



DANISH  
TECHNOLOGICAL  
INSTITUTE

IT'S ALL ABOUT INNOVATION

---

# Annual Report 2012



The front page image shows a section of the 235 magnets which the subsidiary of the Danish Technological Institute, Danfysik, delivered in 2012 to the new synchrotron accelerator project, 'Taiwan Photon Source' in Hsinchu, Taiwan. The synchrotron facility is a high-brightness x-ray light source which will be used for research in, for instance, nanotechnology, biotechnology, material technology and microelectronics.

# Contents

Preface	3
Inspiration, Insight, Impact	4
Cases	6
Building and Construction	8
DMRI	14
Energy and Climate	20
Business and Society	26
Life Science	32
Materials	38
Production	46
Danfysik	52
Review	58

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

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

The Danish Technological Institute's cooperation with the Danish corporate sector is based on confidentiality and professional secrecy. The companies mentioned have all authorised publication.

Read more at [www.dti.dk](http://www.dti.dk)





# Danish Technological Institute – It's all about innovation

---

The Danish Technological Institute (DTI) is an independent, not-for-profit institution, which transforms new knowledge and technologies into benefits for industry and for the world at large. Our objective is to identify and then satisfy requirements for innovative products and future growth industries.

We hereby submit our 2012 financial statements for your review. As is clear, our economic outlook is strong and healthy and provides a secure foundation for our new visionary strategy for the upcoming 2013–2015 period. We are looking ahead towards further strengthening our contribution by delivering even more innovative solutions in response to the major challenges facing industry and the world today.

The global economy offers untold opportunities for the development and application of high-value innovation. This is made possible through wide-ranging technological progress in fields including nanotechnologies, materials, robotics, biofuels and sensor technologies, to name but a few. The more intelligently we are able to combine and utilise these new technological innovations, applying them to the needs of industry, the better our possibilities will be of creating and retaining jobs and of maintaining continued progress.

The ability to access and deploy advances in technology from international sources is a key factor for the competitiveness of any company. However, this is not always so simple. The disruptive nature of technological advance and changing patterns of global technological innovation are a constant challenge for SMEs. DTI has demonstrated that it can help them find their way to success.

More than a century of experience and the broad interdisciplinary expertise of our 1,100 employees are our foundation. During the past year, through global partnerships and cooperation with a view toward Horizon 2020, the EU Framework Programme for Research and Innovation, we have strengthened our international presence. With one third of our revenue generated from international activities, we are able to offer clear insight in support of businesses as they approach this coming global transformation.

DTI is geared to take full advantage of the strategic opportunities arising from today's globalised economy, and convert them into new sources of future growth and progress.

We hope you will enjoy this brief sample of the many projects we undertook for our customers in 2012.

## Inspiration

- ... for technology development
- ... for innovation projects
- ... for networks
- ... for cooperation

## Insight

- ... into new technologies
- ... into customer needs
- ... into customer industries



## Impact

- ... solutions that work
- ... adapted technology
- ... visible effect

IT'S ALL  
ABOUT  
INNOVATION...

# Cases

---

To make technological knowledge accessible to many – that was the objective for which Gunnar Gregersen, MSc (Engineering) established the Danish Technological Institute in 1906 - and it is the same worthwhile objective we still have today.

True to form, we will describe some of the highlights of the year, including a selection of solved customer projects – cases – that reflect our wide professional competences and extensive network.

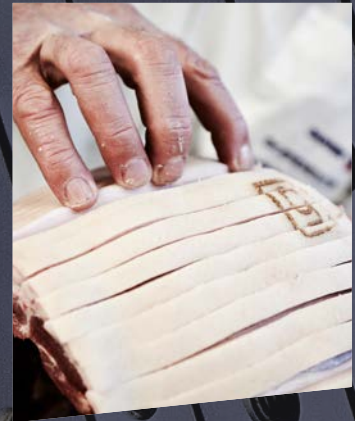
Each story is an example of how, in its role as facilitator and intermediary between the corporate sector and research in Denmark and abroad, DTI creates genuine technological renewal and innovation to the benefit of Danish companies and society at large.



Building and  
Construction  
page 8



DMRI  
page 14



Energy and  
Climate  
page 20



Business and  
Society  
page 26



Life  
Science  
page 32



Materials  
page 38



Production  
page 46



Danfysik  
page 52









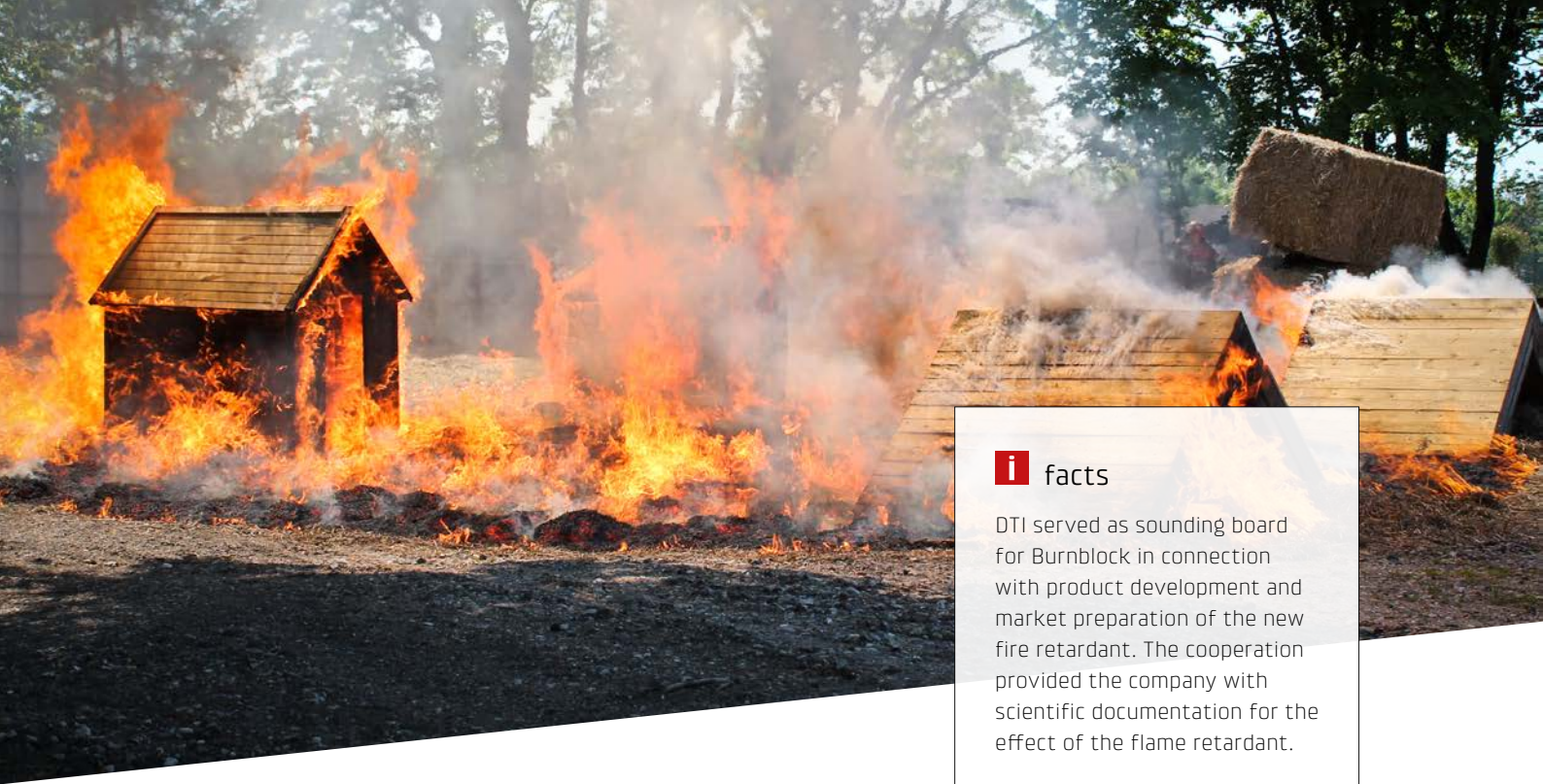


---

## Building and Construction

DTI feels and assumes great responsibility for helping the Danish building and construction industry to find high-technology solutions to weather the crisis well.





### **i** facts

DTI served as sounding board for Burnblock in connection with product development and market preparation of the new fire retardant. The cooperation provided the company with scientific documentation for the effect of the flame retardant.

## Danish eco friendly fire retardant ready for new markets

---

Burnblock is a new world-patented fire retardant for the timber and building industry. DTI assisted Burnblock in developing and testing the idea for organic fire protection of wood-based products.

On the wall at the new company Burnblock hangs a framed copy of the patent for Burnblock, the new fire retardant based on components found naturally in food products as well as in the human body. For the staff, the framed patent serves as a reminder that it is a long way from idea to patent and from patent to the market. DTI has assisted as consultant in preparing the company to bring the product to market and made sure that the company obtained scientific documentation for the effect of the new fire retardant, which was awarded an excellent fire class rating.

– We are extremely pleased with the close cooperation we had with DTI, not least with regard to information on the national and international standards applicable to our product. We received invaluable expert help to understand the issues and to remain calm throughout the process and were therefore able to stay focused in a thoroughly regulated market with a 1,000 pages long chemicals directive and a plethora of international test require-

ments with slight national differences, explains Torben Lyst, Partner, Burnblock.

### **Many applications for new fire retardant**

Most recently, Burnblock has benefited from DTI's expertise and product knowledge in making boarding, wooden floors and wood boards fire retardant. In addition, DTI has investigated the performance of the fire retardant in other applications measured against various EU standards. The Danish fire brigade has also discovered Burnblock. Several Danish fire engines are already equipped with Burnblock.

Thanks to the new patent, Burnblock has confidence in the future.

– The laboratory tests conducted by DTI have given us documentation not only to sell our product to the building industry and the fire brigade but also to market its potential to, for example, the textile industry and in practically all contexts, says Torben Lyst.





### **i** facts

Use of the health-hazardous environmental toxin PCB in building materials has been banned since 1977. PCB renovations are typically comprehensive and expensive to complete and result in massive waste volumes and release of toxins to the environment. The new method devised by DTI effectively reduces the emission of PCB to the environment in connection with renovations and saves construction clients the work and cost of disposing of hazardous building waste.

## New invention reduces hazardous waste and toxic PCB emissions

---

DTI has invented a new method to remove the environmental toxin PCB from polluted building materials and effectively reduce PCB emissions to the environment in connection with renovations.

The new method is both simple and efficient to use and environment-friendly.

– We are now able to make a controlled evaporation of PCB from polluted concrete and other building materials which have been in contact with PCB in joint filler. The evaporated PCB is collected in a carbon filter. The method means that construction clients do not have to remove large quantities of e.g. PCB-polluted concrete and brickwork, which must normally be disposed of as hazardous waste, explains Kathrine Birkemark Olesen, Team Leader, DTI.

The invention consists of a vacuum pump, a sealing, drainage pipes, plastic hoses and a carbon filter. Instead of cutting away the concrete around the joints, you just cut the filler free and establish a sealed cavity with a good airflow which removes any PCB released to the cavity. The PCB-containing air will be pumped

through a carbon filter which collects the PCB. This makes it possible to destroy the substance.

– The method improves the working conditions during renovations since the heavy, dusty and noisy work involved in removing polluted building materials by the joints can be omitted, says Kathrine Birkemark Olesen.

### **Fighting PCB in the Municipality of Hillerød**

DTI has submitted an international patent application for the method to be tested on a large scale in cooperation with Hillerød Local Authority.

– The method holds promise and may prove a gentle and economical solution for us. That is why we participate in the pilot project, so we can gain experience for future PCB renovations in our municipality, says Jan Ulrich Brandt, Architect, from Hillerød Local Authority.





**i facts**

Standard houses from the 60s and 70s are poorly insulated compared to newly built houses. DTI is developing a new technical concept for energy renovating facades to achieve significantly improved insulating properties. The new tile facade will increase the sales value of the houses while massively reduce heating costs.

## New and improved tile facade for single-family homes to boost construction

---

The tile industry and DTI are developing a technical concept for energy renovation of outdoor brick facades on old single-family homes. In addition to creating value for the home owners, this initiative may give a boost to the energy renovation of other existing buildings.

Around half a million standard houses from the 60s and 70s are poorly insulated. The idea behind the new project is to develop, demonstrate and document a new technical concept for energy renovating brick tile facades. The concept involves demolishing the existing outer leaf and erecting a slimmer outer leaf with room for more insulation without increasing the wall dimensions by more than approx. 50 millimetres. The new insulation is made from high-performance insulating materials, which increase the insulating properties of the facade while retaining its robustness and architectural qualities.

– The advantage of erecting a slim outer leaf and using new insulation types is that you achieve significantly better insulating properties almost without making the original wall thicker. At the same time, you increase the strength compared to the old wall and eliminate cold bridging at windows and doors, says Abelone Køster, Centre Manager at DTI, and continues: The house will have a brand new tile facade, increasing its sales value while massively reducing the heating costs.

### **Added value in sight for single-family home owners and not least builders**

This concept is expected to reduce the individual home owner's annual heating bill by EUR 400–1,300.

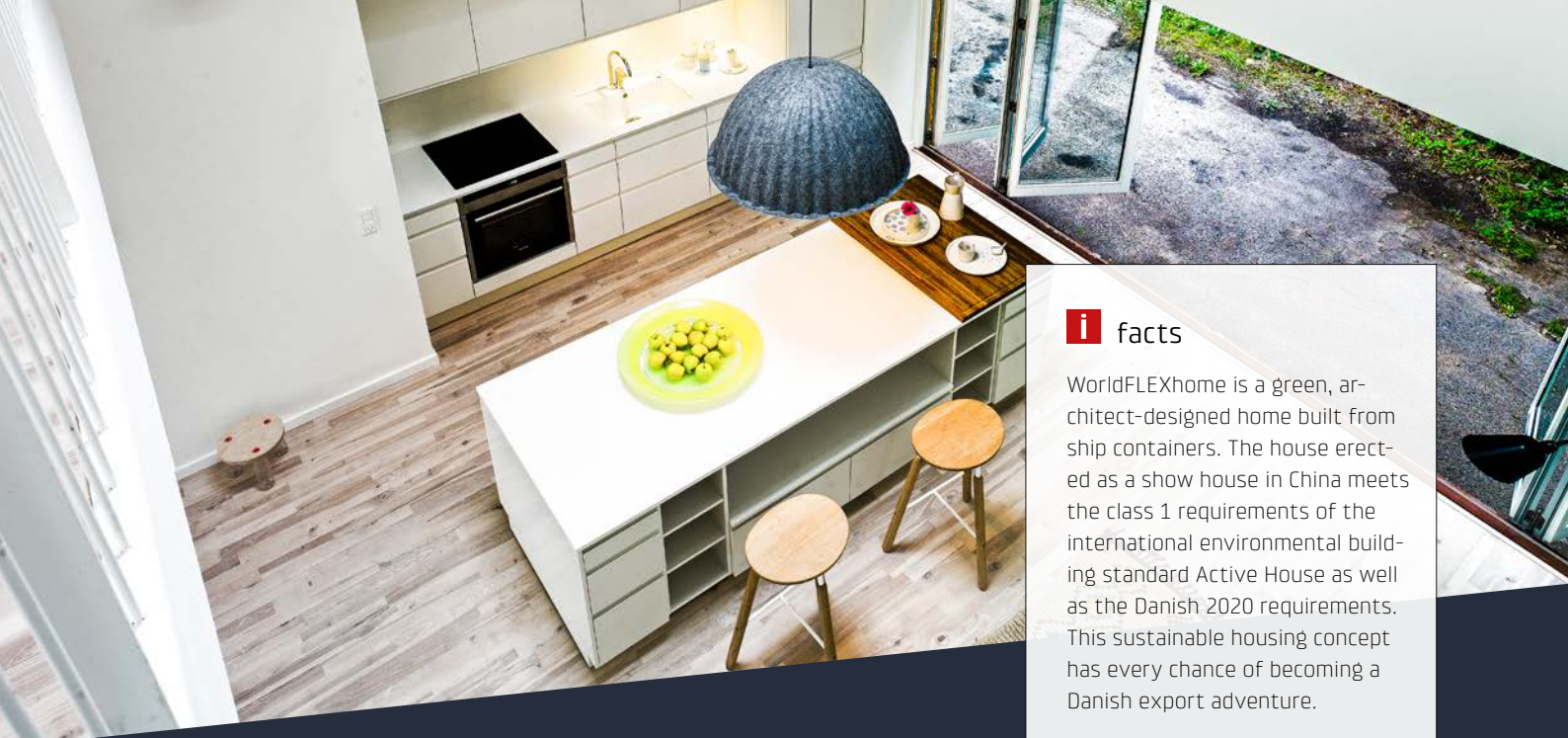
Moreover, the comfort and value of the house will also increase. If you also plan to make an extension, you can make a fully integrated extension with the same facade in connection with the energy renovation.

During the next six months, the project parties will demonstrate how to realise the new concept quickly, efficiently and economically, so that it can be communicated to building companies, home owners, local authorities, housing associations and other building owners.

– We need to find a test house which we can take apart and put back together so that the insulating properties of the house will meet BR (Building Regulations) 2015 standards in the same way as new houses. The effect of this demonstration project must be documented in full scale, explains Tommy Bisgaard, Managing Director of the Association of Danish Clay Products and Lime Manufacturers, and adds: We expect the project to boost sales for our members in the long run.

In addition to DTI, Lundgaard Teglværk, Tyholm Murer, ekolab, Møller Nielsens Tegnestic and the Association of Danish Clay Products and Lime Manufacturers participate.





### **i** facts

WorldFLEXhome is a green, architect-designed home built from ship containers. The house erected as a show house in China meets the class 1 requirements of the international environmental building standard Active House as well as the Danish 2020 requirements. This sustainable housing concept has every chance of becoming a Danish export adventure.

## Sustainable container housing – potentially a major Danish export to China?

A Danish pilot project on sustainable housing is taking shape in the metropolis Wuxi. One of the family homes exhibited is the container home worldFLEXhome. Hopes are that the 'green' test house will become a Danish export adventure.

WorldFLEXhome is a Danish one-and-a-half-floor single-family home of 180 square metres. The house is made of old ship containers by means of a flexible modular construction system. The house produces its own energy via integrated solar cells to cover the residents' heating and power consumption. The house is also flood proof. The concept of worldFLEXhome was devised by Anders Thomsen, Project Manager at DTI, who started the pilot project about two years ago under the export network FISH China, which sprung from the innovation network InnoBYG.

– Danish exports to China must be stepped up by small and medium-sized enterprises joining large companies in strategic partnerships and engaging in cooperation with local producers and local governments in China, says Anders Thomsen.

### **More Chinese sustainable construction**

The choice of China is not a coincidence. In 2012, China built more than nine million homes. In three years, this number is likely to increase to 35 million new homes annually. Chinese planners expect that more than one

million Chinese people will move to Wuxi in the coming years. The hope is that Wuxi will inspire other Chinese cities to build sustainable homes.

– WorldFLEXhome is an interesting and promising innovation project optimised for Chinese market conditions. It may well prove an excellent business for relevant Danish companies if the Chinese adopt this ingenious and environmentally friendly housing concept, says Peehr Svensson, Product Developer at Skandek China, which delivers environmentally friendly roofs for the unique, sustainable and highly flexible construction system.

WorldFLEXhome is created by DTI, WorldFLEXhome, Arcgency, Esbensen, Shanghai ETOPIA Building Development Co., Velux, Cembrit, Isover, Junckers, Bang & Olufsen, Skandek, Knauf Danogips, Nordisk Staal, DEBA, Evers, Holse & Wibroe, Abson, Falck, Lacuna, JELD-WEN, Factotech, Sanistål, PRO TEC, Schneider Electric/Lauritz Knudsen, HTH, CONTAINER-SPOT, Röhlig Danmark, Skandinavisk Byggeplast, Nilan, Solarglas and Siemens.







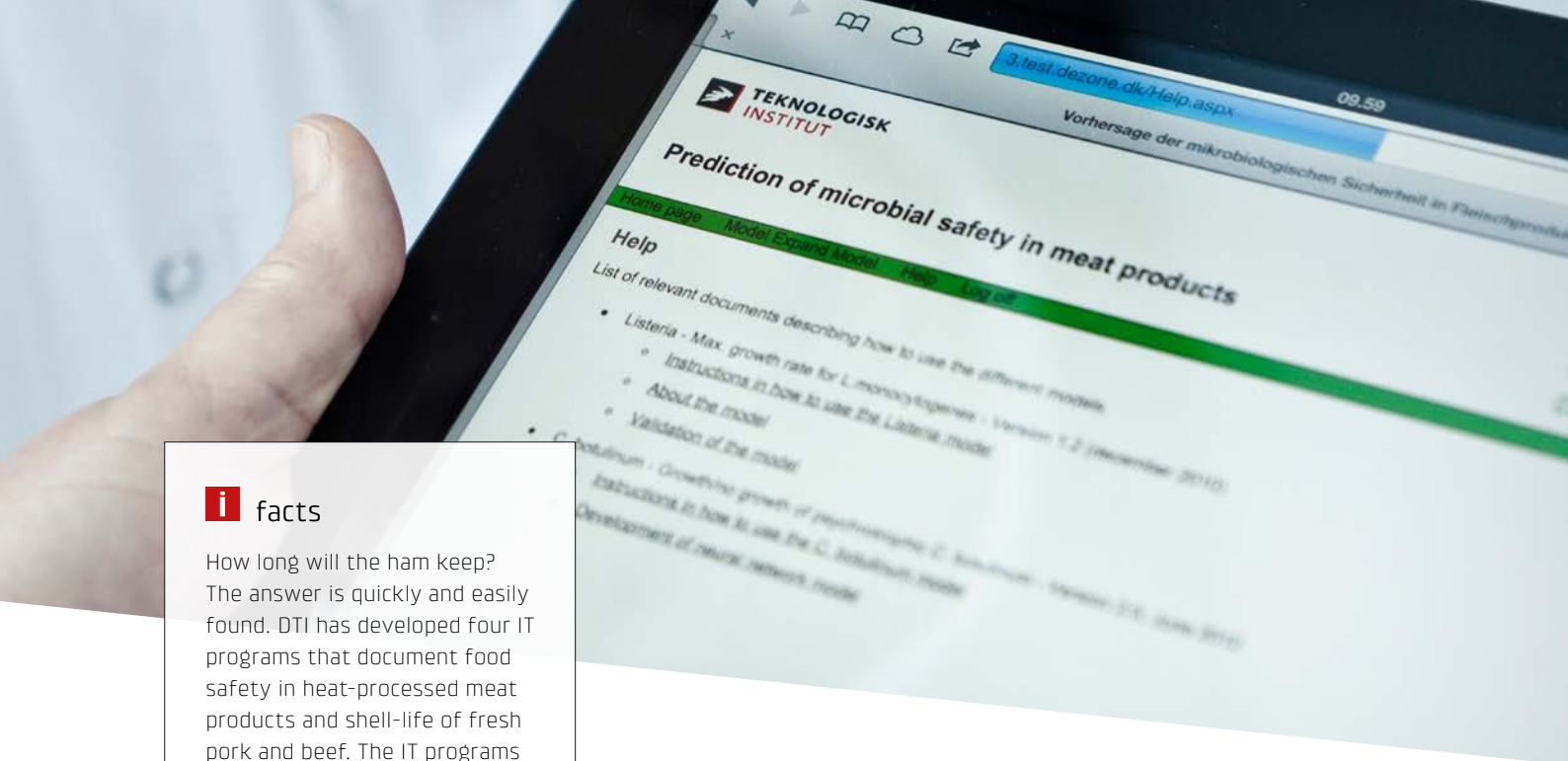


---

## DMRI

DTI's ambition is, through innovation, inspiration and concrete results, to help the Danish food industry see possibilities where others see limitations.





## **i** facts

How long will the ham keep? The answer is quickly and easily found. DTI has developed four IT programs that document food safety in heat-processed meat products and shelf-life of fresh pork and beef. The IT programs are accessible via the Internet from the company e-smiley.

# Fast and easy control of food safety by means of new IT program

A new Danish IT program now enables food producers more easily to achieve precise shelf-life calculations for meat products. The DTI tool makes expensive and time-consuming laboratory tests of food safety superfluous in connection with both product adaptation and development of new food products.

It is no fun becoming ill from eating food that is off. Nor is it legal to sell foods that make consumers ill. Food producers are responsible to both authorities and customers for ensuring that, within the shelf-life period, for example the ham is safe from growth of undesirable bacteria like *Listeria monocytogenes*. With the new IT program, food producers save both time and money on tests to document food safety. Previously it took about five weeks of laboratory time to determine the concrete shelf-life of new foods. That period of time can be cut down to only a few minutes with the new program which models bacteria growth instead of cultivating them in a laboratory.

- I get a microbiological status report of the product by entering the relevant data into the model. It means that I can provide documentation in a few hours, whereas it used to take me weeks, explains Joan Thisted, Quality Manager of Tulip in Svenstrup, adding:

If a product is unsafe, it is easy to find another solution. DTI always supplies qualified knowledge and advice for changing a recipe.

### **User-friendliness is superb - everybody can use it**

The IT program even enables food producers to save on additives.

- Nobody wants to add more preservatives than necessary. And with a few entries into the program, the food producer can now obtain a precise figure of the lowest volume of additives needed while still observing rules, explains Senior Consultant Annemarie Gunvig of DTI.

- In my experience, it is an excellent tool, particularly as it is based on actual data. Its use does not leave you with a great deal of uncertainty – and it is so easy to use, says Joan Thisted of Tulip.





### **i** facts

Denmark is the first EU member state to introduce group movement of unmarked pigs, saving time and trouble for pig farmers. DTI has developed the IT solution that provides the basis for the new delivery method.

## Revolution in tracing pigs may streamline pig farming

---

A new solution from DTI means that pig farmers no longer have to spend time tattooing their producer number on pigs.

In March 2012, Danish Crown's slaughterhouse in Esbjerg made history by receiving a delivery of porkers without tattoos for the first time ever. Till now, the producer has been required to mark the pigs with a tattoo hammer in the pigsty prior to delivering them to the carrier in order to comply with the legal requirements of traceability back to the primary producers. However, with DTI's new authority-approved system based on modern technology and new work methods, pig stocks may in future avoid being tattooed. The new method of ensuring traceability without marking the pigs cuts pig farmers' work load significantly.

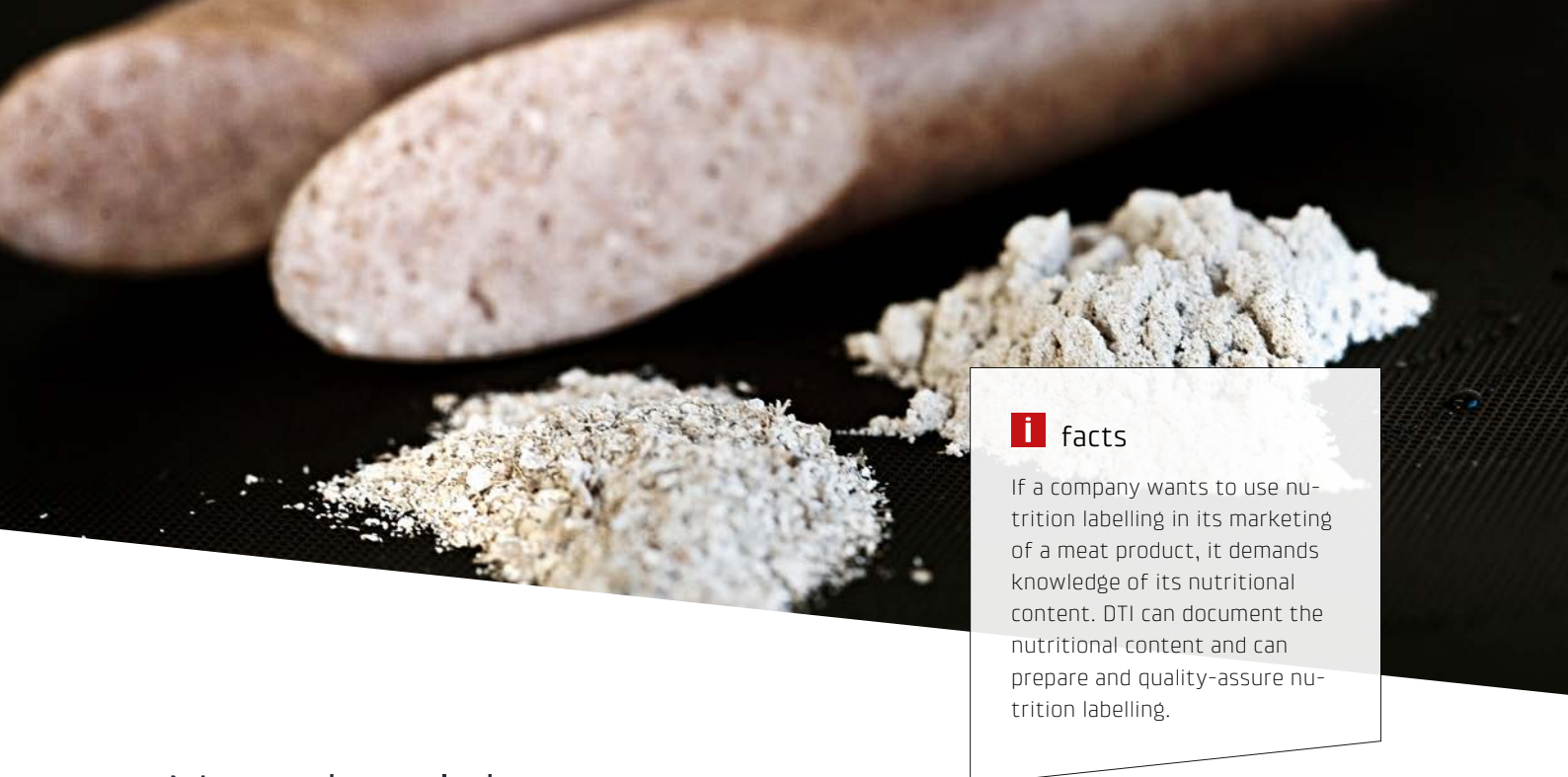
Berg Nicolaisen of Bækmarksbro is one of the pig farmers availing himself of the possibility of sending a batch of unmarked porkers to the Danish Crown slaughterhouse in Esbjerg. For each batch, he saves 45 minutes of work, because he no longer needs to mark the pigs.

- It was both time-consuming, troublesome and stressful to tattoo the animals, explains Berg Nicolaisen, who delivers about 400 porkers a week, and adds: It is a relief not to have to tattoo the pigs – they are so much easier to handle.

### **The new traceability method gains ground**

Pig farmers show great interest in the new delivery method, and Danish Crown is therefore busy implementing the system in other slaughterhouses in Denmark. DTI's new tracking system is instrumental in streamlining pig production in Denmark, declares Vice President Vagner Bøge of Danish Crown. The company slaughters about 300,000 pigs a week in Denmark. Most recently, the system was introduced at the largest and newest slaughterhouse in Horsens.

- We have positive experience with and great expectations for the new system, which is seriously gaining ground among our suppliers, says Vagner Bøge. In his view, the new system is the first revolution in the history of pig marking for more than a century.



### **i** facts

If a company wants to use nutrition labelling in its marketing of a meat product, it demands knowledge of its nutritional content. DTI can document the nutritional content and can prepare and quality-assure nutrition labelling.

## New healthy meat products are launched

---

When we decide to treat ourselves to a sausage, it should be easy to make a healthy choice that is tasty and filling. DTI encourages food producers to develop new healthy and tempting meat products and to document their nutritional content.

DTI is working intensively to provide the food industry with a scientific basis for developing and marketing new animal-derived food products of high nutritional quality at a competitive price. The ambition is to reverse the obesity epidemic by giving the industry specific instructions in and solutions to how to compose new satisfying meat products. In that connection, a healthy high-fibre sausage snapping perfectly on the first bite has seen the light of day.

- A meal at a hot-dog stand is not the healthiest in the world. We have tested if it is possible to add dietary fibres from cereal products to the popular wienerwurst and, in that fashion, reduce the fat content without compromising the taste. The reason is that, like protein, dietary fibres promote the sense of satiety and improve the nutritional profile of the traditional sausage, says Ursula Kehlet, Consultant of DTI, adding: As lean meat contains proteins and a range of important vitamins and minerals, it provides a strong basis for making healthy and satisfying meat products.

### **Healthy meat products are good business**

DTI tried to improve the sausage recipe by adding rye and wheat bran as well as oats to the healthy high-fibre sausage with a reduced fat content, and the

eating quality and nutritional content were subsequently tested and assessed. The best result was a sausage containing coarsely ground rye bran. This sausage, with 2.5 grams of fibre and 10 grams of fat per 100 grams, was described by DTI's trained taste panel as juicy with a pleasantly greasy oral sensation and firmness like other sausages in the market. The customers at Inge's hot-dog stand in Roskilde sampled the healthy alternative to the traditional sausage. More than half of the tasters found that the high-fibre sausage tasted just as good as an ordinary barbecue sausage.

This result pleases Thomas Rasmussen, Product Manager at Stryhns:

- It has been incredibly exciting to develop a new and healthy sausage that can compete with the traditional wienerwurst – we are confident it makes good business to develop new healthy meat products for our customers.

The testing of the new high-fibre sausage will result in a scientific 'cookbook' for the food industry. The book will give directions in how to compose new healthy, satisfying and tasty meat products.





### **i** facts

The new pork loin rind cutter from DTI will increase slaughterhouse productivity, remove unhealthy postures among slaughterhouse workers and result in improved rind cutting of pork loin roasts.

## New technology to optimise and rationalise production of pork loin roasts

---

A new invention from DTI will in future facilitate fully automatic rind cutting of pork loin roasts at the slaughterhouse.

During the final months of 2012, the Danish slaughterhouses were working at full capacity to produce the pork loin roasts traditionally served at Christmas in Denmark. This went hand in hand with the kick-off of the full-scale test of the new in-line pork loin rind cutter, which automatically scores the skin of the pork loins.

- The machine has been developed for the slaughterhouse cutting line, but can also run 'off-line'. Today the existing machinery, developed for streaky bacon, scores pork loins with irregular quality. At the same time, the work of post-cutting is extremely strenuous. There are many inappropriate instances of lifting and turning for the slaughterhouse workers, says Senior Consultant Jens Scheller Andersen of DTI.

### **New pork loin rind cutter brings numerous benefits**

The new machine went into operation at Danish Crown in Herning. Every week, 31,000 pigs are slaughtered on these premises, many of which are processed as rind cut pork loins.

- The potential of the new technology is annual savings of EUR 134 thousand per machine and a substantial improvement in working conditions and the quality of the rind cutting, says Plant Manager Kaj Meldgaard of Danish Crown.

The pork loins enter the machine skin-side down. Inside the machine a rotating knife cuts the rind across in narrow strips, after which the pork loins leave the machine to be checked. The fast-cutting knife is of high quality and is replaced once a day. The machine operates at low noise and uses little power.

Much of the manual work involved with the pork loin roasts is currently done in Germany. As soon as the in-line pork loin rind cutter is introduced at more Danish slaughterhouses, most of the rind cutting work will return to Denmark.

The development of the new technology was financed by the Danish Pig Levy Fund. DTI has filed a patent application for the pork loin rind cutter.









## Energy and Climate

DTI forms new, interdisciplinary cooperation relationships – often across borders – to generate new knowledge and new ideas to strengthen the competitiveness of the Danish energy industry.





### **i** facts

EnergyFlexOffice is DTI's new innovative laboratory which will contribute to solving the challenges faced by office building users and owners relating to poor indoor climate and high energy consumption.

## New business in sight in energy-efficient office buildings

With DTI's new testing facility, EnergyFlexOffice, the Danish construction industry is able to develop sustainable technologies for future energy-efficient office buildings in Denmark and abroad.

EnergyFlexOffice in Taastrup is a new, unique asset to manufacturers, suppliers, growth houses, entrepreneurs, design planners and consultants in the building industry. The idea behind EnergyFlexOffice is to lift Denmark to a leading position as a green technology lab and to ensure Danish small and medium-sized enterprises equal access to front-line test facilities.

– We are now able to meet companies' needs for developing, testing and demonstrating new solutions at component, system or building level under realistic and well-documented conditions, explains Ole Ravn, Centre Manager of Energy Efficiency and Ventilation at DTI. The unique thing is that we not only focus on developing and testing single components but also on the total system solutions that integrate the components.

### **Innovative laboratory welcomes the Danish construction industry**

The 100-square metre laboratory can be divided into two identical open plan offices for comparative

studies of ventilation, heating, cooling, heat and cold accumulation, air quality, day and artificial light, acoustics, flexible energy consumption for Smart Grid as well as management and visualisation of energy services and consumption. Each office is fitted with south-facing, dynamic, storey-high glass facades.

The ventilation company JS Ventilation is using DTI's new facilities to test a newly developed energy-efficient cooling ceiling 'Cool Ceiling', which under the EnergyFlexOffice concept can be coupled with conventional cooling solutions focusing on indoor climate and energy consumption.

– The goal is to create a market that allows us to expand and hire a salesperson, an assistant and a travelling fitter to solve assignments in Scandinavia and the rest of Europe, says Kim Kronby, Manager of JS Ventilation.

EnergyFlexOffice was established with funds from the Danish Agency for Science, Technology and Innovation.





**i** facts

Through its cooperation with DTI, the Danish company Industri-Montage Vest discovered the Norwegian hybrid heat pump, which was so far unknown in Denmark, and has been entrusted with the agency for the technology. The hybrid heat pump has the potential of reducing Denmark's energy needs.

## New hybrid heat pump set to reduce the energy consumption of Danish industry

---

A new test facility at the company Arinco has an innovative high-temperature heat pump which was imported from Norway and put into operation. Now, a pilot project will show whether DTI's promising theoretical calculations for both energy savings and carbon reductions will hold water.

The high-temperature heat pump is a hybrid heat pump using a mixture of water and ammonia as coolant. The heat pump is special because it can utilise surplus heat from industrial processes. Today, Danish manufacturing companies just emit waste heat into the atmosphere. The Arla Foods milk powder factory, Arinco, in Videbæk uses large amounts of heat to dry the powder and also generates large amounts of waste heat, which must be cooled. This factory is therefore perfect to illustrate whether the hybrid heat pump can be used at high temperatures and with significant effect to reduce the company's and in turn Denmark's energy needs in the long run.

– If the calculations for the test facility hold true, the energy consumption for heating and cooling will drop by 78%, and we will emit 1,450 tonnes of CO<sub>2</sub> less every year. In numbers, the energy savings total 7,500 MWh annually, corresponding to the annual energy consumption for heating of 780 150-square metre single-family homes holding the A2 energy label, says Arla Foods' Global Energy Manager Poul Erik Madsen.

### **Obvious climate and environmental benefits – and a potential business gold mine**

The test facility will have to run for a year to achieve unambiguous results. Arla Foods also plans to install the new heat pumps at the Rødkærsgårds dairy in Denmark.

– The potential of using the hybrid heat pump is enormous for the food industry and other process industries, explains Tage Petersen from DTI, and adds: The facility is relatively quickly installed at process companies needing both heating and cooling. The actual installation is quite simple, using well-known technologies – only the output ratio has been significantly improved over the past years.

The new test facility at Arinco is part of an EUDP project. In addition to DTI, Arla Foods and Industri Montage Vest, Anhydro, Affaldsvarme Aarhus, Thise Mejeri and Aarhus Slaughterhouse are participating in the project.



## **i** facts

The project will result in an information leaflet for home owners and two technical manuals for technicians, consultants, contractors and sewer contractors, who will be charged with the actual climate proofing. One manual provides practical examples of inexpedient constructions and sound advice about what you can do to avoid damage in the future. The other manual provides specific directions on proofing basements against rising sewer water.

# No more damage to buildings during monster rain downpours

---

Since 2007, summertime in Denmark has brought us torrential downpours, resulting in enormous amounts of rainwater, often together with sewer water seeping into houses and basements. But how do we best prepare ourselves for the monster rains of the future?

In Copenhagen in particular, many buildings and much furniture and equipment were damaged during last summer's cloudburst and the subsequent flooding. Most of the water damage to buildings in the past years could have been avoided if simple and inexpensive measures had been taken in time, explains Senior Consultant Inge Fladager from DTI. She is heading a new project on climate proofing of buildings, under which 10-15 residential properties and a number of local-authority buildings in Copenhagen will be inspected in order to determine what could have been done to avoid the damage.

– Many of the properties from the 50s, 60s and 70s were built with no thought for the monster rains we are experiencing now. Back then, nobody considered flood protection in the form of an elevated concrete edge on the top step leading down to the basement or by the light well by the basement window below ground level, adds Inge Fladager and continues: Also, many properties are inappropriately located as they were erected where the terrain dips at sites that should never have been parcelled out and sold for housing development.

## **Prepared for cloudbursts**

Group Manager John Kim Jensen from the property management company KAB is looking forward to the inspection of properties in Copenhagen. KAB manages around 50,000 homes in the Copenhagen area, many of which were severely affected by the water damage following monster rains.

– We are coming at this from various angles to prevent water damage to our properties. The fact is that we are still struggling to limit the extent of the damage that is unavoidable following monster rains. We therefore need help and advice on how best to protect ourselves against flooding by taking relatively simple technical construction measures, says John Kim Jensen.

The project results will be followed by the Danish Business Authority to ensure their incorporation into the Danish Building Regulations. The project is funded by Realdania, the Danish Insurance Association and a number of housing associations, including KAB, Lejerbo, Boligforeningen 3B, Gentofte Ejendomme Teknik og Miljø and Ejendomscenteret Gladsaxe Kommune. The project is expected to be completed by the end of 2013.





## **i** facts

African soil is more depleted than Danish soil, and farmers in some African countries will have to pay as much as ten times as much for conventional NPK fertiliser than Danish farmers. Under the 'Biowaste for Sustainable Products' project, scientists will use African biowaste to develop a new type of organic fertiliser to replace NPK fertiliser.

# African biowaste must be better utilised in the future

A new three-year EU project is to ensure that many thousands of tonnes of biological waste in Africa can be converted into biochemicals, fuel, fertiliser, animal feed and food. For Danish businesses, the project may result in new business opportunities with the local agricultural and food industries in Ghana, Kenya, Morocco, South Africa and Egypt.

In cooperation with researchers from Sweden, Italy and Malaysia, DTI and the Technical University of Denmark are to find out how African waste products from agriculture and the fruit industry can best be utilised instead of merely decomposing in a waste dump under the blazing African sun. The waste consists of e.g. bananas, which are the most common fruit in the world, and the root crop cassava, of which Ghana alone produced 12.2 million tonnes in 2009. This corresponds to 2.4 million tonnes of waste from the cassava production in just one year. With the proper technology adapted to local conditions, the waste can be used for biochemicals, fuel, fertiliser, animal feed and food ingredients.

– Africa's waste is an enormous hidden resource, since 80–90% of the waste consists of starch and therefore easily convertible sugars. This paradoxical waste of food is brought about by a lack of cooling and freezing facilities and storage options as well as poor harvesting and collection methods, explains Anne-Belinda Bjerre, Project Manager at DTI. Our own calculations show that the waste from Ghana's most common starch crop, cassava, alone holds sufficient energy to cover one third of the energy consumption of the Danish transport sector.

### **Africa catalogue on waste utilisation**

Young local PhD students and postdocs taking part in the project will produce sugar solutions from bananas

and cassava, respectively, by adding enzymes and then selected micro-organisms which will ferment the sugar into e.g. ethanol, lactic acid and amino acids. The fermentation products will be purified, while the remaining product will become organic fertiliser – and equipment, ingredients, work processes and the products produced will be described and documented. The researchers must then analyse and compare the results from the conversion of e.g. bananas, cassava, olives, sorghum, rice shells, sunflowers, sweet potatoes, sugar canes and cotton straw. The project will result in an Africa catalogue providing an overview and 'recipes' of optimum use of waste resources.

– My dream is that all African countries have their own biorefinery. Many Africans live at subsistence level with an unequal distribution of resources, and they seriously need the know-how to increase the use of their natural resources. The objective is that, in a few years, we can bring representatives from the Danish food industry and energy sector to Africa and create a spin-off from the project for the joint benefit of Africans and Danish businesses, says Anne-Belinda Bjerre.

In addition to DTI and the Technical University of Denmark, partners from Sweden, Turkey, Malaysia, Ghana, South Africa, Egypt, Italy, Morocco and Kenya participate in the project.

Ejendoms circle







---

## Business and Society

DTI helps Danish businesses pave the way for progress and growth by providing partnerships, a global vision and the courage to take new roads.



Ringkøbing-Skjern  
Kommune

### **i** facts

The project has challenged Ringkøbing-Skjern Local Authority to think differently politically and to implement policies across administrative areas. For more information: [www.rksk.dk/vækstpolitik](http://www.rksk.dk/vækstpolitik) (in Danish).

## Local authority seeks new avenues to create growth and jobs

During the crisis, Ringkøbing-Skjern Local Authority takes a leading role in strengthening local business development and employment. With analyses and strategic consultancy services, DTI has assisted the local authority in developing a new local growth policy.

Over the past year, DTI and Ringkøbing-Skjern Local Authority have completed a comprehensive and detailed analysis with workshops mapping the business strength positions and not least the challenges facing local businesses. Town council, the Finance and Trade and Industry Committee, various administrative areas and several local businesses have been involved in the analysis work.

– Working with DTI, we have gained in-depth insight into local challenges. This means that we can now act in entirely new ways. Plenty of areas need to be addressed, and we are willing to seek new avenues – politically, in the business community, in the educational system and the local administration, says Iver Enevoldsen, Mayor of Ringkøbing-Skjern.

The analyses show that the Municipality of Ringkøbing-Skjern currently faces six major challenges. One challenge is that the local population is getting older, combined with an increasing number of residents leaving the municipality. A second challenge is the relatively low educational level of the local population. The third challenge is increased competition from abroad which is forcing local businesses to rationalise, introduce automatic working procedures or relocate production. The fourth challenge is the geographical location of the municipality as the general trend

dictates that growth gravitates towards the metropolises. The fifth challenge is that fewer new businesses set up in this municipality compared to other municipalities in the Central Denmark Region. Finally, the innovation level in the existing businesses is a far cry from the level seen in other areas of Denmark.

### **Well on the way to a new local growth policy**

The analyses documented that Ringkøbing-Skjern is in a strong position particularly in agriculture, food products, tourism and mechanical engineering, including wind turbine production with potential in the energy sector.

– Now that we know our options, we can become more proactive, says Mayor Iver Enevoldsen and adds: Our vision is to attract both labour and businesses and to take proactive action to ensure that private individuals can create growth and new jobs, establishing long-term financial sustainability in the area. We therefore need to launch specific commercial, educational and employment initiatives.

– Ringkøbing-Skjern Local Authority has come far implementing the new growth policy, not least because local politicians took inspiration from abroad when formulating the policy, explains Leif Jakobsen, Senior Consultant from DTI.





**i** facts

User involvement in developing the new ventilation system MicroVent provided Inventilate with useful information about user behaviour, requirements and expectations. It provided valuable insight for optimising the product and targeting the marketing for the product.

## Let your users make you smarter

---

DTI has helped the Danish company InVentilate involving users when developing its new space and energy-saving ventilation solution MicroVent. This involvement brought valuable insight for completing the product and enhancing the product marketing messages.

The new ventilation system from InVentilate has been tested at a school and a firm of accountants. Through qualitative interviews and observations, DTI's innovation consultants were able to uncover these users' needs in respect of indoor climate and their experience of the functionalities of the new product. This has provided the company with crucial insight into how the product will be used in future and quality-assured the development work before the launch of MicroVent.

– It is paramount that users are involved when a company develops a new product as it allows you to target the product much more precisely to the market. The products we develop only have a future if users need them, says Morten Lundehøj, CEO of InVentilate.

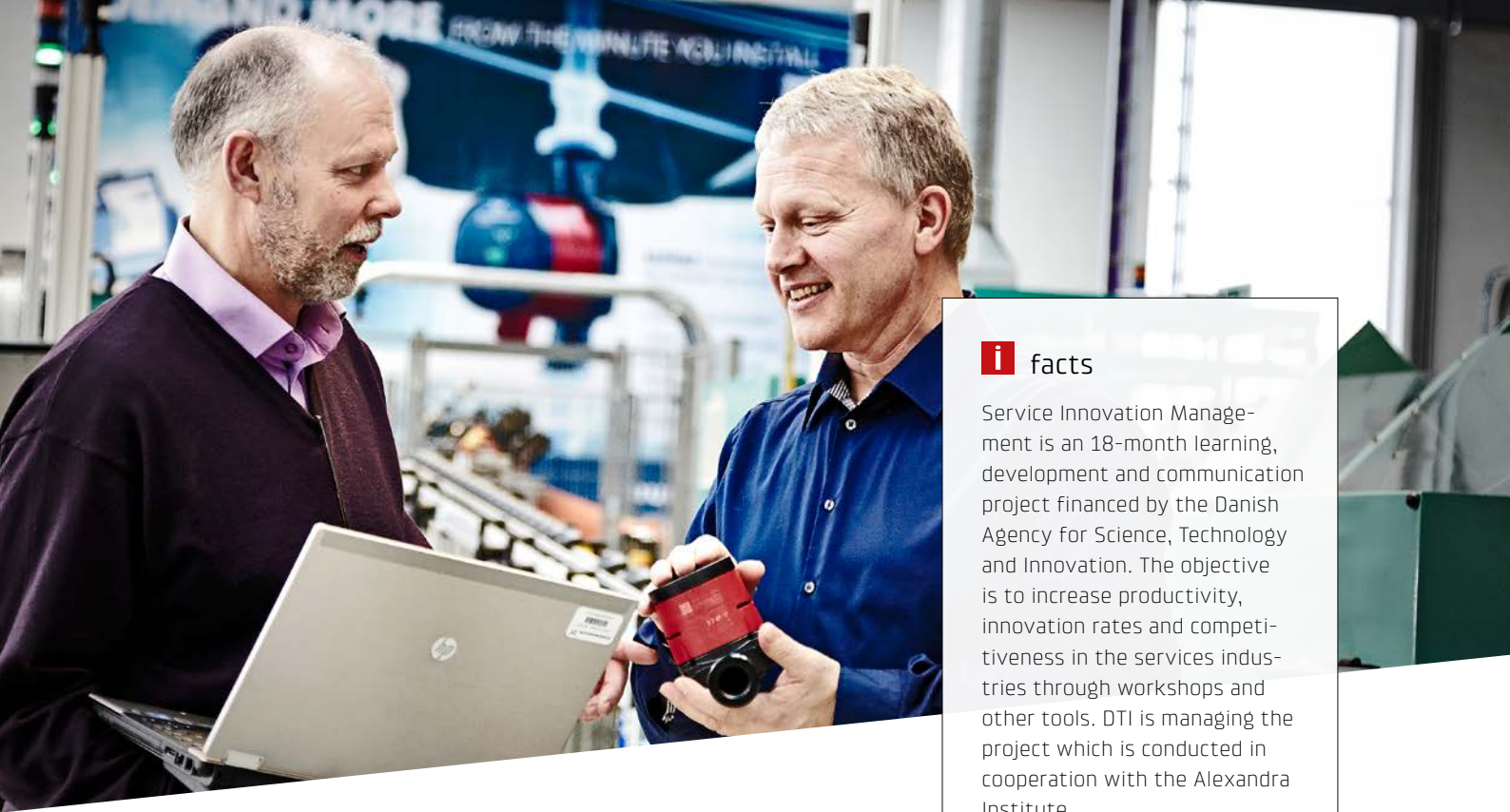
In addition to user studies, DTI has performed various quantitative measurements of e.g. CO<sub>2</sub>, temperature and humidity. This documentation of product performance and functionality as well as the feedback from users mean that InVentilate is very likely to develop a product that hits the bull's eye in terms of market demand.

### **The user studies focus on development and enhance communication**

One of the strengths of MicroVent is that the solution saves space and can be installed in an outer wall, building envelope or window. Since the user studies have shown that the end user prefers to sit by the window, the development of MicroVent will focus on the damper to avoid uncomfortable draughts.

– We have uncovered the key factors affecting the use of our product. Some people feel more comfortable when the room temperature is 22 °C, while others feel comfortable at 27 °C. This is crucial information for us to use when marketing the product. We do not want our customers expecting something other than what they get with our system, says Morten Lundehøj.

In autumn 2012, engineering trade magazine Ingeniøren awarded InVentilate the Product Award in the 'Entrepreneur' category.



### **i** facts

Service Innovation Management is an 18-month learning, development and communication project financed by the Danish Agency for Science, Technology and Innovation. The objective is to increase productivity, innovation rates and competitiveness in the services industries through workshops and other tools. DTI is managing the project which is conducted in cooperation with the Alexandra Institute.

## Greater and better service benefits in the pipeline

---

Grundfos is challenging its service providers to optimise future cooperation based on a strategy to strengthen the business and increase competitiveness. The ambition is realised in the Service Innovation Management project managed by DTI.

Reducing costs and making the machines run optimally all day constitute a major challenge for Grundfos. The company is therefore participating in a series of service innovation sessions that will result in new business models and recommendations for managing services and agreements with service providers in the future.

– We need to determine how much service we can or should outsource since outsourcing to subcontractors is always a matter of trust. DTI provides the framework for us to determine in a systematic manner how we can achieve more value from cooperating with subcontractors in the future. The project helps ensure that our service providers understand our fundamental values and are capable of developing and visualising the services that meet these values, says Preben Sørensen, Category Manager from Grundfos and adds: This will entail improved services, better use of services and increased quality for all parties involved.

### **Improving the partnership on service**

Grundfos and its subcontractors are working towards a future scenario for managing service agreements.

– We have become wiser when it comes to selecting the suppliers we want to cooperate with in the future. Throughout the process we and our future suppliers have gained insight into how we develop a shared platform for working with service and subcontractors in a value-based manner, explains Preben Sørensen from Grundfos and continues: Via our cooperation with DTI, we have established a value-based concept to enhance the existing potential of our service providers – something that has really generated new insight into our suppliers' strategies and goals.

As a spin-off from this project, DTI offers courses and development processes to other major Danish businesses, giving them the opportunity to gain insight and inspiration and to obtain specific solutions for developing their businesses in systematic cooperation with their service providers.





**i** facts

The facilities management training programme targets anyone in private businesses and central and local government organisations working with operations and maintenance, area management, service, provision of advisory services to businesses and strategic property management.

## Facilities management – the way to a more competitive Danish business sector

---

Facilities Management has long been a recognised management discipline in other countries. DTI is the only Danish provider of an actual training programme in facilities management. The programme offers inspiration and tools for optimising operations and producing services cheaper and more efficiently.

In any business, service deliverables in IT, customer services, cleaning, operation and maintenance are subject to constant demands for efficiency improvements, savings and better service. For the ninth time, DTI offered a training programme in facilities management in 2012 – and interest in participating is growing, as the programme offers quick and measurable rewards.

– The facilities management training programme has made me take a much more structured approach to focusing on why I am here and where I best add value to the organisation, explains Jan Thorndal, Head of Division at Danmarks Nationalbank.

### **A coordinated effort strengthens core business**

The essence of facilities management is that local and ad hoc-based decisions can be lifted to a coordinated and strategic level, thus managing all the physical, technological and service facilities that support a company's core business. The outcome is a healthy physical working environment, optimum use of space, optimisation of purchases and other resource-consuming installations and functions.

The participants will acquire knowledge, insight and tools so that they can lift the facilities management function to support the company's core activities in the optimum manner. During the training programme, the participants work with a case from their own company, which they choose themselves – typically a current or future organisational or strategic assignment.



12556

KRAS PROBE2

Amount: 49.5 mg

Mw: 8091.1 g/mol

5'-FAM CTG TATG

Pentabases: 4 (No





---

## Life Science

DTI takes on the challenges of tomorrow with the will to achieve ambitious goals on behalf of businesses through risk-taking research and development projects that give the business sector value for money.



### **i** facts

The preliminary results of the study indicate that Chr. Hansen will be able to increase the pigment extraction from annatto seeds quite substantially by introducing new measures.

## Yield of tropical colouring agent must be increased, strengthening Chr. Hansen's competitiveness

---

Chr. Hansen is a leading producer of natural pigments for the food industry. DTI supports the company's strong global market position in a partnership in which the objective is to improve extraction of the natural yellow pigment from annatto seeds.

Danish company Chr. Hansen receives assistance from DTI to look into the possibilities of increasing the yield of the natural colouring agent from annatto seeds. The colouring agent is used to colour foods and beverages such as sausages, cheese, dressings and soft drinks. The colouring agent is extracted at a factory in Brazil where the exotic plant is widely grown. The factory produces both an oil-soluble pigment for fatty food products and a water-soluble pigment for other products. The water-soluble pigment is extracted from the oil-soluble pigment in a conversion process. Chr. Hansen wants to increase yield throughout the extraction process at the factory while achieving improved quality.

– It is crucial that the production process is as efficient as possible so that we can exploit raw materials to the full. The market for natural colouring agents is characterised by highly cost-conscious food producers. At the same time, our raw materials are relatively expensive compared to the product price. It is therefore important for us to improve the production

process at our factory, says Kim Binderup, Vice President of Product Development at Chr. Hansen's Natural Colours Division.

### **Process improvements can generate progress for Chr. Hansen**

DTI visited the factory in Brazil, reviewed the production and took a number of measurements. Against this background, DTI presented Chr. Hansen with a number of recommendations for improving the production process. DTI also considered whether it would be appropriate to make any radical changes to the production process and discussed the results with Chr. Hansen.

– We chose to cooperate with DTI because it gives us access to competencies that we do not have ourselves in process modelling and extraction processes in the industry, explains Kim Binderup who expects that the company will be able to increase its earnings on the pigment from annatto seeds.





# New biotechnology solutions to increase production of North Sea oil

---

## **i** facts

The Danish oil industry, universities and biotech industry focus on developing new solutions to some of the major challenges in the industry where sophisticated biotechnology is expected to increase oil production or reduce production costs.

If Danish oil production is increased by just a few per cent, the result in increased income will run into hundreds of millions. Moreover, the new biotech solutions offer massive export potential for Danish biotech and service companies.

It is both difficult and expensive to maximise yield from old oil fields across the world. DTI is involved in a Danish initiative set up to develop new and innovative biotechnological solutions for increasing oil yield from Danish oil fields in the North Sea.

Declining oil production in Denmark poses a major challenge to the Danish economy. The methods currently applied for extracting oil mean that 30% of the oil in the subsoil can be extracted in a financially viable manner. Together with Maersk Oil, Dong E&P, Novozymes, CERE-DTU and Roskilde University and with funds from the Danish National Advanced Technology Foundation, DTI is working to develop more financially viable oil extraction methods using enzymes and bacteria.

### **Cost-efficient biotechnology**

The oil is located in reservoirs of either limestone or sandstone and is extracted by injecting large volumes of sea water. Put simply, the process corresponds to pressing the oil out of porous stone in which a large proportion of the oil remains trapped in small pore spaces while the water passes by. The project investi-

gates how to change either the properties of the oil or the water by adding specific enzymes or stimulating the activity of specific micro-organisms in the oil reservoir to achieve more efficient oil extraction. If these biological methods prove commercially successful, they are expected to be cheaper and more environment-friendly than most alternative methods for enhanced oil extraction.

Moreover, the oil industry is struggling with micro-biological corrosion of installations and pipelines as well as gas hydrate formation – an ice-like substance that can accumulate in pipelines and stop production. This problem is currently dealt with by environmentally unfriendly, expensive and not always efficient chemical methods. In connection with the Danish project, the parties will be investigating new, greener biotechnological solutions to these problems.



### **i** facts

Colon cancer is one of the most common types of cancer in the world with approx. one million new cases annually. DTI contributes to developing a new diagnostics kit so that patients do not need to be exposed to drugs that are ineffective in treating their cancer.

## New test ensures appropriate treatment of cancer patients

---

A major challenge in cancer treatment is that cancer cells differ substantially from one patient to the next. That is why patients do not react in the same way to the same medicine. DTI and the company PentaBase are developing a new diagnostic analysis to predict whether a particular drug will be able to help a particular patient.

Researchers all over the world focus on developing new targeted cancer drugs that are effective against cancer cells without affecting healthy cells. One of these new drugs, an anti-EGFR drug, is effective against colon cancer in 10-20% of the patients. It is important being able to distinguish safely between this group and the 80-90% of patients for whom this type of drug does not work. When this distinction can be made, the most effective treatment for the individual patient can be given without delay. The reason for the missing treatment effect is that some cancer cells have certain gene mutations making them resistant to the drug.

The diagnostic analysis kit being developed by DTI and the small Danish company PentaBase under the new project may in all likelihood be able to detect these mutations in a biopsy of a cancerous tumour. This makes it possible to determine whether the patient can be treated with an anti-EGFR drug or whether an alternative treatment option should be pursued. The method is established as a generic technology platform which over time may be extended and combined in new solutions tailored to different types of cancer such as ovarian cancer and malignant melanoma.

Professor Stephen Hamilton-Dutoit from the Institute of Pathology at Aarhus University Hospital is excited about the new two-year research project.

– We need to develop a unique and flexible technology platform to diagnose colon cancer as it will ensure that patients do not have to undergo futile treatment and can start immediately on an effective treatment targeting their specific needs. The health sector also saves expensive, ineffective treatment programmes, assesses Stephen Hamilton-Dutoit.

### **Growth potential for Danish biotech company**

PentaBase holds the patent for a special modification of synthetic DNA molecules sold to scientists and hospitals. Development and sale of complete diagnostic kits constitute a new business area. Ulf Bech Christensen, CEO of PentaBase, expects that the newly developed analysis kit will result in significant business growth over the next five years.

The project is supported by EUREKA and the Danish Council for Technology and Innovation under the Eurostars Programme. In addition to DTI and PentaBase, the Swiss institute of pathology Istituto Cantonale di Patologia also participates in the project.





**i** facts

Oil and gas will still play pivotal roles in energy supplies. To ensure acceptable environmental conditions, the growing wastewater volumes from the oil industry must be managed appropriately. DTI has been instrumental in developing a green environmental technology to treat wastewater from the oil industry.

## DTI makes black industry greener

---

DVS Vandteknik and DTI have developed a turnkey solution for treating oil-containing wastewater and drilling mud from Norwegian offshore oil production by using new physical, chemical and microbiological solutions. The oil industry can now become greener all over the world.

Oil and gas production results in vast quantities of wastewater, consisting of water, minerals, oil, salts, carbonates as well as lubricants and stabilisers. DVS Vandteknik therefore saw a favourable business opportunity in developing a total concept for handling the problematic substances in the wastewater from the oil companies in Norway. Assisted by DTI, the company developed a combined physical, chemical and microbiological process capable of treating the wastewater so that it could be discharged into the fjords around Bergen.

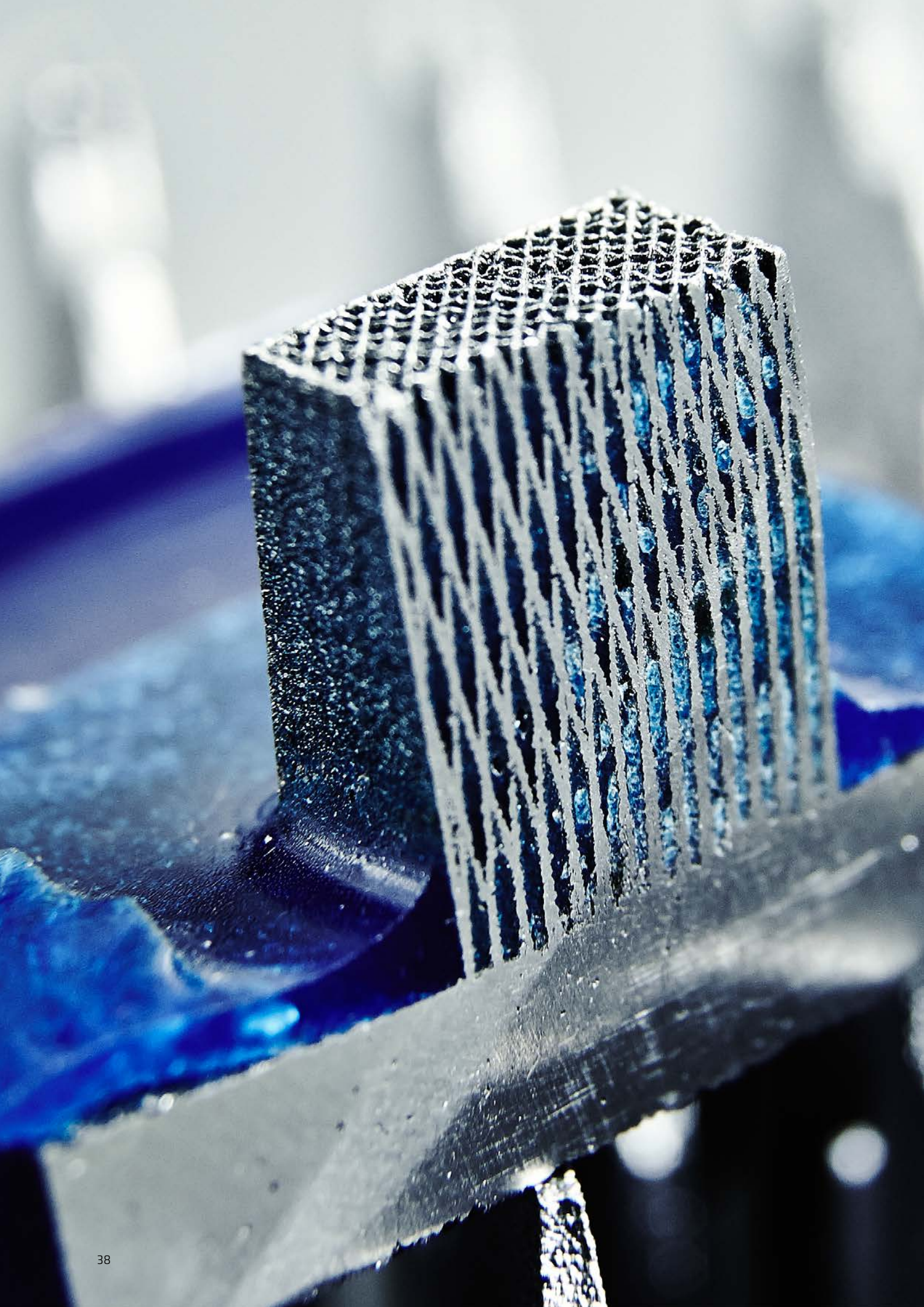
– Cooperating with DTI, we got reassurance that we were developing the proper solutions that also made good business sense. It gave me peace of mind and was a seal of approval in relation to the rest of the world, says Lars Kastholm, Chairman of the Board of DVS Vandteknik.

### **Demand for Danish green environmental technology for the oil industry**

Regardless of political ambitions to phase out the use of fossil energy, oil and gas will play pivotal roles in the energy supply for many decades to come. To ensure acceptable environmental conditions, the growing wastewater volumes from the oil industry must be managed appropriately.

– Through targeted efforts, Danish water companies can attain preferred supplier status for environmental technology to the oil industry. With the right partnerships and the political will to create a strong, national innovation community, there is considerable global growth potential in this sector, says Lars Ditlev Mørck Ottosen, Head of Section, from DTI. It is no secret that the wastewater project in Norway kick-started the growth wheel.









---

## Materials

DTI takes the lead with new technology to inspire industry to think along new lines and prepare for the challenges of tomorrow.

# 3D print technology creates the world's lightest titanium gear wheel for racer bikes

---

The development in 3D printing has taken off. DTI is experimenting with this modern development and manufacturing tool, which has the potential to raise the innovation bar in Danish industry and boost competitiveness.

3D print technology – also known as additive manufacturing – has made it possible for Danish industrial companies to design and print three-dimensional products with complicated structures quickly and easily and have these put into production at DTI. Fantasy is the only limit to new forms and functions with this modern technology which has the potential to accelerate the pace of product development and market penetration of small and medium-sized enterprises' product development and market penetration and thus increase their competitiveness, believes Olivier Jay, Head of Section, from DTI:

- The complexity and the value of printed products increase as 3D printers become both faster and cheaper and able to combine various materials. We expect the technology to turn upside down the way companies are currently manufacturing and developing if they hurry and start thinking of 3D printing as part of the entire production chain.

## **3D printing gives impetus to product development**

CeramicSpeed is one of the Danish companies cooperating with DTI to apply the latest techniques and use the large degrees of freedom in design in 3D printing. The company got input from DTI to design and manufacture the small light gear wheels found on the rear external gears on racing bikes.

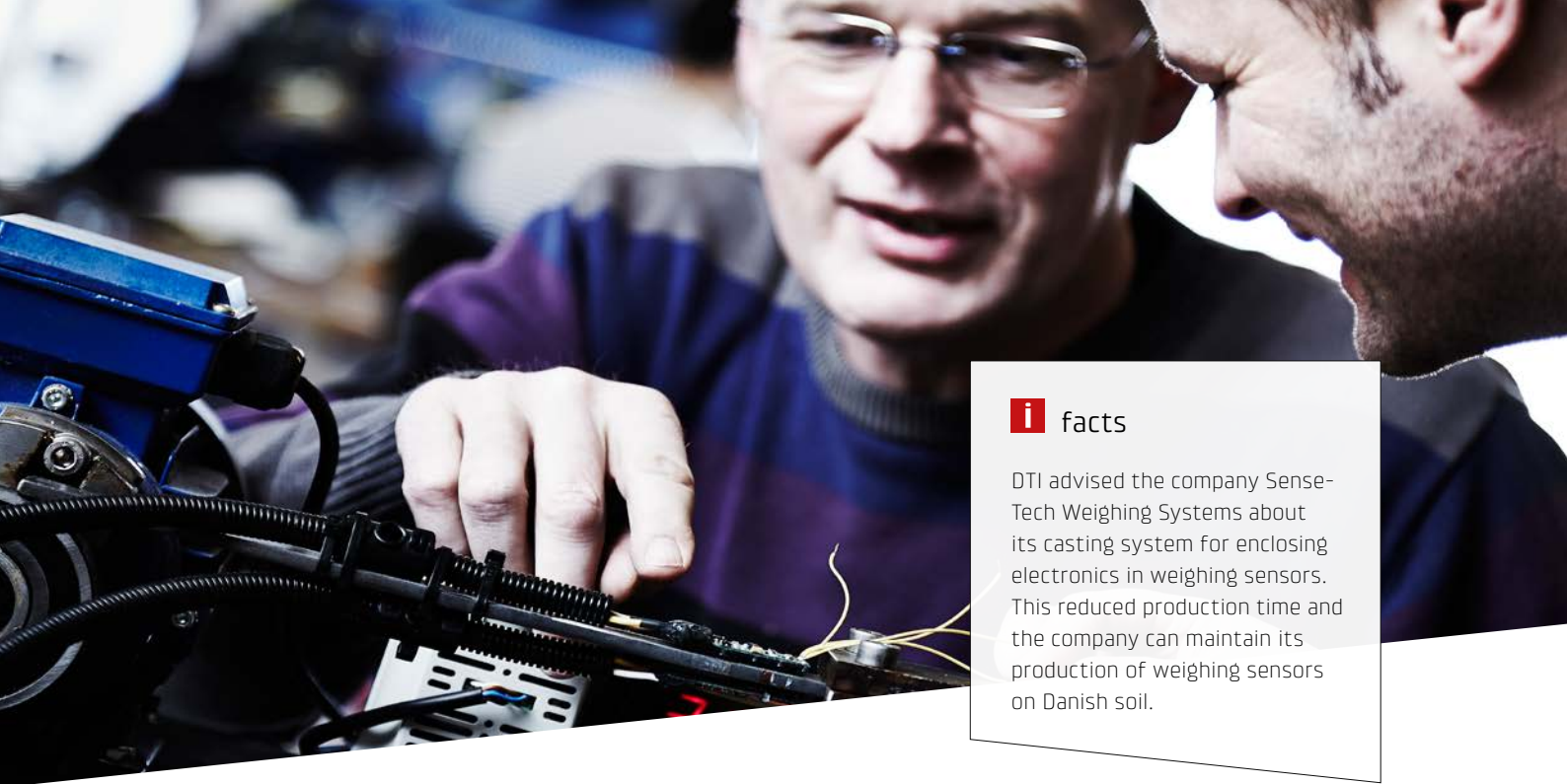
- The 3D printing technology has given us a free rein to experiment with the design in a creative manner, while at the same time allowing us to optimise product functions throughout the process. We are very satisfied with the advice we received from DTI. The cooperation has meant that we have developed and are now manufacturing nothing less than the lightest gear wheel in the world, the so-called pulley wheel, in a new radical design which was only possible with 3D printing. The new gear wheel is made from titanium in a thickness of only 0.3 mm, and it is designed with solid surfaces to prevent dirt from entering, says Bøje Kjær, Director of CeramicSpeed. Bøje Kjær expects the new gear wheel to substantially improve the company's revenue in the high-end market and raise CeramicSpeed's profile as the most innovative business in the market.





**i** facts

DTI provided consultancy services to Danish company CeramicSpeed in the use of 3D print technology for the development and manufacture of a very light titanium gear wheel with unique functionalities that is very difficult to copy. The product is likely to boost CeramicSpeed's competitiveness.



### **i** facts

DTI advised the company Sense-Tech Weighing Systems about its casting system for enclosing electronics in weighing sensors. This reduced production time and the company can maintain its production of weighing sensors on Danish soil.

## Full steam ahead for the production and export of Danish weighing sensors for lorries

---

Sense-Tech Weighing Systems and DTI have optimised and improved the production of weighing sensors for load control of lorries by reducing production time from two days to only two hours, and improve the quality. Now the company can maintain production on Danish soil and keep up with growing foreign demand.

Weighing sensors from the company Sense-Tech Weighing Systems are used for determining the freight weight of lorries and prevent overload of heavy goods such as raw materials from mines or waste and recycled materials. The lion's share of the company's business consists of exports to Europe, Australia and South America. The sensors are cast, assembled and made ready in Denmark. According to Managing Director Erik Kjærgaard, the company has experienced a growing foreign demand in recent years, and that has triggered a need to optimise and improve the efficiency of the manufacturing process.

- We are a Danish company and it means a lot to us to maintain production in Denmark, thereby ensuring local jobs. However, global competition means that we need to look at new ways of optimising and improving the efficiency of our production. We therefore approached DTI to access new knowledge about materials technology, focusing on improving our cast systems for enclosing electronics, and we greatly managed to boost our

competitiveness, explains Erik Kjærgaard from Sense-Tech Weighing Systems. He believes that the cooperation was very fruitful as an improved cast system with new filling processes has led to a simpler and more robust manufacturing process and thus more uniform quality. As our weighing sensors are typically retrofitted on vehicles on site, our customers in the transport sector will benefit, because with our optimised product we can shorten the length of retrofitting.

### **More weighing sensors as standard equipment on lorries on their way overseas**

In consequence of the company's improved output capacity, Erik Kjærgaard expects that the company will soon be able to supply weighing sensor systems as part of the standard equipment on a number of lorry models.

The initial cooperation between Sense-Tech Weighing Systems and DTI received support from the Danish Agency for Science, Technology and Innovation.





## **i** facts

DTI is assisting Tanbreez Mining Greenland in improving utilisation of the minerals extracted from the Greenlandic deposits by means of chemical process technology. Moreover, DTI is developing the magnetic alloys for magnetic couplers and ball bearings, etc. in industrial products. DTI does so by means of new state-of-the-art design processes based on newly developed and complex geometrical shapes geared for mass production. DTI is also to test the magnetic properties of the alloys, including analyses of durability and service life.

# New research challenges Chinese dominance in magnet industry

---

Across the world, the livelihoods of magnet producers are threatened by China, which dominates the market for rare earths and lets prices of these raw materials skyrocket. However, a four-year Danish research project and massive Greenlandic deposits of rare earths are to put an end to that situation.

In recent years, prices of sought-after rare earths, such as neodymium and dysprosium, have fluctuated by more than 900%. Now, a group of Danish industrial players and universities, headed by DTI, will break the Chinese monopoly in the market for rare earths by restoring the entire value chain in Europe from raw materials to production and reuse of so-called high-performance permanent magnets.

- It is a problem to the international community that for much too long China has been controlling deliveries and prices of the rare earths needed to manufacture magnets for use in transport, health, energy and communication. We will lay the foundation for a new future where free market forces will prevail for the benefit of magnet producers, says Jens Christiansen, Head of Section, DTI, and adds: We will develop bigger and stronger magnets to give the Danish business sector in particular a competitive edge. One way of achieving this is to conduct preliminary studies of finds of rare earths at the southern point of Greenland in Kringlerne, where production of rare earth metals is expected to commence in 2015, thereby providing an alternative to the Chinese production.

**New innovative solutions for the magnet industry in sight**  
Jens Christiansen and R&D Manager Peter Kjeldsteen of Danish magnet producer Sintex in Hobro took the initiative to the new research project.

- We will implement sustainable solutions in our magnet production according to the cradle-to-cradle concept and by establishing solutions for collection and reuse of magnets and particularly their content of rare earths, says Peter Kjeldsteen and continues: Finally, we intend to examine if our magnets can be improved by new innovative production solutions. It is interesting to learn how we can develop magnets with improved temperature properties, higher magnetisation and greater strength in the future. It looks so promising that we have now gathered a group of leading international players who contribute research and innovation in relation to materials, processes, life-cycle analysis and technical design at the Technical University of Denmark, the University of Southern Denmark and the Danish Technological Institute.

- The project will make it easier for the cleantech and hightech industries in Denmark and Europe to gain access to the rare earths that are also necessary raw materials in the manufacture of high-technology products such as mobile phones, computers, TVs and microphones, adds Jens Christiansen.



### **i** facts

The project outcome is specific proposals for more expedient work processes and new technical aids for moving and lifting various types of cargo. The project will also provide recommendations for customers on division, packing, cargo labelling and optimisation of access conditions for drivers in connection with loading and unloading. Finally, DTI will develop interactive teaching materials for supplementary training of all drivers and terminal staff.

## Protection of Danish jobs in the transport sector

---

For the benefit of the entire transport sector, DTI, in cooperation with Danske Fragtmænd, takes precautionary measures to protect drivers and terminal workers from being physically worn out and injured at work.

Participants in the project 'Better work environment and labour retention in the transport sector – freight and distribution' are asked to identify particularly strenuous situations at work and come up with ideas to improve cargo handling throughout the transport chain: at carriers, in terminals and at customers.

- Our employees need to know how to take care of themselves so they can stay in their jobs until they retire. The work of handling cargo is physically demanding so it is important to map out working conditions and find solutions to minimise the risk of osteoarthritis and back, leg and arm injuries, says CEO Jesper Nørsgaard of Fragtmænd J. Nørsgaard Petersen.

### **New ways of lifting and moving cargo**

Eight carriers and two freight terminals from Danske Fragtmænd participate in the project. Customers and partners from Danske Fragtmænd are also involved in

the work to find better ways of handling cargo at terminals, in warehouses, on lorries and at customers.

- Our business spans widely as we handle all types of cargo for our customers. The cargo ranges from small and light parcels to very heavy pallets of building materials and long-length cargo in the form of unmanageable units such as awnings, plastic pipes and iron staircases or large sheets of aluminium. As contents, packaging, packing and loading and unloading conditions vary from time to time, ensuring improved working conditions poses a great challenge, says Hans Erik Hansen, Quality Director, Danske Fragtmænd, and adds: This being the case, we need new solutions to protect employees and jobs.

The project ends in May 2013 and is supported by the Fund for Better Working Environment and Labour Retention. DTI provides the expertise in working conditions, logistics and transport.





**i** facts

The innovation consortium 'Product-adapted packing of fresh fruit and vegetables' has increased the quality and reduced the wastage of fruit and vegetables during distribution and sales.

## Correct packaging of fresh fruit and vegetables prevents wastage

---

In Denmark, we throw out EUR 416 millions worth of fruit and vegetables every year. Now, a project offers solutions to packing the lettuce, the broccoli, and the grated carrots.

The greatest wastage of fruit and vegetables is seen in retail trade – losses have previously been calculated at EUR 57 million a year. DTI headed a project aimed at raising the earnings of the food industry and retail trade from sales of fresh fruit and vegetables. Because keeping quality can be improved if the products are wrapped in suitable packaging and stored correctly. Conversely, incorrect packaging and storage can have disastrous consequences.

- Packaged fruit and vegetables can result in half the amount of wastage compared to non-packaged fruit and vegetables. For instance, a cucumber without packaging will typically keep for three days – if the cucumber is wrapped in 1.5 grams of plastic, it will keep for up to two weeks. So it is worth the while packaging fruit and vegetables, says Project Manager Hanne Kastberg from DTI and continues: When the storage temperature is lowered by 10 °C, the keeping quality of fresh fruit and vegetables will improve by an average two and a half times – and by up to eight times in connection with slightly processed products.

Consumers also throw a lot of food in the bin. According to the Danish Environmental Protection Agency, food wastage in the individual household accounts for almost half of the refuse collection. About 23% is food that could otherwise have been consumed. On a national scale, this equals 157,720 tonnes of food a year – of which 62,051 tonnes are fruit and vegetables.

### **Better processed fruit and vegetable products will see the light of day**

The project results enable the industry to optimise packaging and storage, thus leading to products of higher quality and improved keeping qualities.

- Our sampling has previously shown that three out of four slightly processed products of, say, mixed lettuce or grated carrots are not in terms of quality OK on the sell-by date because the packaging is too tight or because of other quality problems. So we need to continue our work to improve both quality and keeping quality. The challenge is to make the entire supply chain work together and to communicate the importance of correct storage, packaging and quality assessment, says Hanne Kastberg and refers to research conducted by Aarhus University.

In addition to DTI, the following partners participated in the project: Aarhus University, HortiAdvice Scandinavia, Scanstore Packaging, NNZ Denmark, PBI Dansensor, Multivac, AGA, COOP, Axel Månsson, Yding Grønt, Tange Frilandsgartneri, Slice Fruit, Gl. Estrup, Årstiderne, Ørskov Frugt, CFS, Videometer, Svanholm, Peter Skov Johansen, Juice4You, Lykkegården, Danske Frugtavlere, Gartneriet Torup and Ventegodtgård.



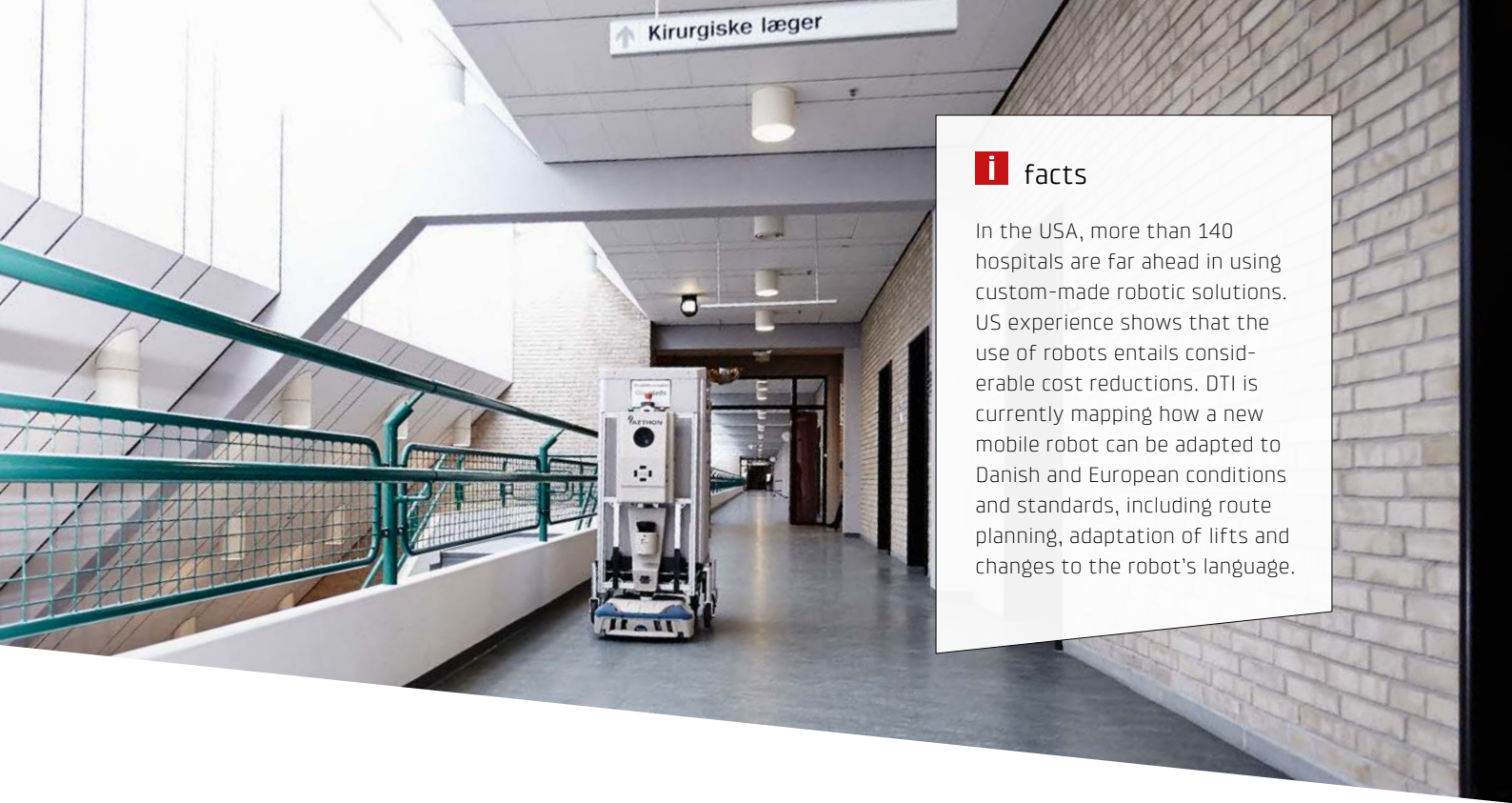




---

## Production

DTI has a keen eye for applying familiar technologies in new ways and implementing new technologies in existing or new products.



## **i** facts

In the USA, more than 140 hospitals are far ahead in using custom-made robotic solutions. US experience shows that the use of robots entails considerable cost reductions. DTI is currently mapping how a new mobile robot can be adapted to Danish and European conditions and standards, including route planning, adaptation of lifts and changes to the robot's language.

# Talking transport robots lend a hand at the hospital

When the hallways at the hospital Sygehus Sønderjylland in Åbenrå on rare occasions are empty, you will often still hear a light buzzing and whirring. The hospital's new transport robot is on its way with a blood sample.

Hospitals grow bigger and bigger and many new hospitals are in the pipeline all over Denmark. This places greater demands on internal logistics at the hospitals when blood samples, bed linen, medicine and food need to be transported to the various wards.

– We need to choose the best technologies for transport jobs to enable our employees to spend their working hours in the best way for treatment, nursing and care, says Søren Aggestrup, Chief Medical Officer at Sygehus Sønderjylland, and continues: For many years, pipe systems have been an obvious transport choice. However, we are curious to test the advantages of the new mobile robots that can transport everything regardless of size, shape and material.

Following advice from DTI, Sygehus Sønderjylland is now testing an AGV robot named TUG from the American company Aethon as part of a major project.

### **Future savings by transporting pillows, pills and blood samples by robots**

– To deliver proper quality to the patients, we need the right things in the right place at the right time, regardless of whether it is a pillow, a pill or a blood sample – that is what we hope the robot can help us with, says Søren Aggestrup.

The newly acquired robot is on call 24/7. The TUG robot only has a start and stop button. When a nurse summons it via a mobile phone or computer, the robot finds its way to the ward by itself and stops at a defined stand. The nurse can then place trays with blood samples into a cabinet on the robot and press the start button. The robot will then move to the laboratory. On its way, it may take the lift. The robot summons the lift itself and says via the network at which floor it needs to stop. When it exits the lift, it asks any bystanders politely to step aside. Once the robot reaches the laboratory, it stops at its stand and waits until a laboratory technician collects the samples. If it has no more jobs, it will return to its charging station and await its next job.





### **i** facts

DTI has been involved in designing, developing and producing the unique fingers of the Hybrid Gripper which handles known and uncomplicated processes well. The gripper can help release human labour and create more value overall. The Hybrid Gripper is available for purchase on a trial basis.

## Seize the possibilities with a new flexible robot hand

---

DTI, the University of Southern Denmark and various companies are behind the Hybrid Gripper, which is a new, flexible robot hand intended to ease industrial automation and strengthen the competitiveness of Danish businesses.

Today, 60% of the robots work in the industry, where they move objects from one place to another. As long as the object is always the same, most robot grippers can handle the job. However, if you have a production line where the objects vary in shape, material and size, there are fewer, competitively priced robot grippers available to choose between in the market.

– Robot grippers are usually designed to handle specific objects only. If you want a higher degree of flexibility, the price is much steeper. The Hybrid Gripper is a good, cost-effective solution, explains Gert Knudsen from Eltronic and adds that it can handle more diverse objects than other robot grippers in the same price range.

#### **Robot solution imitates a human hand**

The inspiration for the Hybrid Gripper comes from the human hand which has 32 different gripping actions. However, we only use ten of these actions on a daily

basis using our thumb, index and middle fingers. Just like the human hand, the Hybrid Gripper can adjust itself to the shape of the object to get a better grip. Rubber coating on the gripper exerts gentle pressure so that the object is not damaged. The fingers on the gripper can be made in different sizes and shapes as required.

A traditional gripper has a finger configuration determined by the producer. With the Hybrid Gripper, finger location and rotation are independent of their function, meaning that a company can place and adjust the fingers according to the task at hand.

The Hybrid Gripper project is funded by the Danish National Advanced Technology Foundation. In addition to DTI and the University of Southern Denmark, the project group includes KeySolution, Eltronic, Gråsten Maskinservice, Bayer MaterialScience and Schunk Intec Denmark.

# Sensor unit developed in Denmark creates excitement

---

A new, specially developed sensory unit in the shape of a sphere from the Danish company Webstech can solve nothing less than global food shortage. DTI served as a technological sounding board during the development of the new crop sensor Senseseed.

Up to a third of the world food production is ruined by mould, bacteria and insects – particularly when the crop has been harvested and it is being stored. However, with the new Danish sensory sphere, harvested crop health can now be monitored so that the farmer can be alerted and intervene before the grain sprouts or the corn rots in the barn or silo.

A jury consisting of scientists, product developers and commercial specialists awarded Webstech and the inventor Ole Green the Main Prize for the crop sensor Senseseed as part of the engineering trade magazine Ingeniøren's 'Product Award 2012', where 62 cutting edge Danish products competed in eight categories.

–Obviously, I am thrilled about the prospect of new cooperative partnerships and business opportunities related to winning such a prestigious prize in fierce

competition with many other new and innovative solutions, says Ole Green, Director of Webstech. He adds that DTI provided highly specialised technological consultancy when the new, wireless sensor technology was developed, which meant that the company was able to offer a new generation of wireless sensors after just one year. According to the inventor, the greatest challenge was to develop a wireless multihop system.

## **Europe embraces wireless sensor technology**

With the new wireless sensor technology, the farmer can monitor the crop temperature and moisture content via a smartphone and computer and identify the location in the crop where any sudden changes occur which may damage the crop. Webstech has already marketed the sensory sphere in eight European countries.



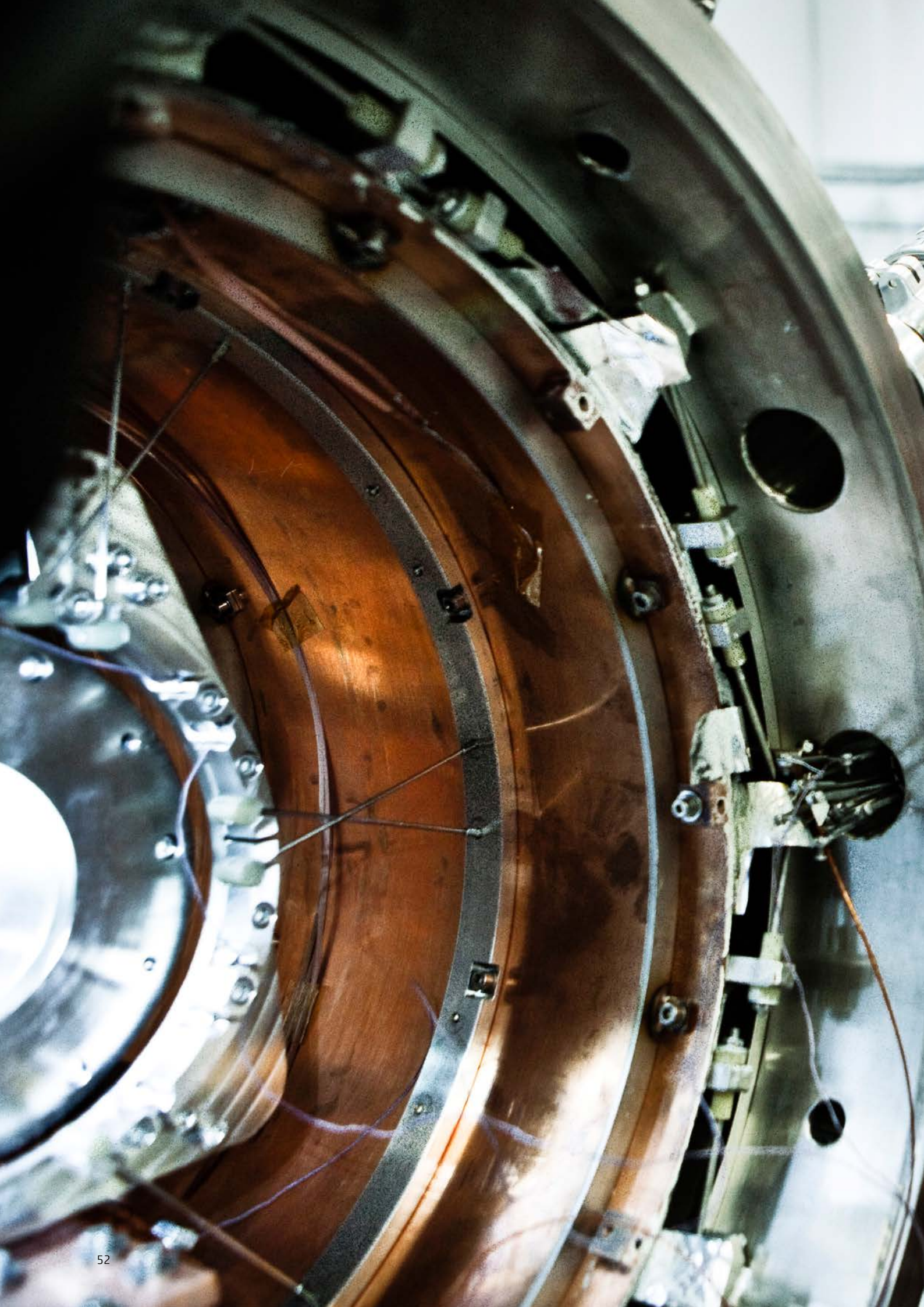


**i** facts

DTI contributed to developing the wireless sensor technology which constantly measures the temperature and the relative moisture of the crop in a warehouse. The sensor units have integrated transmitters and receivers which communicate with each other and with a base station. The sensory sphere can measure temperatures as low as minus 40 °C and up to 80 °C. The battery has a life of up to two years.









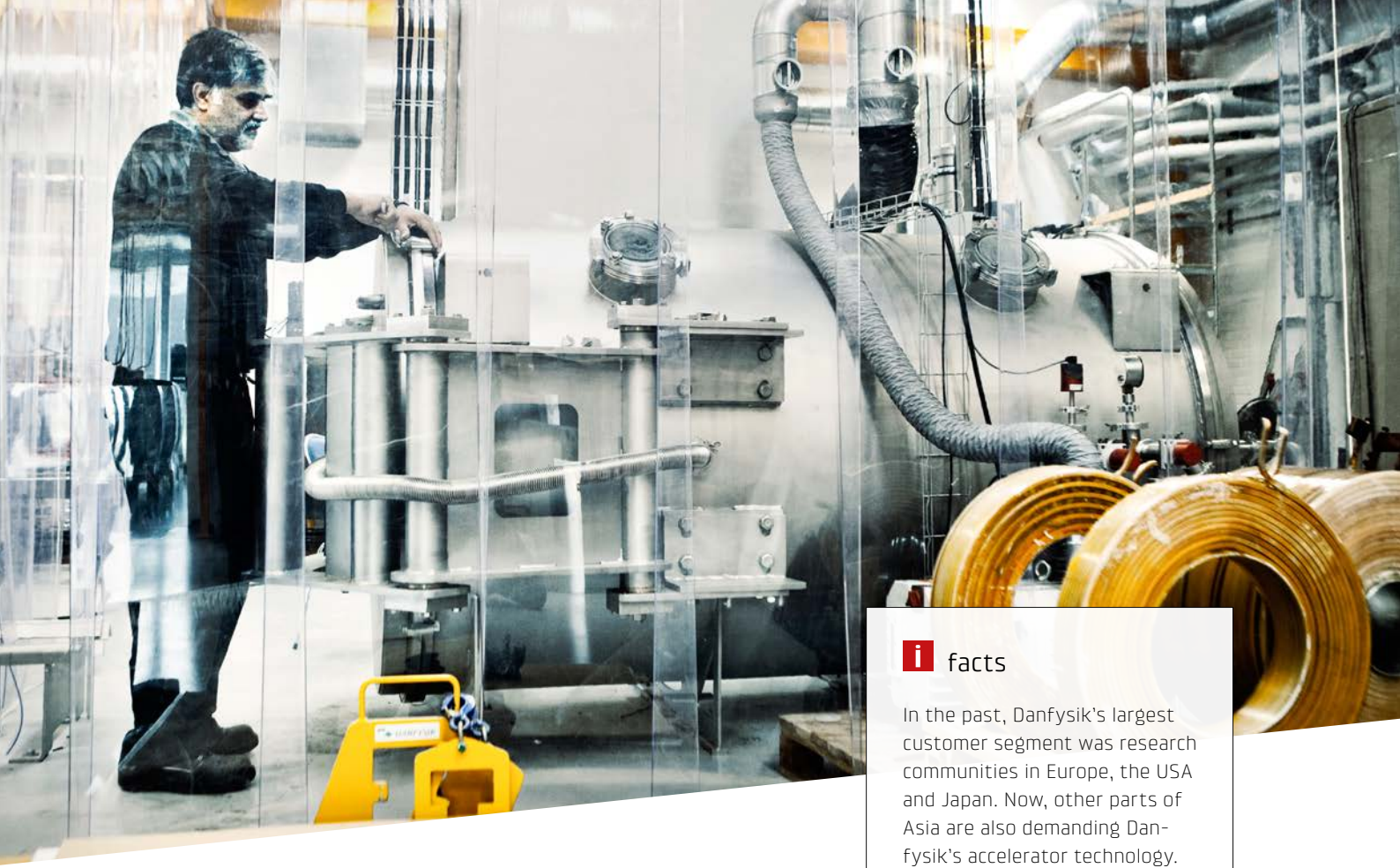


---

## Danfysik

Danfysik creates innovative solutions and new products in the accelerator market to be applied in research, the health sector and industry.





### **i** facts

In the past, Danfysik's largest customer segment was research communities in Europe, the USA and Japan. Now, other parts of Asia are also demanding Danfysik's accelerator technology.

## A tiger's leap into the future with Asia as a new large market

---

Investment activity is high in Asia. Recently, Danfysik has won several new projects in Asia in both research and the health sector, securing Danish jobs and growth in Danfysik.

While the large growth engines of industry and research in the accelerator industry are running at full speed in the traditionally strong western economies, the engine is only just starting up in Asia. The accelerator market is developing fastest in China, India and Korea. With two new campaigns in Asia, Danfysik has kicked open the door to the new markets' engine room. For instance, Danfysik has entered into an agreement with Siemens to take over the responsibility for installation, commissioning and servicing of the world's most advanced particle therapy accelerator for the treatment of cancer in China, where they are planning to establish more particle therapy and research facilities. This provides Danfysik with a platform for targeted sales efforts in the otherwise highly inaccessible Chinese market.

### **Danfysik takes the lead in the Asian accelerator market**

Korea is another large market for Danfysik. Until a few years ago, the country did not have any noticeable activity in the accelerator market. This situation has changed dramatically in recent years when a large number of new accelerator projects have received grants running into billions. Danfysik became highly visible in Korea in 2012. Together with sixty other Danish businesses, Danfysik participated in the business promotion campaign 'Inspiring Denmark' in May 2012, in which also the Danish Crown Prince and Princess participated. To follow up on the visit, Danfysik was represented at the international particle therapy conference PTCOG in Seoul.





## **i** facts

Green Magnet is a new product in the particle accelerator market. Danfysik developed the new technology in cooperation with Aarhus University and Aalborg University as well as Sintex, the magnet producer. The Danish National Advanced Technology Foundation granted support to the development of the Green Magnet technology.

# New Green Magnet technology reduces particle accelerator energy consumption

Future particle accelerators will save the research community and the industry exorbitant electricity bills thanks to a new zero power magnet from Danfysik.

When two German mountain hikers found the dead body of a man in the Alps in September 1991, no one could say for sure how long the dead man had been lying in the snow. However, by using a particle accelerator the size of one-story house, the University of Vienna was able to reveal through carbon-14 dating that the body was that of a Bronze Age man who died more than 3,100 years ago.

To maintain giant particle accelerators in operation like the one in Vienna, a strong power supply and a large-scale water and energy consuming cooling system are needed. A large-scale particle accelerator is a burden on the operating budget, costing several millions of Danish kroner a year. However, Danfysik has now developed a powerless and compact accelerator magnet for a team of researchers at the Swiss Federal Institute of Technology Zürich. There, they are developing the most compact carbon-14 dating accelerator in the world for archaeological use.

### **New magnet with many applications**

The so-called Green Magnet technology is based on very powerful permanent magnets instead of

conventional electromagnets designed with energy-guzzling and space-consuming copper coils. In addition to taking up less space and being more environmentally friendly, the Green Magnet technology has more applications than just dating archaeological finds.

- We have with joy been looking forward to introducing our new power and water-saving magnets of the Green Magnet type. The new technology will make a huge contribution to less expensive and more sustainable development and manufacture of the high-technology products that we all use every day, says Leif Baandrup, Project Manager at Danfysik, and adds that these are products like mobile phones, computers, entertainment electronics and other electronic units manufactured by means of compact particle accelerators.

In modern medical diagnostics and treatment, the implementation of the new Green Magnet technology will also reduce the energy consumption of particle accelerators.



### **i** facts

Particle therapy is much more efficient in cancer treatment than conventional radiotherapy, which uses photons. Particle therapy applies hydrogen or carbon ions, which, at a speed close to that of light, are aimed directly at the cells in the cancer tumour which is treated inside the body with extreme precision.

## Danfysik rejoins the ranks of the particle therapy elite

---

Danfysik has assumed responsibility for establishing and commissioning the world's most advanced particle therapy accelerator for cancer treatment in China. This saves Danish jobs in a unique niche production.

When Danfysik took over the staff from Siemens' particle therapy branch in the autumn of 2012, the staff grew to 100. The takeover also involved the project of installing, testing and commissioning one of the world's most advanced particle therapy facilities for cancer treatment in Shanghai.

The advantage of particle therapy is that cancer cells may be treated accurately and effectively with radiotherapy without damaging the surrounding healthy tissue. This makes it possible to treat tumours that are particularly sensitive to radiation, including brain, spinal, eye, lung or liver tumours.

### **More and more hospitals to apply particle therapy**

Many hospitals particularly in Europe, the USA, Japan and China have embraced particle therapy as research in the area increased, and this state-of-the-art treatment is also finding its way to Danish hospitals.

– Our strategy is to use our strong competences in accelerator technology in the health care market and specifically in cancer treatment where we see increasing investment activity in especially the Far East, says Bjarne Røger Nielsen, Managing Director of Danfysik, and continues: As we have previously worked extensively with accelerators and particle therapy equipment, we have high hopes for this business area, and it is obvious for us to cultivate it further. We are also thrilled that our technology can be used directly for the benefit of humans.





### **i** facts

Solenoid magnets from Danfysik are made from coils without electrical resistance, which generate magnetic fields that are up to several million times stronger than the earth's magnetic field. Particle accelerators worldwide need these strong magnetic fields to perform experiments and to unveil the secrets of the universe. Danfysik will design, produce and test four solenoid magnets for the European research centre CERN.

## Superconducting magnets decodes the mystery of the creation of the elements

---

All organic and inorganic matter on earth was created in stars in a distant past. Today, we know that substances heavier than iron come from rare star explosions. But how do we learn more about the beginning of all elements in the universe? A solenoid magnet from Danfysik is to provide new insight into the secrets of the universe.

The European research centre CERN in Switzerland needs Danfysik's technology for new nuclear physics experiments aimed at revealing how the elements and the structure of the atomic nucleus were created. Danfysik has been asked to deliver the compact superconducting magnets between autumn 2013 and summer 2014.

– Very few companies worldwide are capable of designing, building and testing superconducting magnets. Danfysik will be among the best in the world to master this superconducting technology, explains Arnd Baurichter, Sales Manager, and adds: Worldwide, more than EUR 3.4 billion will be invested in accelerator projects based on superconducting technology in Europe, the USA and Asia over the next five years, and we want a large chunk of this.

### **American interest in superconducting magnets**

Danfysik's ambitious goals have resulted in the world's first commercial solenoid magnet with the newest generation of high-temperature superconductors. This special superconducting magnet was purchased by the University of Wisconsin-Madison in the USA in 2012, and the University intends to use the technology to conduct the research necessary to design the drugs, biofuels and exotic materials of the future.

– Danfysik has a very strong reputation in our accelerator community. The HTS solenoid will be a key component, providing emittance compensation for our SRF Electron Gun, explains Michael Green from the University of Wisconsin-Madison in the USA.

# Review

---

The principal role of DTI is still to ensure that both big and small Danish businesses – including new businesses – succeed in translating public research into commercial successes in the form of new and exportable technologies, products, processes and services.

**Søren Stjernqvist, President, DTI**





Waters SFC USA  
412-967-5665  
www.waters.com  
R250 Reactor  
Vessel Volume 254ML  
MAWP: 10,000 PSI @ 150°C  
6,000 PSI @ 150°C with 316  
Material 316 SS  
Serial # 45J1:87877-1

Bactiguard BIP

# Review 2012

---

The Danish Technological Institute (DTI) delivered a satisfactory financial performance for 2012, with net profit of EUR 5.8 million. DTI as well as all its subsidiaries, including the Danish subsidiary Danfysik in particular, reported excellent revenue and bottom-line figures.

Consolidated revenue passed a milestone as revenue exceeded EUR 134 million at the end of 2012.

DTI's plan for the next three years' strategic research and development work during the performance contract period for 2013-2015 was finalised in 2012. The strategy underpins the ambitions of the government's recently published national innovation strategy 'Denmark – Land of solutions'. Thirty proposals have been prepared for new performance contracts, and they have been published at [www.BedreInnovation.dk](http://www.BedreInnovation.dk) (in Danish). DTI stakeholders may consult the website for further information on the proposals. The financial goal for the strategy period 2013-2015 is to boost DTI's commercial revenue by 16%. Moreover, the revenue of the international activities must be raised by 25%. Finally, DTI must realise a total increase in research and development revenue by just over 10%.

In 2012, DTI embarked on the construction of an internationally leading knowledge centre for research and innovation in relation to animal-derived food products. The more than 100 employees of the DMRI division, the former Danish Meat Research Institute, will have an optimum framework for developing solutions for the meat industry and for providing consultancy services in areas such as meat quality, slaughter technology, environmental efficiency and animal welfare. In April 2012, a contract was signed with the construction company Pihl that will be erecting the 6,600-square metre building which is scheduled for completion in February 2014. The investment is the largest one made by DTI since the relocation to Taastrup in the 1970s.

The EnergyFlexOffice in Taastrup was inaugurated in 2012. The facility represents an initiative to develop and apply sustainable and energy-efficient technology in the construction of office buildings. The EnergyFlexOffice is both a technical laboratory and a living lab for researching, developing, testing and documenting individual technologies and system solutions.

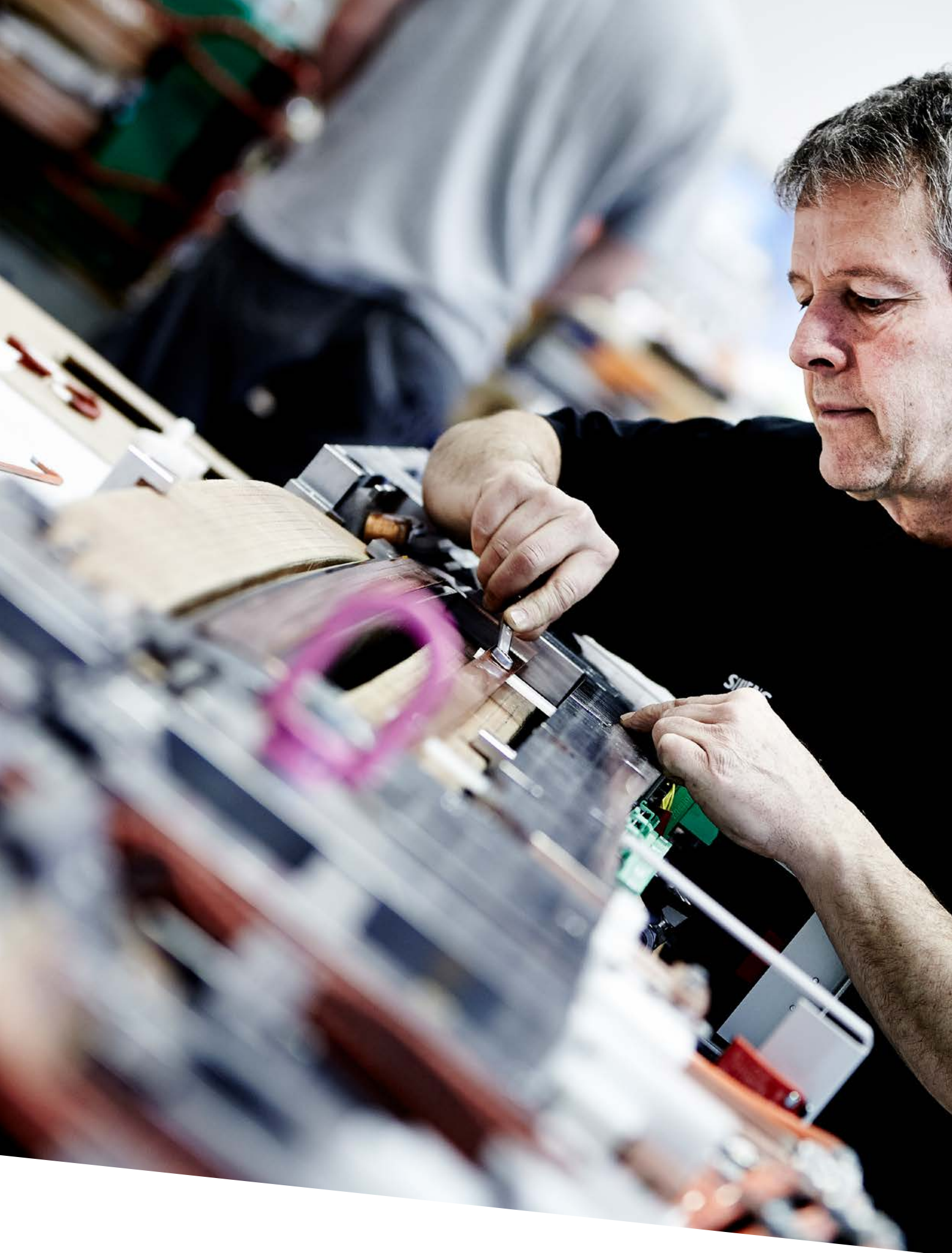
In 2012, DTI built a new modern experimental and training workshop for the Pipe Centre. The facility will create an environment for developing optimum solutions to handle climate change and the challenges to create the drainage network of tomorrow.

In September, the World Economic Forum published its annual rankings in the form of its competitiveness report for 2012. Being the new partner of the World Economic Forum in the survey of Denmark, DTI was responsible for conducting the survey among Danish businesses.

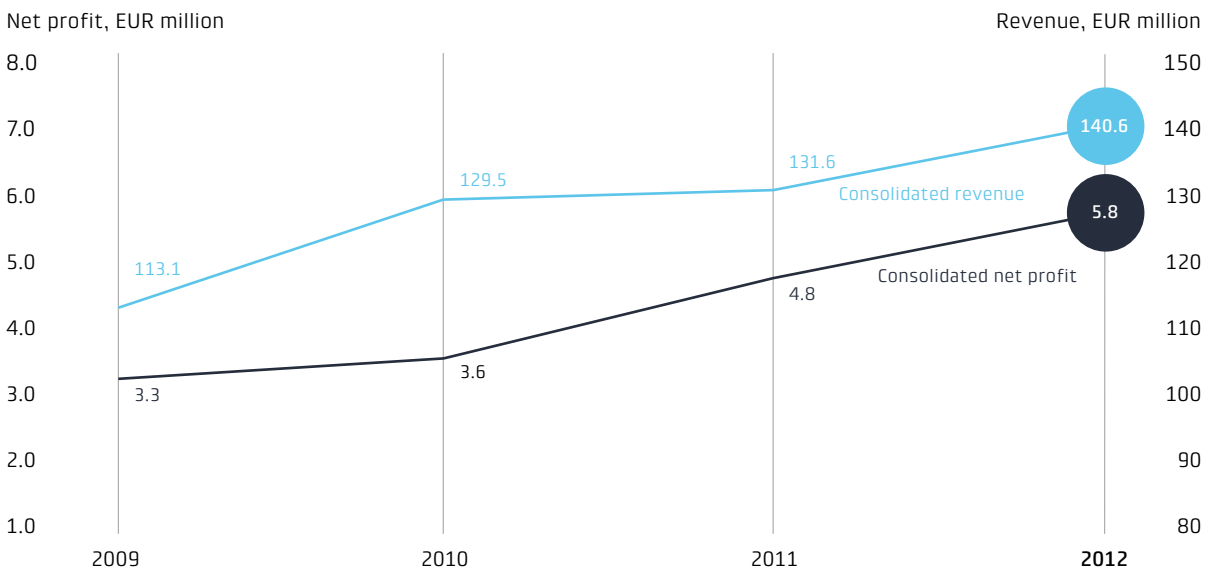
DTI subsidiary Danfysik took over 23 employees and a number of projects from Siemens' particle therapy branch in Jyllinge on 1 September. The first project for the new team will be to complete the installation, testing and commissioning of one of the world's most advanced particle therapy facilities in Shanghai.

Also in 2012, DTI was engaged in close cooperation with other Danish businesses and institutions on EU research and development projects. DTI realised revenue of EUR 34.1 million on this type of projects.





## Consolidated revenue and net profit for the period 2009–2012



### Financial review

In 2012, DTI realised net profit of EUR 5.8 million, up EUR 2.5 million on the budget and EUR 1.1 million on the year earlier. One reason is that the subsidiaries returned a profit in 2012 unlike the year before and another that DTI realised above-budget operating income.

Total consolidated revenue stood at EUR 140.6 million, an increase of 6.7% compared to 2011.

DTI's revenue was generated through commercial activities and research and development activities, including performance contract activities. DTI's commercial revenue came to EUR 89.2 million. This is EUR 6.6 million more than the year before, corresponding to an increase of 7.8%. The subsidiaries Danfysik and Technological Institute AB Sweden contributed particularly by realising strong revenue growth. In the domestic market, DTI was still experiencing customer reluctance as a consequence of the sharp fall in the number of jobs in Denmark. Research and development revenue as well as performance contract revenue accounted for EUR 51.4 million, or 36.6% of total revenue, which was in line with 2011.

In 2012, DTI's development activities financed by operations ran into EUR 12.6 million, up 25.8% 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 6.0 million, corresponding to net profit for the year and value adjustments of forward contracts in subsidiaries. The balance sheet total was up by EUR 9.5 million to EUR 109.8 million (2011: EUR 100.3 million). Cash flow from operating activities amounted to EUR 14.1 million, compared to EUR 12.1 million in 2011. The increase can be ascribed to operating profit, changes in work in progress and inventories in relation to the level in 2011. Cash flow from investing activities totalled EUR 12.3 million (2011: EUR 1.9 million).

Financial resources remained strong and worked out at EUR 23.4 million at end-2012.

### Subsidiaries

Danfysik performed positively in 2012. The company recorded revenue of EUR 17.1 million, an increase of 61% on 2011. Net profit worked out at EUR 0.8 million, up EUR 54 thousand on the budget and EUR 0.6 million on the year earlier. The company saw a very satisfactory order intake in 2012. Among large orders are the 16 magnet systems for Jagiellonian University in Krakow in Poland, 10 quadrupole magnets for Rutherford Appleton Laboratory in the UK, 12 magnet systems for the MAX IV project in Lund, Sweden, an in-vacuum undulator for Brookhaven National Laboratory in the USA and 15 large power supplies for JLAB in the USA. At end-2012, Danfysik had an order book of EUR 21.4 million, compared to EUR 17.4 million in 2011.



At 1 September 2012, Danfysik took over 23 employees and projects from Siemens' particle therapy branch in Jyllinge. The biggest job for Danfysik will be to install and put into commission one of the world's most advanced particle therapy facilities for the treatment of cancer patients in Shanghai.

Technological Institute AB Sweden performed satisfactorily in 2012. Revenue came to EUR 7.2 million compared to EUR 6.2 million in 2011. The company recorded net profit of EUR 0.2 million compared to a net loss of EUR 0.3 million in 2011. The leased premises in Gothenburg, housing the head office, were reduced by 50%. A similar process has been initiated in Stockholm, which will reduce the company's fixed costs considerably. At end-2012, the order book was about 5% below the 2011 level, but, thanks to the reduced cost base, this is not likely to have any adverse impact on the net profit budgeted for 2013.

The Polish subsidiary, Firma 2000 Sp. z o.o., performed satisfactorily in 2012 and realised profit of EUR 148 thousand, against EUR 67 thousand in 2011.

Dancert A/S, charged with DTI certification activities, had a less satisfactory year, recording profit of EUR 13 thousand as in 2011.

#### Associates

Syddansk Teknologisk Innovation, in which DTI holds an ownership interest of 50%, performed according to plan in 2012. In 2013, the innovation scheme will be subjected to a tendering process, the current six innovation environments being expected to be reduced to only three. Being the second-largest environment, Syddansk Teknologisk Innovation will work actively on this structural change to be as ready as possible for the upcoming tendering process.

PhotoSolar, in which DTI holds an ownership interest of just over 20%, failed to meet its sales targets in 2012. DTI did not want to inject additional capital into the company so two of the other shareholders, Vækstfonden and SET Venture Partners, exercised their rights to convert a bridge loan into share capital at a very low price. This meant that DTI's ownership interest was significantly diluted. The share capital was subsequently written down to zero, and the two owners have contributed fresh capital. DTI is therefore no longer a shareholder in the company.

#### 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

## Financial highlights

EUR million	2012	2011	2010	2009	2008
<b>KEY FINANCIAL FIGURES</b>					
Revenue	141	132	129	113	103
Operating profit	6	5	4	3	3
Financial income and expenses	0	0	0	0	1
<b>Net profit for the year</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>3</b>
Balance sheet total	110	100	90	90	75
<b>Equity</b>	<b>65</b>	<b>59</b>	<b>55</b>	<b>51</b>	<b>48</b>
Cash flow from operating activities	14	12	-1	8	5
Cash flow from investing activities	12	2	3	10	5
Of which for investment in property, plant and equipment	12	2	3	5	5
<b>Total cash flows</b>	<b>-2.6</b>	<b>10.2</b>	<b>-3.8</b>	<b>-1.3</b>	<b>0</b>
<b>FINANCIAL RATIOS</b>					
Operating profit margin	4.1	3.6	2.8	2.9	3.1
Equity interest (solvency)	59.6	59.3	61.0	57.0	63.6
Development financed by operations	9.0	7.6	5.9	5.9	5.3
<b>Average number of full-time employees</b>	<b>992</b>	<b>953</b>	<b>974</b>	<b>904</b>	<b>854</b>

DTI's financial statements can be read on and downloaded from DTI's website at [www.dti.dk](http://www.dti.dk).



level of interest rates. No material currency risk or material risks relating to individual customers or partners exist.

#### **Outlook for 2013**

DTI budgets for revenue in the amount of EUR 148.1 million (realised 2012: EUR 140.6 million) and for net profit in the amount of EUR 2.0 million (realised 2012: EUR 5.8 million). The net profit forecast has been significantly reduced on account of market uncertainties and the markedly reduced performance contract grant from the Danish Agency for Science, Technology and Innovation, which unfortunately leads to a decline in activities of more than EUR 2.7 million compared to the 2012 level.

At year-end 2012, DTI's R&D order book totalled about EUR 53 million, against some EUR 56 million in 2011.

Subsidiary performance was above budget in 2012. At Technological Institute AB Sweden, the order book is slightly thinner than last year, but this is not expected to influence the budgeted net profit for 2013.

At Danfysik A/S, the order book provides a basis for forecasting a 30% increase in revenue and improved profit performance in 2013.

#### **Customers**

Customers buying DTI's commercial services are Danish business customers and international customers. In 2012, DTI provided solutions to a total of 11,157 customers, 9,226 of whom were Danish

customers. Fifty one per cent of the Danish business customers come from the service sector, while 49% come from manufacturing industry. In this context, too, DTI works closely with small and medium-sized enterprises, in particular. Eighty three per cent of customers have fewer than 50 employees.

DTI had 1,031 public customers in 2012. 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 3,491 international customers, including subsidiary customers in Sweden and Poland. Overall, DTI's international revenue came to EUR 39.3 million.

#### **Project evaluation**

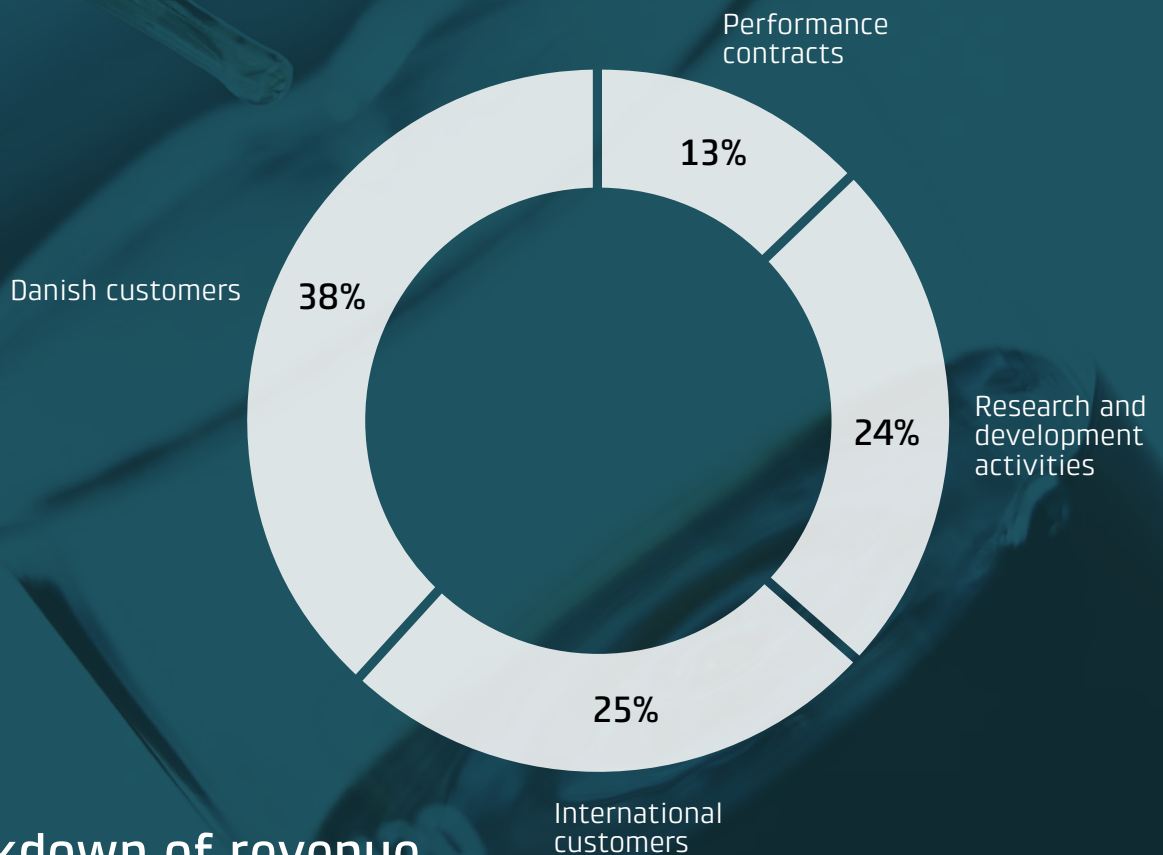
To DTI, the work of transforming new knowledge into daily practice in companies constitutes a central element in its non-profit activities, and it is important to learn how satisfied customers are with the projects undertaken by DTI. So in recent years, customers have been asked to evaluate DTI's work in the light of a number of parameters such as quality and time of delivery. In 2012, about 90% of customers said that they were satisfied or very satisfied with the work.

#### **New innovation consortia**

DTI maintained its position in research and development in 2012. During the period under review, DTI assumed the role of project manager of five new



## Breakdown of revenue 2012



innovation consortia granted by the Ministry of Science, Innovation and Higher Education, the total budget for DTI running into EUR 4.6 million, up from EUR 4.2 million in 2011.

### Performance contract activities

In 2012, DTI concluded its research and development activities under the performance contract entered into for the period 2010-2012 with the Ministry of Science, Innovation and Higher Education. The new performance contract for the period 2013-2015 is already well underway, and strong focus is maintained on innovation and knowledge sharing to the benefit of the Danish business sector.

### New facilities

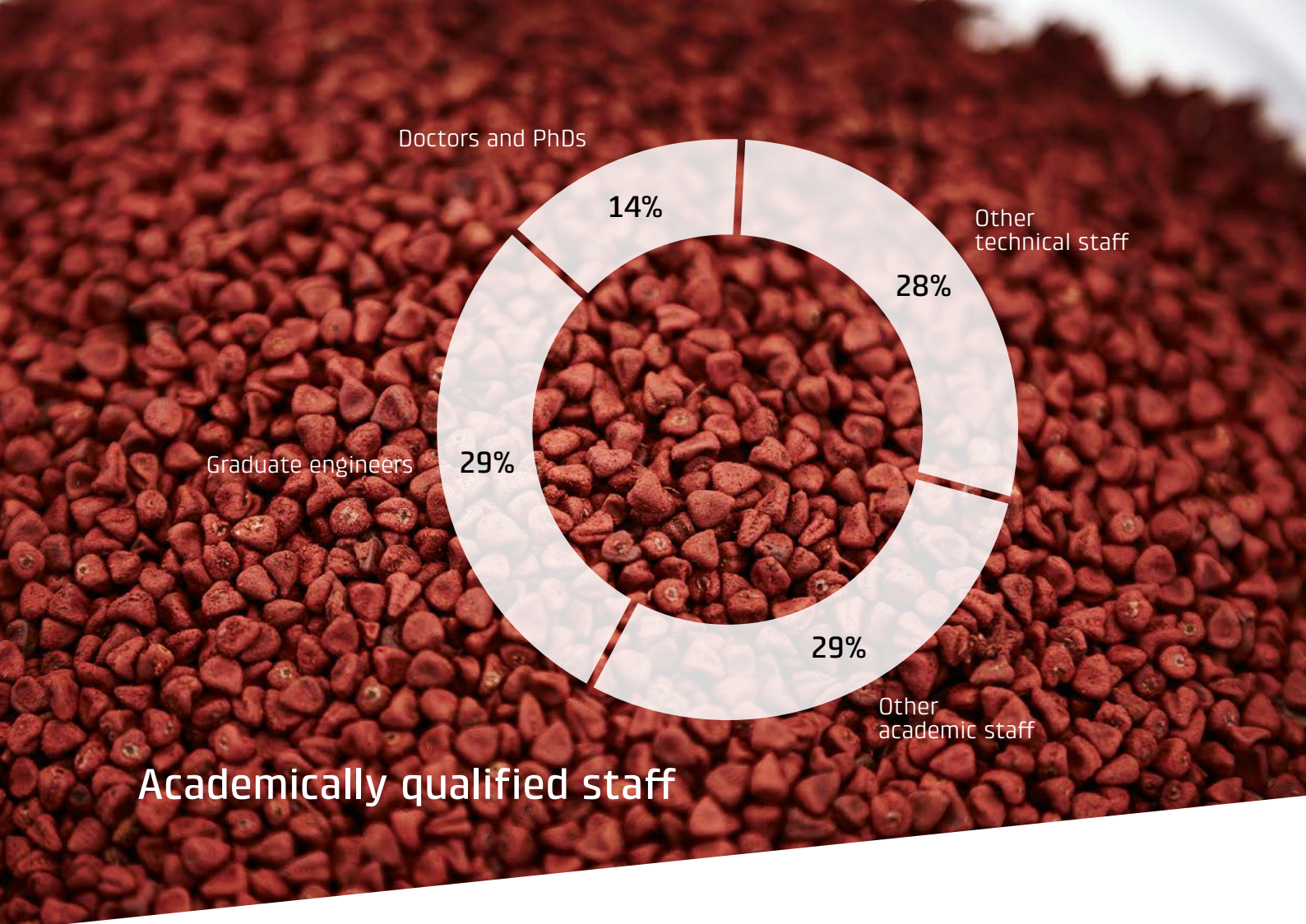
DTI experienced a record-high investment level of EUR 12.2 million in 2012, one reason being a massive investment in new buildings and laboratories. So in 2012, DTI embarked on the construction of an internationally leading knowledge centre for research and innovation in relation to animal-derived food. The more than 100 employees of the DMRI division will have an optimum framework for developing solutions for the meat industry and for offering consultancy services in areas such as meat quality, slaughter technology, environmental efficiency and animal welfare. The

building project was subjected to a tendering process among selected contractors. In April 2012, a contract was signed with the construction company Pihl that will be erecting the 6,600-square metre building. The building project is scheduled for completion in February 2014.

The 3D print technology business – also known as additive manufacturing – grew in 2012. The activities undertaken in both Denmark and other parts of Europe focused on developing businesses' production with new materials and new processes. DTI's new titanium laboratories are in place, and test runs have been completed with titanium powder in an SLM machine. Customers responded positively to the new possibilities.

The newly established 'Green Lab for Energy Efficient Buildings' (GLEEB) opened in the autumn of 2012 and will, in the years ahead, contribute significantly to the improvement, demonstration and market preparation of energy-efficient technologies for the building industry. DTI will achieve this through on-going development of its testing and documentation facilities to ensure that they match the stricter international requirements, combined with development of technological services in close cooperation with development communities.







### **Consultancy services**

Consultancy services for private and public companies account for 19% 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 are essential in terms of giving DTI insight into customer challenges.

### **Operator projects**

At the end of 2012, the Consultancy Service for Inventors had entered into 23 licence agreements and had thus exceeded the target for the period 2010-2012. Moreover, the School Service under the Consultancy Service for Inventors taught more than 3,600 students in 2012. Lessons were practice-oriented and helped pupils in primary and lower secondary schools and higher education students gain experience of and operational skills in idea generation, product development, IPR and model technology.

During the period under review, the Consultancy Service for Inventors organised an open consultancy night in Odense, with participation by more than 70 people and television coverage. Also, the Consultancy Service for Inventors attended the Iværk&Vækst fair in Copenhagen, where more than 200 inventors came to the service stand for advice.

In late October, the Danish Energy Agency pointed out DTI as its supplier of the secretariat for approval of building materials in contact with drinking water. The tender was won in competition with two other tenderers, and both the Danish Energy Agency and the Danish Nature Agency considered DTI's tender clearly the best. In their assessments, both agencies found it important that DTI provides the administrative and management competences and thus the requested structure as well as a very high technical level in toxicological competences and health assessments of building materials in contact with drinking water.

### **Organisation and employees**

In the context of in-house training, DTI continued the line of offering all employees English lessons at high level and also German lessons for certain technical groups. Moreover, courses in project control and management – including with special focus on EU projects.

On 1 June 2012, DTI held the biggest technical event for all employees ever, the DTI-Day, – both in terms of the number of participants, technical activities and presentations. The objective of the DTI-Day was to create broader knowledge of all DTI disciplines across technical fields.

In October 2012, DTI conducted its sixth staff satisfaction survey, which is conducted every two years. The survey revealed that the level of satisfaction remains high. Ninety two per cent of DTI staff responded. Ninety per cent of the respondents 'agreed completely' or 'agreed' that DTI is the ideal workplace for them. This was the highest score seen in the 10-year period during which the survey has been conducted. It was also the highest response rate seen for the period.

The year 2012 was also the year when DTI came in 10th place in the image survey conducted by the magazine *Ingeniøren* of the most attractive businesses for engineers. A goal of our strategy was to achieve this high ranking.

In 2012, DTI employed 1,069 people, 72% of whom were employees with master's degrees. Out of this group, 14% held PhDs or doctorates.

### **Corporate social responsibility**

The majority of DTI workplaces are office workstations. The environmental impact of these comprises consumption of electricity and heating. 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/csr](http://www.dti.dk/csr).

### **Post balance sheet events**

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

# Organisation

## BOARD OF REPRESENTATIVES

## BOARD OF TRUSTEES

## DANISH TECHNOLOGICAL INSTITUTE



President  
Søren Stjernqvist

## BUILDING AND CONSTRUCTION

## DMRI

## ENERGY AND CLIMATE

## BUSINESS AND SOCIETY

## LIFE SCIENCE



Director  
Mette Glavind



Director  
Lars Hinrichsen



Director  
David Tveit



Director  
Jane Wickmann



Director  
Bo Frølund

### Concrete

Centre Manager  
Dorthe Mathiesen

### Sustainable Building

Centre Manager  
Peter Holm Ishøy

### Indoor Climate and Building Inspection

Centre Manager  
Jørgen Baadsgaard-Jensen

### Masonry

Centre Manager  
Abelone Køster

### Swimming Pool Technology

Centre Manager  
Ole Bisted

### Textile

Centre Manager  
Jørgen Baadsgaard-Jensen

### Wood Technology

Centre Manager  
Niels Morsing

### Hygiene and Processing

Centre Manager  
Rie Sørensen

### Measurement Systems and IT

Centre Manager  
Paul Andreas Holger Dirac

### Meat Quality

Centre Manager  
Susanne Støier

### Slaughter Technologies

Centre Manager  
Jens Ulrich Nielsen

### Automobile Technology

Centre Manager  
Kristian Eldam

### Energy Efficiency and Ventilation

Centre Manager  
Ole Ravn

### Installation and Calibration

Centre Manager  
Kaj L. Bryder

### Refrigeration and Heat Pump Technology

Centre Manager  
Claus Schøn Poulsen

### Pipe Centre

Centre Manager  
Ulrik Hindsberger

### Secretariat Services and Quality Assurance

Centre Manager  
Tanja Weis

### Renewable Energy and Transport

Centre Manager  
Sten Frandsen

### Policy and Business Analysis

Centre Manager  
Hanne Shapiro

### Human Resources Development

Centre Manager  
Henriette Hall-Andersen

### Ideas and Innovation

Centre Manager  
Knud Erik Hilding-Hamann

### Training

Centre Manager  
Janice Dyrlynd Høst

### DTI Oil & Gas

Centre Manager  
Thomas Lundgaard

### Food Technology

Centre Manager  
Per Isager

### Chemistry and Biotechnology

Centre Manager  
Mikael Poulsen

### Laboratory for Chemistry and Microbiology

Acting Centre Manager  
Paul Lyck Hansen



## MATERIALS



Director  
Mikkel Agerbæk

## PRODUCTION



Director  
Anne-Lise Høg Lejre

## FINANCE AND ACCOUNTS



CFO  
Jørgen Kunter Pedersen

**Packaging and Logistics**  
Centre Manager  
Lars Germann

**Materials Testing**  
Centre Manager  
John Overmark  
Mortensen

**Plastics Technology**  
Acting Centre Manager  
Mikkel Agerbæk

**Product Development**  
Centre Manager  
Claus Erichsen Kudsk

**Tribology**  
Centre Manager  
Lars Pleth Nielsen

**Metrology and Quality Assurance**  
Centre Manager  
Niels Thestrup Jensen

**DTI Nano and Microtechnology**  
Centre Manager  
Leif Højslet  
Christensen

**Robot Technology**  
Acting Centre Manager  
Anne-Lise Høg Lejre

## SUBSIDIARIES

**DTI Robotics US, Inc.**  
Managing Director  
Anne-Lise Høg Lejre



**Technological Institute AB Sweden**  
Managing Director  
Peter Bergermark



**FIRMA 2000 Sp. z o. o.**  
Managing Director  
Marcin Opas



**Dancert A/S**  
Managing Director  
Gitte Olsen



**Danfysik A/S**  
Managing Director  
Bjarne Roger Nielsen



**Teknologisk Innovation A/S**  
Managing Director  
Jørgen Kunter Pedersen



## DANISH ASSOCIATES

Syddansk Teknologisk Innovation A/S

## STAFF FUNCTIONS

**Facilities Management**  
Manager  
Andras Splidt



**Secretariat of Executive Board**  
General Counsel  
Andras Splidt



**IT and Communications**  
IT and Communications  
Manager  
Peter Hjortshøj



**Personnel and Development**  
Personnel Manager  
Annemarie Søgaard

**International Centre**  
Director  
Lars Drejer



---

# Board of Trustees



---

## Thorkild E. Jensen

Advisor  
Danish Metal Workers' Union

---

## Jens Nørgaard Oddershede

Vice-Chancellor, professor  
University of Southern  
Denmark

---

## Niels Techen

CEO, MSc (Engineering)  
Helmer Christiansen A/S

---

## Clas Nylandsted Andersen

Director  
(Chairman)  
Nielsen & Nielsen Holding A/S





**Gunde Odgaard**

Head of Secretariat  
Federation of Building,  
Construction and  
Wood Workers' Unions

**Carsten Christiansen**

Sales Consultant  
Employee Representative

**Lars Aagaard**

CEO  
(Deputy Chairman)  
Danish Energy Association

**Søren F. Eriksen**

Technical Director  
Danish Crown AmbA

**Eva Bak Jacobsen**

Laboratory Technician  
Employee Representative

# Board of Representatives of the Danish Technological Institute

Clas Nylandsted Andersen  
Director  
(Chairman)  
Nielsen & Nielsen Holding A/S  
Appointed by the Confederation of Danish Industry

Ane Buch  
Managing Director  
Danish Federation of Small and Medium-Sized Enterprises  
Appointed by the Danish Federation of Small and Medium-Sized Enterprises

Erling Duus  
Managing Director  
Eegholm A/S  
Appointed by the Confederation of Danish Industry

Søren F. Eriksen  
Technical Director  
Danish Crown Amba  
Elected by the Board of Representatives

Lisbet Thyge Frandsen  
Group Senior Vice President  
Grundfos Management A/S  
Appointed by the Danish Academy of Technical Sciences

Ulrik Gammelgaard  
Managing Director  
KJ Industries A/S  
Appointed by the Confederation of Danish Industry

Lars B. Goldschmidt  
Deputy Director General  
Confederation of Danish Industry  
Appointed by the Confederation of Danish Employers

Niels Jørgen Hansen  
Managing Director  
TEKNIQ: Danish Mechanical and Electrical Contractors' Association  
Appointed by the Confederation of Danish Employers

Jørgen Rørbæk Henriksen  
Regional Council Member  
North Denmark Region  
Appointed by Danish Regions

Ejner K. Holst  
Confederal Secretary  
Danish Confederation of Trade Unions  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Per Højbjerg  
MSc (Engineering)  
Appointed by the Society of Danish Engineers

Thorild E. Jensen  
Advisor  
Danish Metal Workers' Union  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Ulla Jeppesen  
Chairman  
Union of Commercial and Clerical Employees in Denmark, IT, Media & Industry, Metropolitan Branch  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Torben Dalby Larsen  
Chairman  
Confederation of Danish Employers  
Appointed by the Confederation of Danish Employers

Jannik Schack Linnemann  
Head of Research Policy  
Danish Chamber of Commerce  
Appointed by the Danish Chamber of Commerce

Morten Andersen Linnet  
Chief Adviser  
Danish Agriculture & Food Council  
Department of Food and Research  
Appointed by the Danish Agriculture & Food Council

Mette Lyshøj  
Consultant  
United Federation of Danish Workers  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Flemming Ejde Nielsen  
General Manager  
Ejde Nielsens Værktøjsfabrik A/S  
Appointed by the Danish Federation of Small and Medium-Sized Enterprises

Michael H. Nielsen  
Director  
Danish Construction Association  
Appointed by the Confederation of Danish Employers

Jens Nørgaard Oddershede  
Vice-Chancellor, professor  
University of Southern Denmark  
Appointed by the Danish Academy of Technical Sciences

Gunde Odgaard  
Head of Secretariat  
Federation of Building, Construction and Wood Workers' Unions  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Hans Olsen  
Councillor  
Local Authority of Lejre  
Appointed by Local Government Denmark

Hans Müller Pedersen  
Director General  
Danish Agency for Science, Technology and Innovation  
Appointed by the Danish Ministry of Science, Innovation and Higher Education

Lauritz Rasmussen  
Managing Director  
Taasinge Træ A/S  
Appointed by the Confederation of Danish Employers

Pia Mulvad Reksten  
Consultant  
Danish Confederation of Trade Unions  
Appointed by the Economic Council of the Labour Movement and the Danish Confederation of Trade Unions

Niels Techen  
CEO, MSc (Engineering)  
Helmer Christiansen A/S  
Appointed by the Danish Federation of Small and Medium-Sized Enterprises

Bo Vistisen  
Chief Negotiator  
Danish Association of Managers and Executives  
Appointed by the Danish Association of Managers and Executives

Lars Aagaard  
CEO  
(Deputy Chairman)  
Danish Energy Association  
Elected by the Board of Representatives



# Employee representatives

---

Jens Bording  
Measurement Technician  
Installation and Calibration

Niels Peter Lindeblad  
Electrician  
Facilities Management

Benny Neister  
Consultant  
Plastics Technology

Susanne Gundlach  
Technical Assistant  
Metrology and Quality Assurance

# Executive Board

---

President  
Søren Stjernqvist

Director  
Mette Glavind

General Counsel  
Andras Splidt

Director  
Mikkel Agerbæk

Director  
Lars Hinrichsen

Director  
David Tveit

Director  
Lars Drejer


Director  
Anne-Lise Høg Lejre

Director  
Jane Wickmann

Director  
Bo Frølund

Group CFO  
Jørgen Kunter Pedersen



A dark blue map of Europe with white callout boxes for various cities. Each box contains the city name and a red horizontal line below it. Lines connect the boxes to their respective locations on the map.

Stavanger

Stockholm

Hirtshals


Gothenburg

Aarhus

Sønder Stenderup

Roskilde

Odense

A dark blue map of the United States with a white callout box for Atlanta. The box contains the city name and a red horizontal line below it. A line connects the box to a small white square on the map representing Atlanta.

Atlanta



## Taastrup

### Taastrup

Gregersensvej  
DK-2630 Taastrup  
Tel: +45 72 20 20 00  
Fax: +45 72 20 20 19  
info@dti.dk  
www.dti.dk

CVR No.: 5697 6116

### Aarhus

Teknologiparken  
Kongsvang Allé 29  
DK-8000 Aarhus C  
Tel: +45 72 20 20 00  
Fax: +45 72 20 10 19  
info@dti.dk

### Roskilde

Maglegårdsvej 2  
DK-4000 Roskilde  
Tel: +45 72 20 20 00  
Fax: +45 72 20 27 44  
dmri@teknologisk.dk

### Odense

Forskerparken 10F  
DK-5230 Odense M  
Tel: +45 72 20 20 00  
Fax: +45 72 20 39 70  
info@dti.dk

### Hirtshals

Nordsøen Forskerpark  
Willemoesvej 2  
DK-9850 Hirtshals  
Tel: +45 72 20 39 30  
Fax: +45 72 20 39 44  
info@dti.dk

### Sønder Stenderup

Gammel Ålbovej 1  
DK-6092 Sønder Stenderup  
Tel: +45 75 57 10 10  
Fax: +45 75 57 10 29  
info@dti.dk

### Dancert A/S

Gregersensvej 4  
DK-2630 Taastrup  
Tel: +45 72 20 21 60  
info@dancert.dk

### Danfysik A/S

Gregersensvej 8  
DK-2630 Taastrup  
Tel: +45 72 20 24 00  
Fax: +45 72 20 24 10  
sales@danfysik.dk

### Technological Institute AB Sweden

Vallgatan 14  
411 16 Gothenburg  
Sweden  
Tel: +46 (0) 31 350 55 00  
Fax: +46 (0) 31 350 55 10  
info@teknologiskinstitut.se  
www.teknologiskinstitut.se

### FIRMA 2000 Sp. z o.o.

Ul. Królowej Marysienki 90  
02-954 Warsaw  
Poland  
Tel: (+48 22) 642 58 72  
Fax: (+48 22) 642 58 73  
mail@firma2000.pl  
www.firma2000.pl

### DTI Robotics US, Inc.

1 Piedmont Center, Suite 400  
3565 Piedmont Road, N.E.  
Atlanta, GA 30 305  
USA  
Tel: +1 404 835 6725  
info@dtirobotics.com

### Ipark

Pro. Olav Hanssensvei 7A  
4068 Stavanger  
Norway  
Tel: +47 51 87 42 02

## Warsaw

