institut, Sweden focused on creating a stable platform for the future of our business. Rationalisation and focus measures were implemented and yielded positive results, financially as well as strategically - and even engendered a greater presence in the Swedish market.

One of several new initiatives during 2013 was the development of programmes and courses in the area of concrete, which - in spite of a weak market - grew and expanded. HVE-programs with a focus on concrete will be a development area in 2014.

Over the year, initiatives were also taken to position Teknologisk Institut, Sweden in initiatives linked to the Swedish business community such as the European Build Up Skills project in which we have been the driving force in securing a Swedish application.

In 2014, we will continue to provide a comprehensive platform offering businesses and organisations a partner to help them meet their immediate and long-term needs for education and training in various areas - technology being the common denominator. This is the only way in which we can create the preconditions for the success of individuals and companies.



Peter Bergermark
Managing Director

Rapidly developing organisations need skilled people

As society and business strive to promote a culture of life-long learning and implement innovative business practices, the need for training and development is more important than ever. And now, technology is expanding opportunities for taking advantage of the virtual workplace, where employees, partners, customers and governments can connect. We see this as the reason why companies understand that teamwork and agility are critical to success. To accelerate these trends, DTI Polska provides training and consulting services to enterprises, business support organisations, local governments, institutions and labour.

Our key assets include our experience in managing large scale development projects and "learning by doing" education in three main areas: 'Training and knowledge transfer', 'project management' and 'evaluation programs'.

We work with numerous small and medium-sized enterprises, international organisations and Polish and foreign consultants to implement commercial programs, as well as projects carried out under the supervision of institutions such as the World Bank, the European Bank for Reconstruction and Development and The Polish Agency for Enterprise Development.

We have gained invaluable experience during the implementation of over 70 training and consulting projects in Poland and abroad, experience that we can share with our partners.

In 2013 we strengthened our focus on the implementation of integrated development projects with commercial clients. Our aim is reaching companies that are in the process of creating a permanent system for the development of skills and minimisation of competence gaps, enhancing their staff potential or undergoing restructuring processes.

Another focus is the creation of the Projects Management Platform. It is driven by the idea of combining the potential of DTI Polska and several leading Polish consultants in the field of project management. The users of the platform will be subject to a project management audit, which will enable them to develop in the areas of management, organisational culture, systems, people and processes within the organisation.

Polish law is challenging for young entrepreneurs, especially in the field of financial management. Our special offer for accounting services and essential support in this area is aimed at small Polish companies, with a focus on start-ups.

Investment projects financed from public funds remain invariably popular among clients. We decided to improve our consultative potential in order to meet the challenges of the market. Aside from obtaining investment funds for our clients, our ambition is to gain funds which will enable us to enter the field of technology and provide services directly associated with DTI Polska.

After several years of cooperating with the Danish Technological Institute, we jointly decided to start our integration with DTI. The changes will not be limited to a common name and visual identification for the new brand, DTI Polska, but will also include integrating the culture of both organisations and transfer of knowledge. This transfer involves the adjustment of business technology and solutions to the Polish realities.

In the next years we will continue to nurture and promote our project management approach and strengthen the brand awareness in the Polish commercial market.

DTI POLSKA

< Insight 2013



Marcin Opas
Managing Director

“ These are exciting times for technology and for the Danish Technological Institute.

These years, we are witnessing an unparalleled technology race. Danish and international businesses alike have now realised that it takes extremely sophisticated production methods and intelligent products to supply the global value chains.

Our focus is therefore on ensuring that Danish manufacturing businesses apply knowledge and technology throughout the value chain from idea and design over pilot production to large-scale production.

The trend dictates that, more than ever before, technological differences pave the way to the market and ensure a leading position. In many cases, technological advances require a multi-disciplinary approach where innovation is created by combining very different technology and knowledge areas.

The Danish Technological Institute houses vast specialist expertise and offers state-of-the-art facilities for testing, pilot production and development in all specialist fields. Our combined staff represent a profound specialist base.

We work in the span from research and development to implementation of knowledge and technology in commercial products. We develop new knowledge and technology jointly with small and large businesses. Our objective is to ensure our customers access to the technologies and the knowledge that can increase the value of their services.

Søren Stjernqvist, President



Søren Stjernqvist
President

Review

The Danish Technological Institute (DTI) delivered a satisfactory financial performance for 2013, with a net profit of EUR 4.3 million. The Institute achieved good growth in commercial revenue, matching the 2008 revenue levels attained before the financial crisis truly kicked in. Our subsidiaries more or less developed according to plan, with our Swedish subsidiary, Teknologisk Institut AB, realising a profit significantly above budget. Our Danish subsidiary Danfysik A/S generated growth in revenue of 13.0%.

DTI is well on its way to meeting the financial goals for the 2013-2015 strategy period. In 2013, commercial revenue increased by 6.8%. The international activities increased by 13.8% in 2013 and, finally, growth in research and development revenue accounts for 2.3%.

2013 was the first year in the new performance contract period. DTI prepared a proposal for 'Performance Contract 2013-2015' consisting of 24 proposals for activity plans, of which 19 were approved by the Danish Ministry of Higher Education and Science.

Compared to the previous performance contract period from 2010 to 2012, the Ministry of Higher Education and Science has reduced funding by 14.3%, corresponding to EUR 2.5 million. However, DTI has chosen to finance some of the projects not considered by the ministry, which corresponds to a total investment of EUR 1.3 million.

Moreover, the 'Production in Denmark' performance contract was launched. This initiative aims to show small and medium-sized Danish manufacturing businesses the technological paths that can lead to increased production and make it more flexible and adaptable.

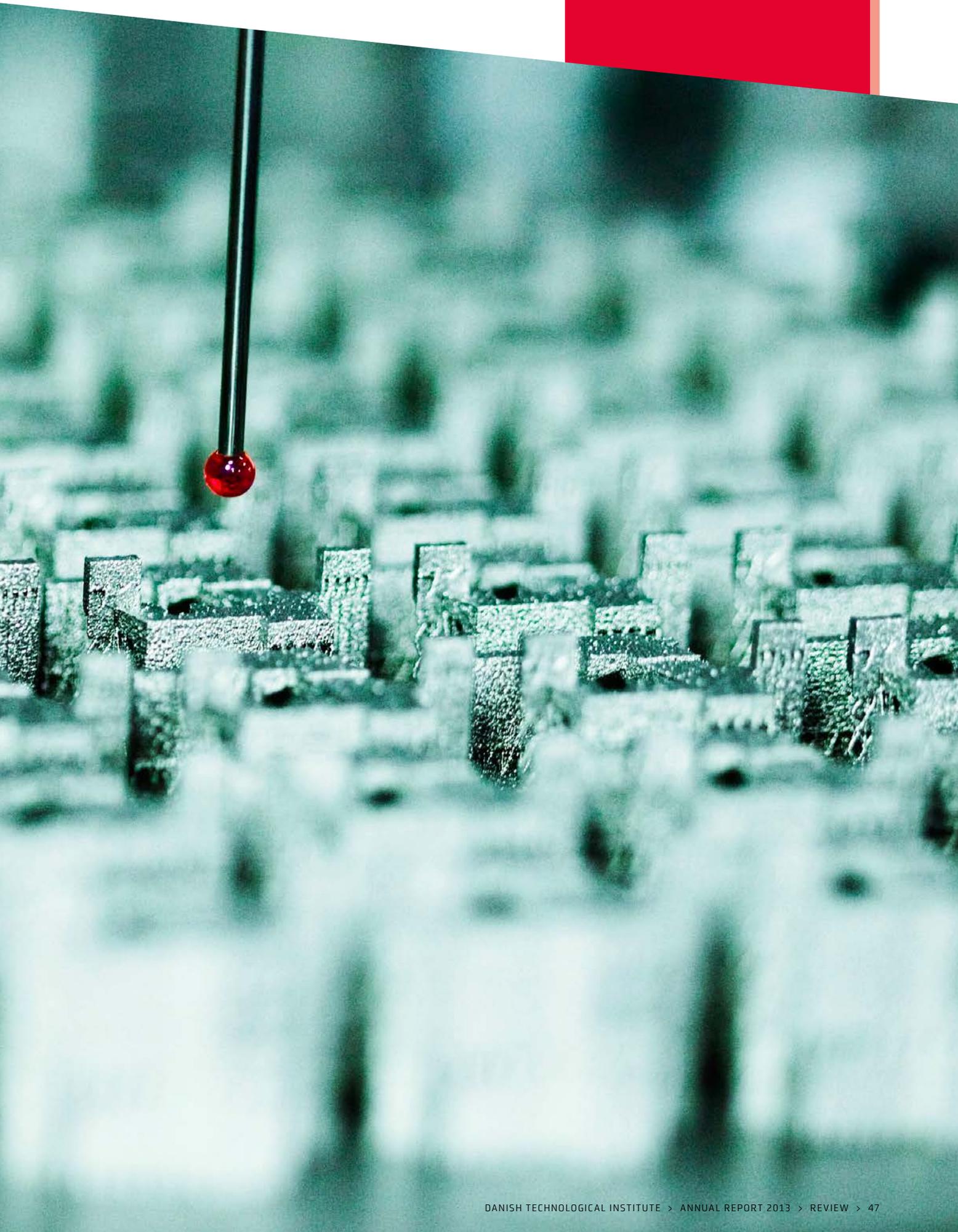
DTI is also a driver of the SPIR project 'MADE – Platform for Future Production'. The platform addresses three business challenges: shortening development time and thus time to the market, being able to handle vast complexity and creating flexible production that can adapt quickly.

In 2012, DTI embarked on the construction of an internationally leading knowledge centre for research and innovation in animal food. In 2013, construction was unfortunately delayed some months due to the bankruptcy of the contractor Pihl & Søn. DTI has taken over the construction and concluded a new agreement with the contracting company Enemærke & Petersen to complete the construction. This decision limits the financial and timing consequences of the bankruptcy.

During the reporting year, DTI also invested intensely in new laboratories. In Aarhus, the biotech laboratories have been expanded to provide a total area of 2,500 m². As a new feature, process laboratories have been added, thus enabling work with biological and chemical processes related e.g. to biological conversion of residual products, reuse of water and enhanced oil extraction.

A new heat pump laboratory has also been opened in Aarhus, which as one of the first in Europe can offer a full test of heat pumps and air-conditioning systems according to the new harmonised European standard, which also forms the basis of energy labelling.

Also in 2013, DTI cooperated closely with other Danish businesses and institutions on e.g. EU research and development projects. DTI realised revenue of EUR 34.7 million on this type of project.



Financial review

In 2013, DTI realised a net profit of EUR 4.3 million, up EUR 2.4 million on the budget but down EUR 1.5 million on the year earlier. This is attributable to various non-recurring income in 2012 and to a reduction in performance contract funding. All subsidiaries, except for DTI Robotics US, Inc., contributed with a profit in 2013.

Total consolidated revenue stood at EUR 145.0 million, up 3.1% compared to 2012.

DTI's revenue was generated through commercial activities and research and development activities, including performance contract activities. DTI's commercial revenue came to EUR 95.3 million. This is EUR 6.1 million more than the year before, corresponding to an increase of 6.8%. For the first time since the financial crisis struck in 2008, DTI experienced real growth in commercial revenue to match 2008 levels.

Research and development revenue as well as performance contract revenue accounted for EUR 49.7 million against EUR 51.4 million the year before. This accounts for 34.3% of total revenue against 36.6% in 2012. The drop occurred because the Danish Ministry of Higher Education and Science reduced the performance contract funding by EUR 1.9 million, or 12.5%.

In 2013, DTI's development activities financed by operations ran into EUR 14.6 million, up 15.9% compared to the year before. The knowledge development resulting from these activities is essential to the Danish business sector. This enables DTI, also in the future, to provide top-quality technological services and, in this way, ensure that Danish businesses are capable of maintaining production and creating new jobs in Denmark.

Equity rose by EUR 4.6 million, corresponding to net profit for the year and value adjustments of forward contracts in subsidiaries. The balance sheet total was up by EUR 2.5 million to EUR 112.3 million (2012: EUR 109.8 million). Cash flow from operating activities amounted to EUR 8.7 million, compared to EUR 14.0 million in 2012. The decrease can be ascribed to operating profit, changes in work in progress and inventories in relation to the level in 2012. Cash flow from investing activities totalled EUR 8.9 million (2012: EUR 12.3 million).

Financial resources remained strong and worked out at EUR 23.2 million at end-2013.

Subsidiaries

Danfysik A/S recorded revenue of EUR 19.3 million, an increase of 13.0% on 2012. Pre-tax net profit worked out at EUR 0.5 million, down EUR 0.9 million on the budget and EUR 0.5 million on the year earlier. For the year as a

whole, extreme difficulty executing projects on schedule in the first six months affected the financial ratios, a situation engendered to some degree by the considerable revenue growth in the year before.

At end-2013, Danfysik A/S had an order book of EUR 19.6 million, compared to EUR 21.4 million in 2012.

Teknologisk Institut AB, Sweden performed satisfactorily in 2013. The company recorded net profit of EUR 0.4 million compared to EUR 0.2 million in 2012. Revenue came to EUR 6.6 million compared to EUR 7.2 million in 2012. The increasing profit is primarily attributable to the reductions in fixed costs, including a significant reduction in rent costs in both Gothenburg and Stockholm.

Despite market challenges, our Polish subsidiary, DTI Polska Sp. z o.o., performed satisfactorily in 2013 and realised profit of EUR 0.1 million, against EUR 0.2 million in 2012.

Dancert A/S, charged with DTI certification activities, had a satisfactory year, recording profit of EUR 13.4 thousand as in 2012.

With its specialist and market focus on robot co-workers for the industry as well as health care and welfare technology, DTI Robotics US, Inc. recorded a net loss of EUR 0.2 million in 2013 compared to a net loss of EUR 0.1 million in 2012.

Associates

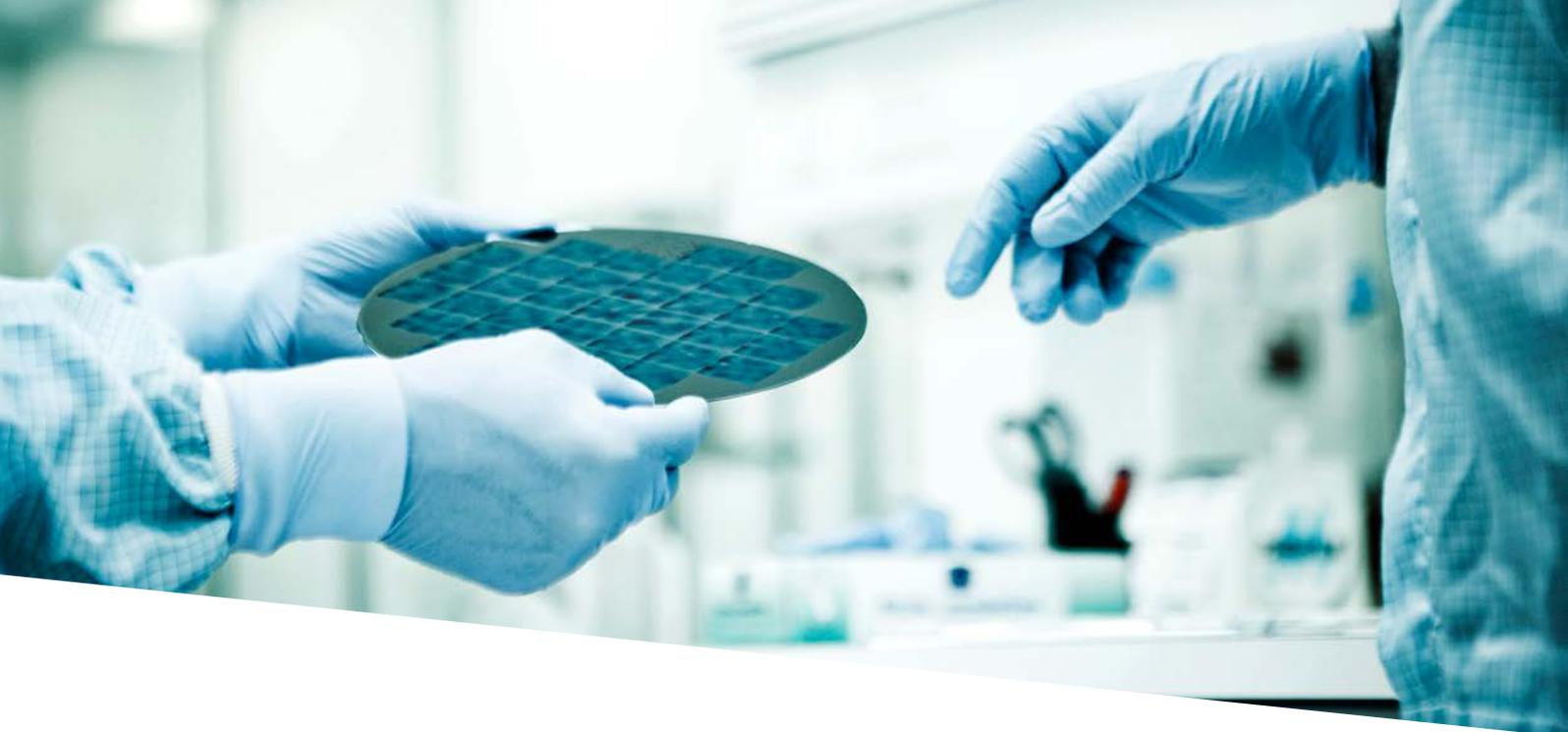
Syddansk Teknologisk Innovation, in which DTI holds an ownership interest of 50%, performed better than forecast in 2013. The company recorded profit of EUR 0.3 million, up EUR 0.1 million on the budget. During 2013, we managed to sell some of its portfolio companies at a handsome profit. In 2013, the innovation scheme was subjected to a tendering process, and the Danish Agency for Science, Technology and Innovation concluded contracts with four environments, including Syddansk Teknologisk Innovation A/S. The number of environments used to be six, but four of the small environments have merged into two. The new contract ensures operations until end-2017.

Special risks

DTI's prime operating risk is linked to the management of ongoing research and development projects and longer-term commercial projects. The risk has been given due consideration in the financial statements. DTI's solvency and financial resources render DTI sensitive only to a limited extent to changes in the level of interest rates. No material currency risk or material risks relating to individual customers or partners exist.



Jørgen Kunter Pedersen
Group CFO



Outlook for 2014

DTI budgets for revenue in the amount of EUR 152.8 million (realised 2013: EUR 145.0 million) and for net profit in the amount of EUR 3.4 million (realised 2013: EUR 4.3 million). Commercial revenue is expected to increase by 6.3%, while growth in total research and development revenue and performance contract revenue is forecast to be minimal.

At the beginning of 2014, DTI's R&D order book totalled about EUR 44.4 million, against some EUR 53.2 million for 2013.

At Danfysik A/S, the order book provides a basis for forecasting an 11% increase in revenue and an improved profit performance in 2014. The market appears to be sluggish, which lengthens the process time from quotation to order placement. Investment activities in the US are also very low due to major budget reductions. However, promising and extensive possibilities lie in the active quotation volume, and the first six months of 2014 are expected to generate a significantly better influx of orders.

Teknologisk Institut AB, Sweden has an order book up 25% on the year before, and is expected to deliver satisfactory results in 2014.

Customers

Customers buying DTI's commercial services are Danish business customers, organisations, public customers and international customers. In 2013, DTI provided solutions for a total of 11,241 customers, 9,201 of whom were Danish. 55% of the Danish business customers come from the service industry, while 45% come from the manufacturing industry. In this context, too, DTI works closely with small and medium-sized enterprises, in particular. 82% of customers have fewer than 50 employees.

DTI had 901 public customers in 2013. Public customers and organisations procure services such as consultancy and training in the same way as private customers. In addition, DTI serves public customers via various operator projects.

International activities

DTI had 3,653 international customers, including subsidiary customers in Sweden and Poland. Overall, DTI's international revenue came to EUR 44.7 million.

Project evaluation

To DTI, the work of transforming new knowledge into daily practice in companies constitutes a central element in its non-profit activities, and it is important to learn how satisfied customers are with the projects undertaken by DTI. So in recent years, customers have been asked to evaluate DTI's work in the light of a number of parameters such as quality and time of delivery. In 2013, about 90% of customers said that they were satisfied or very satisfied with the work.

New innovation consortia

During the period under review, DTI became project manager for three new innovation consortia granted by the Danish Ministry of Higher Education and Science, with the total budget for DTI running into EUR 2.3 million, up from EUR 4.6 million in 2012.

Performance contract activities

2013 was the first year in the new performance contract period. DTI prepared a proposal for 'Performance Contract 2013-2015' consisting of 24 proposals for activity plans, of which 19 were approved by the Ministry of Higher Education and Science.

Compared to the previous performance contract period from 2010 to 2012, the Ministry of Higher Education and Science has reduced funding by 14.3%, corresponding to EUR 2.5 million. However, DTI has chosen to finance some of the projects not considered by the ministry, which corresponds to a total investment of EUR 1.3 million.

Moreover, the 'Production in Denmark' performance contract was launched. This initiative aims to show small and medium-sized Danish manufacturing businesses the technological paths to increasing production and making it more flexible and adaptable.

New facilities

The construction of an internationally leading knowledge centre for research and innovation in animal food, started in 2012, continued in 2013. Construction was unfortunately delayed some months due to the bankruptcy of the contractor Pihl & Søn. DTI has taken over the construction and concluded a new agreement with the contracting company Enemærke & Petersen to complete the construction. This means that the financial and timing consequences of the bankruptcy are limited.

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Moreover, a new heat pump laboratory has been opened in Aarhus, which as one of the first in Europe can offer a full test of heat pumps and air-conditioning systems according to the new harmonised European standard, which also forms the basis of energy labelling.

Consultancy services

Consultancy services for private and public companies account for 15.2% of total DTI revenue. Consultancy services are rendered on the basis of the knowledge developed from research and development activities and through long-term cooperation with a large share of the business sector. These tasks provide DTI with essential insight into customer challenges.

Operator projects

The recent approval of EUR 1.9 million has secured the Transport Innovation Network four more years from 2014 to 2018. The network was launched in 2009, and throughout its existence, DTI has been in charge of all land transport.

DTI runs the 'Secretariat for building components approved for drinking water', comprising e.g. the secretariat's platform, i.e. IT system in the form of ESDH, a website and the accreditation basis. The secretariat was established on 1 April 2013.

Concurrently, DTI has run the ordinary operations of two existing secretariats, the 'House Inspection Scheme' and the 'Building Damage Insurance Scheme'. Development under the 'House Inspection Scheme' remains affected by the housing market and a moderate turnover of reports. Under the 'Building Damage Insurance Scheme' 100 first-year inspections were reviewed in the third quarter. The findings were collected in a report for the Danish Energy Agency. The question of how to review the five-year inspection is being considered as well as whether to perform targeted reviews of specific failure types. The work to share experience with insurance companies and edit the guidelines for insurance companies and building experts has commenced.

On 18 March 2013, the Danish Energy Agency announced that DTI had won the tender for continuing the framework agreement for 'Centre for Energy Savings in Buildings'. The agreement runs for three years.

Through active communication and information activities, the Consultancy Service for Inventors has been busy dealing with contacts from many inventors and is experiencing an increased influx of approx. 20%. The Consultancy Service for Inventors also continues to develop, and opened Fablab TI – Denmark's third "fabrication laboratory" in 2013. Fablab TI supports the work of the Consultancy Service for Inventors and the School Services, thus creating learning, growth and workplaces based on ideas from citizens.

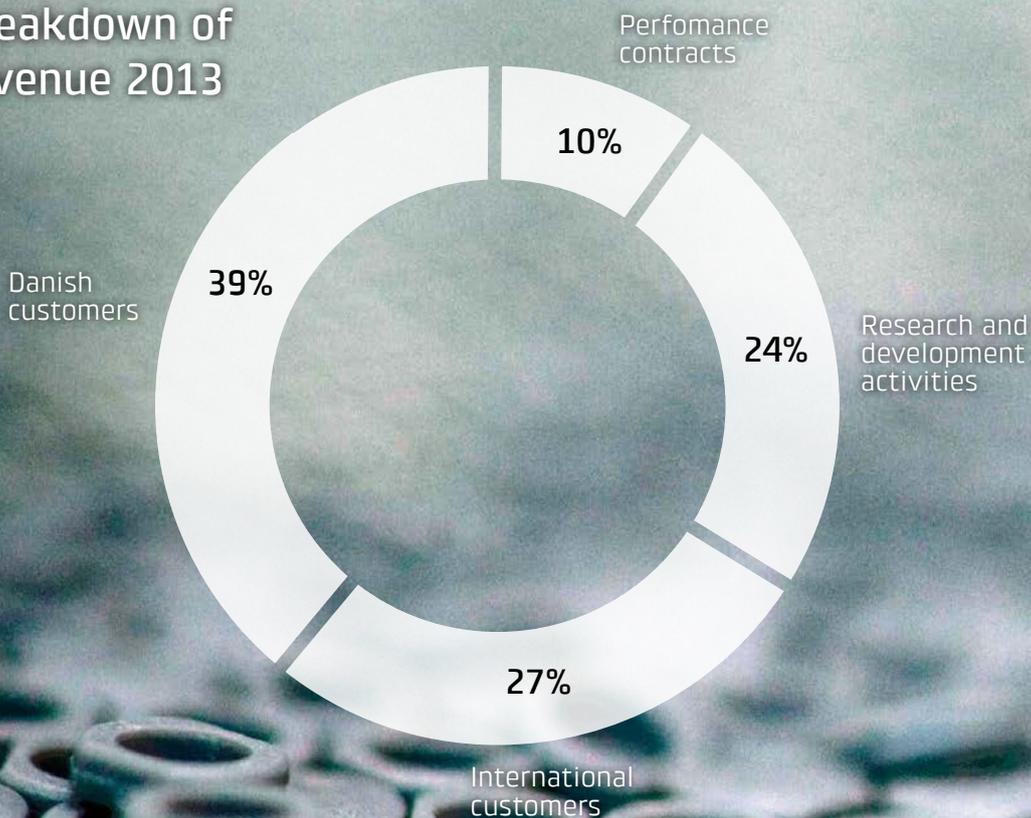
Organisation and employees

In 2013, focus was aimed at meeting DTI's employee strategy. Objectives were set for 2013-15 in employee development, manager and career development and employer branding, and activities were defined to support the objectives.

In the area of employee development attention was focused on making career paths apparent and strengthening project discipline. The first project certification courses were held, in which selected employees completed their PMP certification at the internationally recognised PMI (Project Management Institute). Training courses for project employees were also held in tender writing and negotiation techniques.

Technical specialist competencies have been further strengthened as DTI has now hired more than 130 employees with a Ph.D. or doctorate out of its total staff of 1051.

Breakdown of revenue 2013



In manager and career development, initiatives have been launched to strengthen the Team Manager level. This has been done by clarifying responsibilities and providing extra training activities for newly appointed Team Managers. In 2013, DTI also conducted the fifth talent programme, which increased the focus on business development and commercial activities from a management perspective.

In 2013, DTI ranked 11th in the image survey performed by the trade magazine *Ingeniøren* and 8th in Universum's survey assessing preferred workplaces among engineers in Denmark. This result is also based on our targeted employer branding activities. In 2013, we began working with selected social media to strengthen our profile and take a more proactive approach to recruiting new employees.

In terms of the organisation, one new division was established in 2013 to pool the activities in production and enhance efforts related to production in Denmark.

Corporate social responsibility

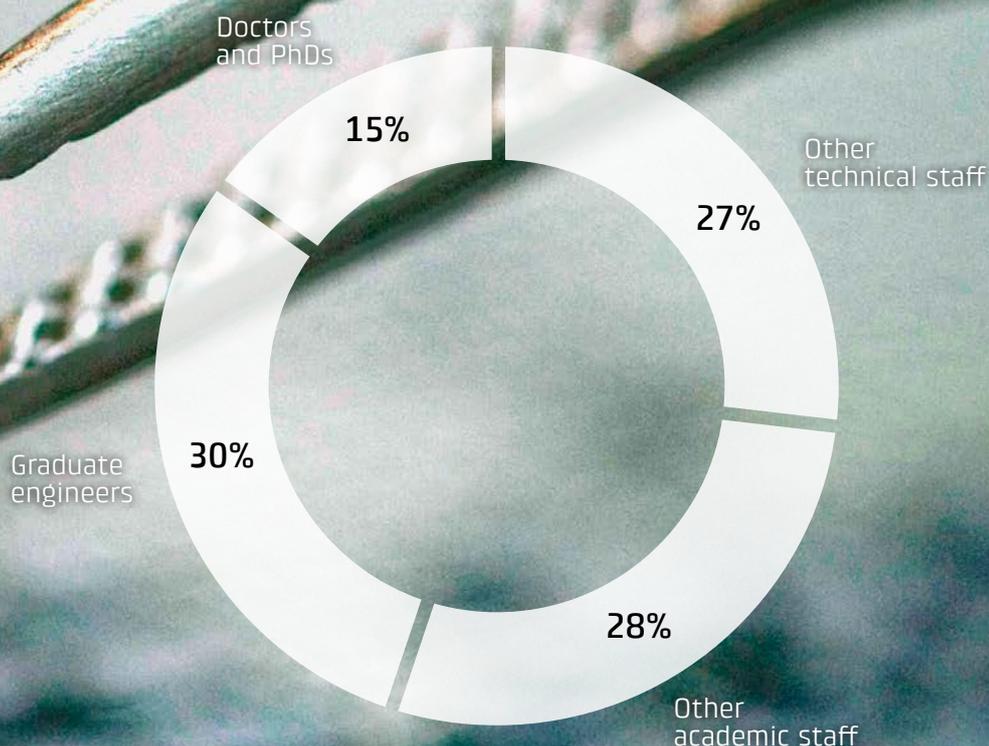
The majority of DTI workplaces are office workstations. The environmental impact of these comprises consumption of electricity and heat. In addition, DTI has a number of laboratories that make use of different forms of consumables, the use and disposal of which comply with the acts and executive orders in force from time to time in the area, including the rules on health and safety at work.

DTI has described what it understands by corporate social responsibility and the policies and guidelines this entails. Management has decided to publish its statutory report on corporate social responsibility on its website at www.dti.dk/csr2013.

Gender equality

In 2013, the DTI prepared a policy concerning the gender composition of the management at DTI and its subsidiaries. DTI's Board of Trustees consists of nine members (including two employee-elected members, of which one

Academically qualified staff



is female). For 2017, DTI has a subobjective of welcoming one woman on the Board of Trustees (in addition to the employee-elected board members). For 2020, DTI aims for a distribution among men and women on the Board of Trustees that reflects DTI's staff mix. At the end of 2013, the gender composition of DTI, including its Danish subsidiaries Danfysik A/S and Dancert A/S, is 34% women and 66% men.

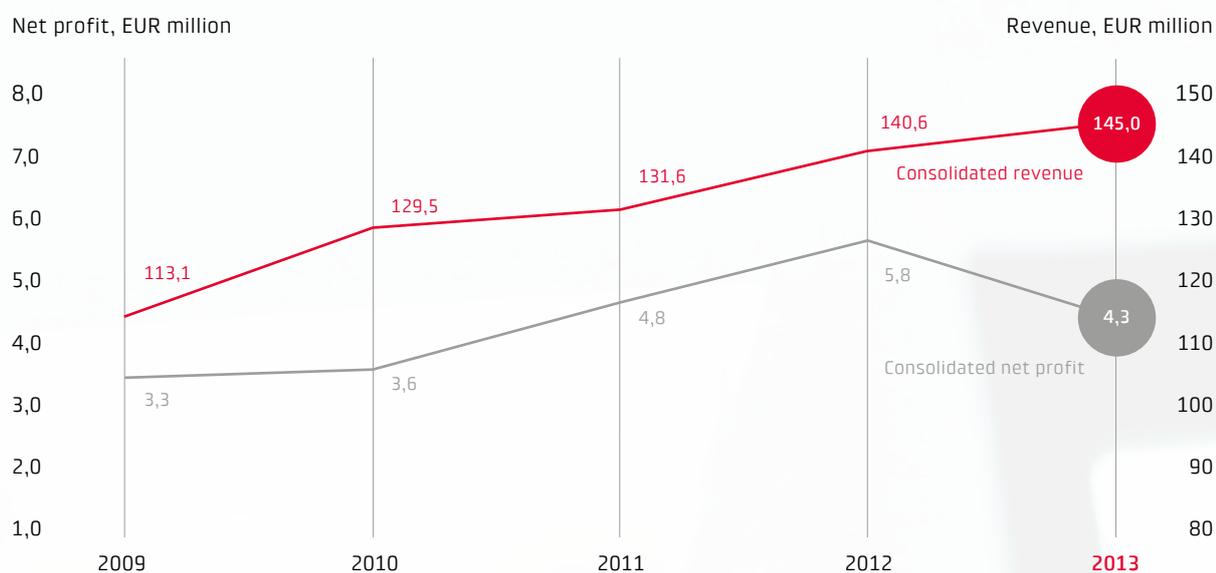
The overall position is that DTI treats all its staff equally, irrespective of their gender in all aspects of their work. This applies to both recruitment, selection for management positions and career development. This is supported by DTI's staff policy, which states: "We are working to promote a balanced staff mix so that DTI at all times

have access to the best qualified staff within DTI's core competencies." The objective of DTI is to achieve an equal gender ratio in management. Furthermore, DTI is also working to ensure that all staff – regardless of gender – have the same possibilities in terms of development and promotion. This parameter is also included in DTI's staff survey, which is conducted every two years. In 2014, DTI is aiming to achieve a gender ratio in its Talent Programme that reflects the staff group to ensure that staff of both genders are equipped to assume management positions in the company in the future.

Post balance sheet events

No material events have occurred after the balance sheet date that will affect the financial statements.

Consolidated revenue and net profit for the period 2009-2013



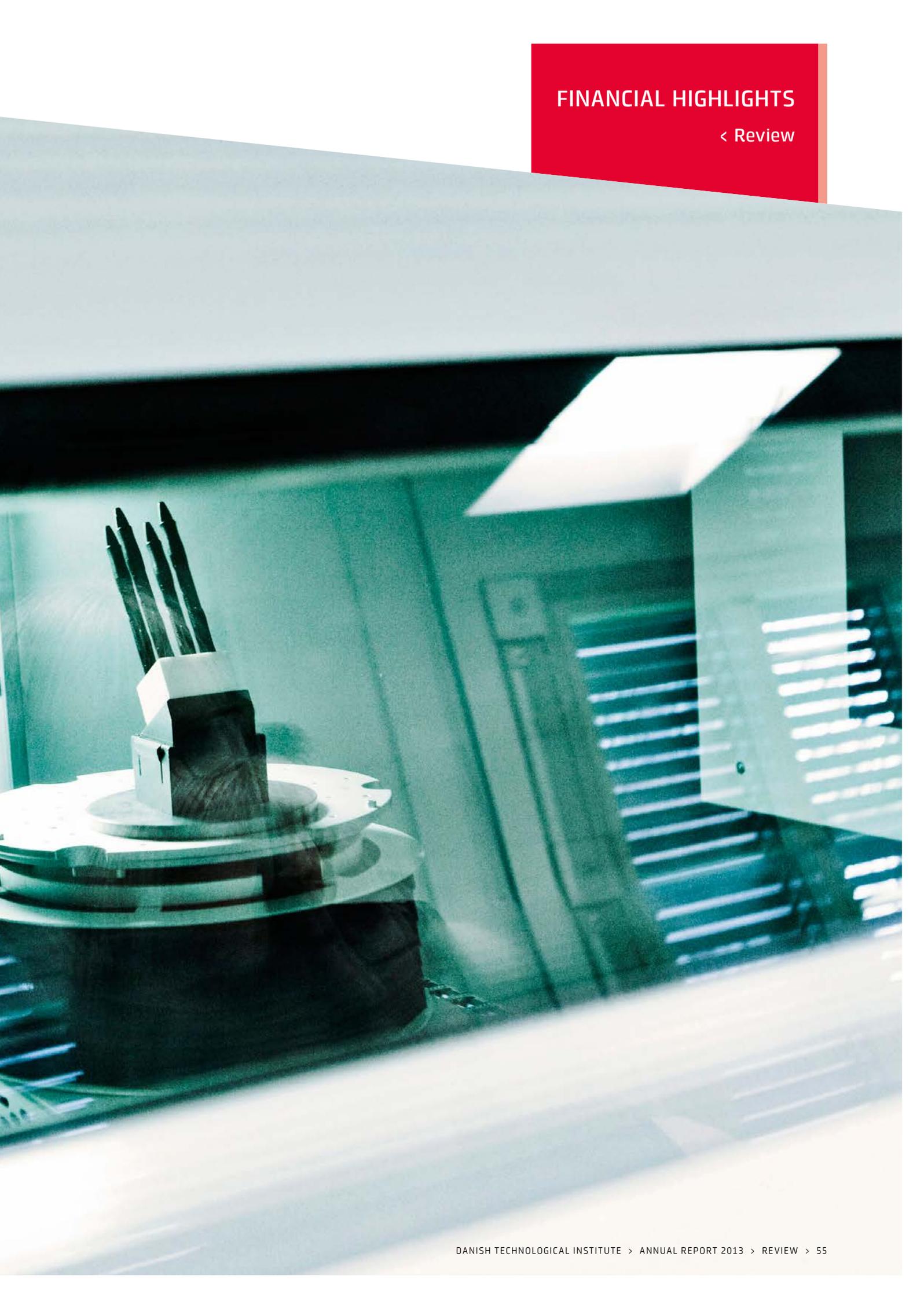
Financial highlights

EUR million	2013	2012	2011	2010	2009
KEY FINANCIAL FIGURES					
Revenue	145	141	132	129	113
Operating profit	5	6	5	4	3
Financial income and expenses	-	-	-	-	-
Net profit for the year	4	6	5	4	3
Balance sheet total	112	110	100	90	90
Equity	70	65	59	55	51
Cash flow from operating activities	8	14	12	-1	8
Cash flow from investing activities	9	12	2	3	10
Of which for investment in property, plant and equipment	9	12	2	3	5
Cash flow from financing	-2	-4	-	-	-
Total cash flows	-3	-3	10	-4	-1
FINANCIAL RATIOS					
Operating profit margin	3,2	4,2	4,0	3,1	3,1
Equity interest (solvency)	62,5	59,6	59,3	61,0	57,0
Liquidity	139,4	145,0	175,0	160,0	104,2
Development financed by operations	10,1	9,0	7,6	5,9	5,9
Average number of full-time employees	1051	992	953	974	904

An extract of DTI's financial statements can be read on and downloaded from DTI's website at www.dti.dk

FINANCIAL HIGHLIGHTS

< Review



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Gunde Odgaard

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Taastrup

Warsaw



4 This picture shows a turbo compressor included in the compact and energy-efficient cooling system of the future, which uses water as coolant. The technology can enhance the energy-efficiency of e.g. dairies, abattoirs, CHP plants and large buildings. It will also generate financial and CO₂ savings.

Our Annual Report 2013 offers more examples of how we develop new, ground-breaking technologies and translate knowledge into products and services of real value to society and our partners.