NL Agency
Ministry of Economic Affairs, Agriculture and Innovation

SBIR
The power of public procurement: innovative solutions to societal challenges

25 societal challenges
25 innovation procurements

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SBIR Programme in the Netherlands

In 1982, the Small Business Innovation Development Act was enacted in the United States. This led to the Small Business Innovation Research (SBIR) programme in the US. Through the SBIR programme, the American government commissions small companies to conduct societal relevant innovative research – and with great success. Leading companies have been established as a result of an SBIR assignment; examples include telecom company Qualcomm and software producer Symantec.

Inspired by American successes, we started our own Dutch SBIR programme in 2005. The Dutch Government uses its procurement power to mobilise the innovative capacity of Dutch companies to solve major societal challenges, such as mobility, sustainability, safety and health. At the same time, we promote innovation, especially in small and medium-sized companies, strengthen the business climate and increase the competitiveness of Dutch companies. This is in line with my focus on top priority areas, such as logistics, food and life sciences, in which we stand out international.

Five years later, it is time to take stock of where we stand. This booklet will show you how much innovative power, creativity and entrepreneurship Dutch companies have to offer. In a short time span, these entrepreneurs have proven that they are capable of developing and marketing new products, services and methods in very diverse areas.

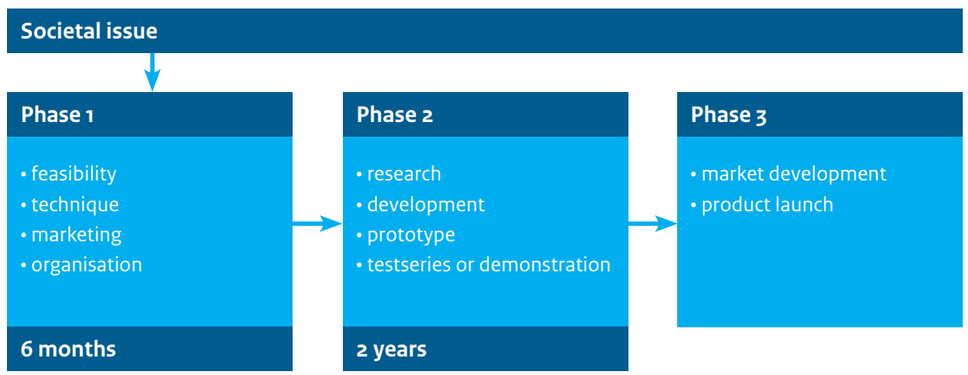
Take, for example, tech start-up Hansje Brinker, which uses satellite footage to locate weak spots in dams and dikes. The same technology can also be put to use to monitor the structural integrity of buildings, bridges, oil tanks, viaducts and industrial pipelines – not just in the Netherlands, but also in the United States. In California, for instance, the company monitors the strength of dams in an area which is frequently afflicted by earthquakes.

I hope such examples will inspire you to get involved in our SBIR programme as well, whether you are the managing director of a large or small company, or a government representative. Let's work together to achieve sustainable economic growth and innovative solutions for the societal challenges of today.

Maxime Verhagen
Minister of Economic Affairs, Agriculture and Innovation

About SBIR

SBIR is a tried and tested method that originated in the United States. The government uses this instrument to provide incentives for companies to develop and market innovative solutions to societal issues. SBIR is a good way for the government to solve specific societal problems or accelerate a desired transition. SBIR is used if there are no ready-to-use products or services to address a challenge. This approach is used when innovation is necessary in order to make products or services available and market them to customers.



In the United States, SBIR stands for Small Business Innovation Research. The name suggests that small businesses are the only target group. This is not the case. Any company, independent of its size, stands a chance in an SBIR tendering procedure. Innovators always take into account whether they will be able to recover the costs of developing a product, process or service. SBIR reduces the financial risk. In the Netherlands SBIR has turned out to be particularly beneficial to early-stage and small and medium-sized enterprises (SMEs), due to its simple, fast procedure, accessible registration and low administrative costs.

SBIR and EU procurement rules

SBIR is subject to the EU pre-commercial procurement legal framework for research and development projects. Research and development projects involve fundamental research, industrial research, experimental development, exploration and design, prototyping up to the original development of a limited volume of first products or services in the form of a test series. For R&D projects the public procurement directives do not apply (see Art. 16f of 2004/18/EC, Art 24e of 2004/17/EC). Of course the fundamental principles of the EC Treaty still apply to SBIR procurement: non-discriminatory, transparent and in line with the prevailing market.

In December 2007, the European Commission stated that it encourages pre-commercial procurement by governments. The European Commission views SBIR as a valuable supplement to the array of financial aid instruments. SBIR concurs with the European view on pre-commercial procurement of innovations.

How does SBIR work?

1. The challenge
A ministry or other public authority identifies a specific challenge, a societal issue for which innovative solutions are needed or a situation in which a transition is desired, and makes a budget available for that purpose.

2. Competition
NL Agency and a ministry or other public authority initiate an SBIR procurement and launch an open competition. All competitions are expressed as a desired outcome, rather than a required specification. Companies send in applications within the tender period. call for tenders. NL Agency processes the applications and notifies companies. Because SBIR involves contracts, it is also attractive to early-stage companies and companies from different sectors to submit their ideas. This cross-pollination is how, for example, innovations from the automobile industry can be put to use for dike monitoring (GeoBeads – Alert Solutions, page 11).

3. Assessment phase 1
An independent evaluation committee formed for a specific SBIR, reviews the proposals on the following criteria:
- Impact on the societal issue
- Entrepreneurship
- Innovation
- Economic prospects

SBIR budget 2005-2010 in million euros

Year	2005	2006	2007	2008	2009	2010
Budget	1,1	3,5	3,1	7,4	18,2	26,3

- Ecological and societal aspects
- Quality of the proposal and the project

The evaluation committee ranks all the projects and advises the contracting authority, generally the relevant minister.

4. Phase 1: feasibility of the innovation is studied
The contracting party decides which of the highest-ranking companies will receive a contract for a feasibility study (phase 1). These companies research the feasibility of their innovation (maximum of six months, maximum of 50,000 euros per project). In the feasibility study companies explore if technological development of their innovation is possible, determine whether there is a market for their innovation, and identify potential customers and other requirements to turn the innovation into a success.

5. Assessment phase 2
In phase 2, all companies with viable phase 1 projects compete with each other in a new round. The assessment criteria are identical to phase 1; economical prospects for phase 3 also play a significant role in the assessment. In phase 2, again the evaluation committee advises the contracting authority, generally the relevant minister.

6. Phase 2: research and development
The contracting authority decides which projects will be commissioned a phase 2 contract. These companies start a research and development process (maximum of 2 years, maximum of 450,000 euros per project). The end result is a tested prototype, demonstration, limited pilot run or pilot project of the product, process or service.

7. Phase 3: marketing the innovation
In phase 3, the companies start preparing their products for market launch. This phase is not supported by government funding.

Phase 3 offers the government an excellent opportunity to take up a strong position as a large innovation-driven buyer and to act as a first client for new SBIR products, benefiting from the new possibilities.

The fact that SBIR consists of several phases limits the risks for the government, because only the best and most viable projects will receive funding for the development phase. Furthermore, the government encourages entrepreneurs to look for partnerships with an external party who would be interested in financing the market introduction of the innovation. So that at an early stage an external party has an interest in the innovation's success and will take care of the economic viability of the innovation.

Prevent dike breaches by better understanding the condition of the dikes and dams with real time monitoring systems

Using satellites for dike inspection

Nowadays, dikes are visually inspected every once in a while. Hansje Brinker, operating systems supplier, demonstrates a more efficient and reliable method of inspection. This enterprise proved that satellites can be used to inspect dikes. They developed a monitoring service for dike managers in the framework of SBIR New monitoring technologies for dike and dam inspection.

Dike inspectors used to rely on a good pair of eyes and a solid dose of common sense. In today's society, technology, electricity and ICT are now also available to facilitate dike inspection in a more effective, sustainable and reliable way. In early 2007, the Directorate-General of Public Works and Water Management invited enterprises to develop innovative dike inspection systems.

Dike inspection from outer space

Hansje Brinker uses recently developed satellite radar technology to monitor dams and dikes. Satellite observations provide a quick and frequent overview of the dikes and dams in the Netherlands, resulting in a solution that is both sustainable and cost-effective. A satellite produces radar footage, which Hansje Brinker uses to analyse the stability of the dikes, and the data is sent to a database. Dike managers are now able to pre-inspect their dikes through Hansje Brinker's online database in just an hour, looking down from the satellite's vantage point in outer space, and then identify suspect locations for further analysis.

Furthermore Hansje Brinker developed a passive monitoring system supplemented by an active warning system, which raises a red flag if dike instability or deformation, for example a subsidence, is detected. If the threshold value of a dike is surpassed, Hansje Brinker sends a warning signal to the dike manager. Water levels, malformed dikes, everything is automatically detected. Deformations can be digitally inspected in detail by zooming in, providing valuable information prior to repair. For the highest dike in the Netherlands, the Hondsbossche en Pettemer Sea Wall, the company has even produced a 3-D visualisation. Hansje Brinker's innovative technology is a great asset for dike managers, who work hard at keeping the Netherlands dry for all its inhabitants, both now and in the future.

(Hans Brinker is the hero in an American Children's book about a Dutch boy who kept the sea at bay all night long; according to the story, he plugged a leak in the dike by putting his finger in the hole.)

Looking inside dikes with GeoBeads™

In conversation with Pepijn van der Vliet from Alert Solutions

Dikes are crucial to prevent the low-lying regions of the Netherlands from flooding. For the *SBIR New monitoring technologies for dike and dam inspection* set up by Rijkswaterstaat (the executive arm of the Dutch Ministry of Infrastructure and the Environment. On behalf of the Minister and State Secretary, Rijkswaterstaat is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands.), Alert Solutions developed a method for continuous real-time monitoring of dike stability. "GeoBeads™ makes it possible for dike managers to look inside a dike," says Pepijn van der Vliet from Alert Solutions.

"We started in early 2008, and the prototype was successfully installed and tested in September that same year. Its added value has been proven. Five district water boards already actively use the system."

"In order to really understand the condition of a dike, you have to know what is going on inside," Van der Vliet explains. Water tension has to be measured, as well as the temperature that determines water flow, and the movement of soil layers to track down and pinpoint deformations. Van der Vliet: "Continuous monitoring of various soil layers in the dike and observation of their various parameters gives a real-time assessment of the stability of a dike."

A string of beads providing geological insight

This SBIR programme aimed at finding new technologies to map out the condition of dikes. Alert Solutions proposed their product concept, GeoBeads™. GeoBeads™ are strings of beads: a series of sensor modules monitoring the dike. "During the feasibility phase, we examined which parameters you need to track in order to produce a useful large-scale monitoring system. GeoBeads™ was subsequently adjusted and improved," Van der Vliet explains. The GeoBeads™ prototype for dike monitoring was developed in the second phase of this SBIR. "We started in early 2008, and the prototype was successfully installed and tested in September that same year. Its added value has been proven. Five district water boards already actively use the system," says Van der Vliet.

Embracing new technology

Constantly monitoring the inside of dikes has proven its worth. Van der Vliet has noted market interest in this new inspection technology. As a result, it is important to give these innovations a standard niche in the normal operating processes of regional water authorities. For example, this form of dike monitoring could be implemented as a standard part of testing dams and monitoring fortification works. "At this point, the innovation is constantly being developed further in consultation with the district water boards." The water market is large and important, and new technologies are adopted with all due caution. "It will take time before the technology is widely accepted," says Van der Vliet.

Broader scope

Van der Vliet considers SBIR a good way to develop innovative products. An urgent market demand is the starting point for an SBIR. Moreover, SBIR funded the development of the GeoBeads™ product, facilitating the creation of a new method for continuous dike monitoring. The company can now expand on this unique product basis. The potential market goes far beyond dike monitoring; there are also opportunities for GeoBeads™ in the building sector, for example in monitoring risks in and near excavation sites.

Survival basin contributes to sustainable fishing

Declining fish populations call for far-reaching measures. By participating in *SBIR Biodiversity* set up by the Ministry of Economic Affairs, Agriculture and Innovation, VOF Schilder is developing a new bycatch sorting system in shrimp fishing. It will substantially increase the chances of survival for bycatch, e.g. juvenile fish, starfish, crab and lobster.

The World Wildlife Fund reports that over 40% of fish caught worldwide consists of bycatch: fish or marine animals which accidentally get trapped in fishermen's nets. Bycatch accelerates declining fish stock even further, because it often includes young fish or marine animals which have not yet reproduced. Consequently, bycatch is currently one of the most important items on the agenda for European fishing policy. VOF Schilder, a family business run by three brothers, professional fishermen on the IJsselmeer (the largest freshwater lake in the Netherlands), is developing a system to handle bycatch in shrimp fishing in a sustainable way.

Survival basin

Until recently, bycatch was not a point of special interest for suppliers of shrimp processing systems. VOF Schilder is developing a new system to sort bycatch which can be used on a shrimp cutter. The new system has been based on the current shrimp processing method on vessels, with the important distinction that bycatch will remain in permanent contact with water in what is known as a survival basin. This will greatly enhance the chances of survival for bycatch.

Immediately overboard

One convenient feature of the new bycatch sorting system is that fish are almost immediately thrown overboard, without direct human intervention. This has made sorting bycatch on board much less labour-intensive. The system is made up of large collection bins which lead to the buffer tank. Caught fish are transferred from this tank to the sieve drum using a fish-friendly pump. Bycatch is separated from the shrimp by way of the sieve and directly carried back below the water line. Shrimps can be further processed after the sieve drum.

New standard

The bycatch sorting system developed by VOF Schilder is expected to become the standard for the sector within a few years. It enables fishermen to produce the same amount with no extra costs as a result of bycatch. The sale price will be comparable to the price of a regular system. These advantages can play a major role in more effective fish stock control, both in the Netherlands and abroad.

In November 2011 VOF Schilder received the prestigious Herman Wijffels Innovation Award for this project.

Faster detection of blue-green algae with biosensors

The explosive growth of blue-green algae (cyanobacteria) in lakes and pools is a direct threat to the health of humans and animals. It also leads to long-term deterioration of local biodiversity. For the *SBIR Biodiversity* set up by the Ministry of Economic Affairs, Agriculture and Innovation, innovative companies Analytic Devices and ELTI Support developed a biosensor to quickly locate blue-green algae.

If surface water contains a high concentration of the poisonous microcystin produced by cyanobacteria, it has many harmful consequences. If the water is used for recreational purposes or as drinking water, microcystin can result in acute skin and lung problems, and in the long term may cause liver damage in humans, sometimes even leading to fatalities it can be fatal. Moreover, cyanobacteria have serious and long-lasting consequences for the biodiversity of plankton and plants in and around the water, eventually causing fish and birds to die as well. The biosensor developed by Analytic Devices and ELTI support, entitled Rapid *assays for microcystins*, uses a simple method to test the microcystin concentration and generates a fast, real-time test result. This faster detection of microcystin contributes to the desired recovery of the biodiversity of surface waters.

Tool for water managers

Using the biosensor can contribute to better protection of local ecosystems in surface waters. It also reduces immediate health risks for people seeking recreation and for animals and marine life. The biosensor is installed in a user-friendly handheld detector, making it possible for water managers to test the concentration of microcystin themselves, on the spot. If necessary, the biosensor can also be implemented in a fixed drinking-water machine near a lake. In this case, it will be linked to an online monitoring system. The biosensor fills an obvious gap in the area of microcystin tests. Current tests are mostly carried out in labs and the result can take days. This means loss of valuable time in which measures could be taken to manage the blue-green algae bloom or a ban on swimming could be imposed. Because the microcystin test can be carried out quickly and easily with a biosensor, it becomes possible to prevent a great deal of damage to humans, animals and the environment.

Distilling residual heat from cooling towers

In conversation with Eric van Sonsbeek, Technical Director of Aquastill

Within the framework of the *SBIR More sustainable heat and cold in industry* set up by the Ministry of Economic Affairs, Agriculture and Innovation the firm Aquastill has examined whether the distilling quality of a membrane distillation installation is preserved if it is powered by residual heat from industrial cooling towers. "It lowers production costs with no loss of quality", says Technical Director Eric van Sonsbeek.

Van Sonsbeek explains: "The warmth released from cooling towers literally vanishes into thin air. Basically this is a huge waste of energy. Our technology makes a sustainable and valuable product from this warm air: distilled water."
Most companies use energy-intensive processes to purify water for industrial purposes, for example boiler feedwater. The Aquaflex process, an optimized Memstill process, does not disturb any other production processes, but is driven by the residual heat wasted by cooling towers and therefore saves energy. "This is a risk-free option for companies, because the unit is freestanding and is kept outside process flows. It even yields a profit for its customers. That is what is so good about this innovation," according to Van Sonsbeek.

Larger pores

Aquastill's membrane technology was originally only applicable to high-grade residual heat above 85° Celsius. Evaluations, however, showed that at most companies the cooling towers have a maximum temperature of 46° Celsius. In order to guarantee higher efficiencies at lower temperatures, Aquastill developed a membrane with larger pores together with a membrane supplier. During the feasibility study carried out for this SBIR, the company examined whether the quality of the distillate was preserved in this process.

Residual heat from industrial cooling towers

It was Aquastill's potential clients, companies whose business processes produced residual heat, who originally pointed out the possibilities of cooling towers. This is how the idea and the innovation came about. Eric van Sonsbeek: "The application possibilities are enormous, because almost every industrial producer has a cooling tower. The idea of using industrial residual heat from cooling towers had never been part of Memstill's original design, but the demand was so great that we started to work on the idea."

Win-win situation

Aquastill is now testing the membrane's functioning by studying the properties of the membrane and the end product, the distillate, at different temperatures. The innovation is set to make an important contribution to industry and to society. Much less CO_2 will be pumped into the air by industrial processes. Thanks to this innovation, companies with cooling towers will be spending less money and making more profit.
Van Sonsbeek concludes: "It's a win-win situation."

Recovering warmth from heat

In conversation with Erik van den Berg, co-founder of HeatMatrix Group

It is a waste not to use warmth which is released – for example, in power stations or in the food industry. HeatMatrix Group has therefore developed a way to regain useful warmth from industrial residual heat, within the framework of the *SBIR More sustainable heat and cold in industry* set up by the Ministry of Economic Affairs, Agriculture and Innovation. "Hopefully it will make today's industry a bit more energy efficient," says Erik van den Berg of HeatMatrix Group.

During the SBIR's feasibility phase HeatMatrix explored how heat exchangers could be applied in a profitable way, and subsequently developed a unique *plastic heat exchanger:* a breakthrough technology by which residual heat can immediately be put to use in the factory where it is obtained. "This prevents that once again fossil fuels are used," according to Van den Berg.

Narrow tubes

The heat exchanger is constructed using narrow tubes in modular sections which can be linked together, so the device can be made as large or small as necessary. The heat exchanger can therefore be placed anywhere industrial waste heat is produced. "In fact residual heat is created everywhere warmth is produced, including steam boilers, waste combustion plants, and in the food industry", says Van den Berg. "So we get to see lots of different locations."

Low-hanging fruit

During the feasibility study HeatMatrix Group consulted at length with potential customers to find out where the technology could be of best use. "We went looking for unique possibilities and low-hanging fruit," says Van den Berg, "and for the largest unsolved problems in the world of heat exchangers." Various technological applications were devised, as with their first client, the energy supplier E.ON. HeatMatrix developed a way for E.ON to condense flue gases from coal-fired power stations and so recover waste flue heat. E.ON will soon be installing and testing a HeatMatrix heat exchanger there.

Right focus

Thanks to this SBIR, HeatMatrix was able to focus all its efforts on this new product during its development phase, a phase in which there are normally hardly any earnings. In Van den Berg's view, the project has also sharpened focus for the HeatMatrix Group: "In the early technology phase we were already thinking a lot about the market. We did not stay at our kitchen tables or in our labs, but went actively looking for end users. We explored how we could make this technology widely applicable. The real innovation is the business of turning this technology into a marketable product."

Bright

Van den Berg sees a bright future for this technology. As soon as its applicability has been demonstrated at E.ON, he expects the heat exchanger to sell itself: "We are already getting spontaneous phone calls from people asking for quotations. It is nice to see that while we have always actively approached companies, they are now finding us."

Make travelling by train more attractive by removing barriers and develop new ways to travel to and from the railway stations

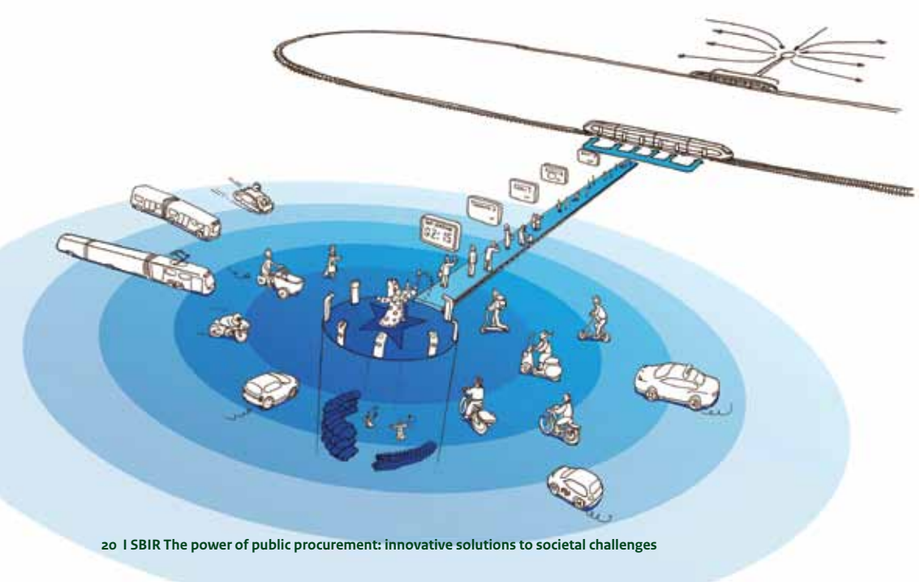
Multimodal transfer with TransferCity

How can the number of train passengers be increased? By improving travel to and from train stations, for example. Consultancy and project management agency NPC have come up with *TransferCity: a multimodal transfer location*. In a feasibility study within the framework of the *SBIR Innovative travel to and from the train station* set up by the Ministry of Infrastructure and the Environment, NPC explored public transport users' needs for this special type of valet parking, where someone parks your vehicle for you, regardless of its type.

The Ministry of Infrastructure and the Environment aims to increase the number of train passengers by 5% each year until 2012. The Ministry is supporting this ambition with SBIR procurement, thereby investing in good ideas for better transport to and from train stations. TransferCity is an example. Together with KVD reframing & design, NPC invented a transfer location for stations to which passengers can come together with any type of transport.

Smooth operator

If desired, a TransferCity 'smooth operator' takes care of your bicycle, car, scooter, moped or motorcycle. The traveller then checks in using his public transport smart card, enters the station by a moving sidewalk, and knows exactly at what time he will arrive on the platform. TransferCity is also the logical point of departure from the station into the city. Working together with KVD, NPC has investigated the extent to which current and potential train passengers and stakeholders in the vicinity of the station are interested in TransferCity, what their further wishes are, and how this concept could be developed further.



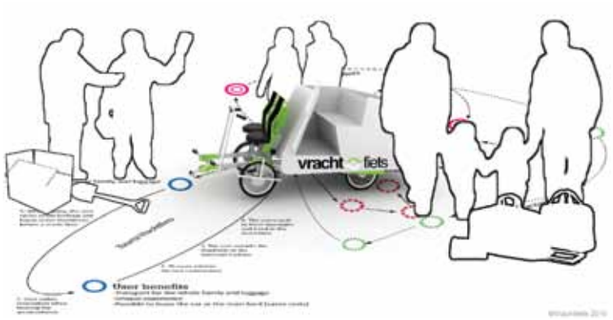
Make travelling by train more attractive by removing barriers and develop new ways to travel to and from the railway stations

To and from the station by carrier cycle

The founders of *Vrachtfiets* ('cargo cycle') intend to develop a special carrier cycle within the *SBIR Innovative travel to and from the train station* set up by the Ministry of Infrastructure and the Environment. This SBIR is looking for fun, smart ways for passengers with luggage to travel to and from the station.

Vrachtfiets

Vrachtfiets was founded by two industrial design engineering students at Delft University of Technology. With SBIR funding, they carried out a feasibility study of a combined product and service using two-person, electrically-assisted carrier cycles. Travelling with Vrachtfiets in combination with train travel is a good alternative to a car. Especially for holidaymakers within the Netherlands. What makes it particularly interesting is the fact that many tourists travel outside rush hour. After arriving at the train station, tourists can use the Vrachtfiets to travel with children and luggage to their holiday destination. Vrachtfiets identified several stakeholders for the concept, including holidaymakers, rental locations, campsites, parks and local councils. The study also looked at the specific demands and wishes of potential travellers. What would the ideal Vrachtfiets look like, and what other improvements could be made in travelling to and from the station?



Developing innovative housing and holding systems for sustainable livestock farming: better animal welfare and health, better for the environment, better working conditions, more energy efficient and better integrated in the countryside

A cow garden as an integrated, sustainable cowhouse

Animal welfare in the cattle breeding industry can be greatly improved. Stichting Courage (the Courage Foundation) has therefore studied the feasibility of a *Koeientuin* ('cow garden') as part of the *SBIR Sustainable livestock farming* set up by the Ministry of Economic Affairs, Agriculture and Innovation. A Koeientuin not only has advantages for cows, but also for the environment and society.

Stichting Courage's project team looked at several zoos for inspiration. They wondered under which conditions large grazing animals were kept there. They learned that animal residences do not have to resemble factory halls, but can reflect the animal's original surroundings pretty well. They also learned that visitors are enjoying the 'spectacle' and are willing to pay for it. With this knowledge the project team started designing the new cowhouse with the needs of the cow in mind. It resulted in an open construction with plants and without cow cubicles, called the Koeientuin. In the SBIR's first phase the feasibility of the design principles were tested by Stichting Courage in close cooperation with ID Agro BV, BETEBE GmbH and Pape Creavorm VOF.

Advantages for cows, the environment and society

In a Koeientuin cows have more freedom of movement, more light, and a more natural and healthy habitat. The cows can stand and lie wherever they want amongst the bushes, trees and climbers. A synthetic floor was designed especially for the Koeientuin, the Weidevloer ('the pasture floor'). This floor imitates as many qualities of pastureland as possible. It is a comfortable surface for cows, and also facilitates the separation of solid manure and urine.

The separation of the manure and urine goes as follows: urine quickly flows through a top cloth into a closed cellar, while manure remains on the cloth until it is removed by a specially-developed robot. Because in the absence of urine manure can be fermented, the Koeientuin is ideal for manure fermentation. This results in a considerably higher and more efficient biogas production.

Open construction

Thanks to its transparent and open construction, the Koeientuin fits better into the landscape than traditional cowsheds. The cows are also visible to passers-by because the sheds are open and accessible. So the cattle farm is brought back into closer contact with society. Thereby the Koeientuin also has environmental advantages: the separation of manure and urine can lead to reduced ammonia emissions and more efficient usage of manure. Farmers enjoy working in the green, lighter and less dusty environment of the Koeientuin. All-in-all, the Koeientuin is better for animal welfare and health, for the environment, for energy consumption, and for farmers' own working conditions.

Developing innovative housing and holding systems for sustainable livestock farming: better animal welfare and health, better for the environment, better working conditions, more energy efficient and better integrated in the countryside

Overall pig farming concept for a better environment

Technology enterprise HoSt BV has explored an *overall concept for sustainable sties in the pig farming industry*. The study was part of the feasibility phase of the *SBIR Sustainable livestock farming* set up by the Ministry of Economic Affairs, Agriculture and Innovation. This innovative concept contributes to the welfare of the pigs and to a better environment, and therefore also to the public acceptance of pig farming.

Pig farmers are looking for overall sustainable solutions due to tightened the environment and well-being regulations. HoSt BV studied in cooperation with its partners Kempfarm BV, Wopereis Staalbouw BV, Wageningen UR Livestock Research en Varkens Innovatie Centrum Sterksel the feasibility of pig friendly sties, that produce less odour, lower ammonia and methane emissions, less energy use, reuse of energy and above all produce high-quality manure. In this concept faeces and urine are drained away separately.

Pig wellbeing

A number of approaches and technologies are combined in the design of this overall concept. HoSt and its research partners have pooled their knowledge and expertise to improve sty sustainability in several areas. The companies aim to make the sty compliant with the criteria for two or three stars of the *Beter Leven* ('better living') quality mark awarded by the Dutch animal protection society. The pigs are therefore given rooting material, adequate space, and a means to go outside. By separating and directly draining their faeces and urine, the living climate inside the pig sties has been greatly improved.

An improved quality of life thanks to an overall concept

In the feasibility study for this SBIR, the companies involved explored the use of a fermentation device to derive energy from faeces and the production of an officially approved substitute for artificial fertilizer from urine concentrate. An ammonia stripper was used to remove ammonia from the urine, resulting in much less nitrogen ending up in the fermenting device. The individual parts of this concept could probably be applied directly to existing systems, but the focus of the study is on a new overall concept intended for broad application in pig farming. The lower emissions, open sties and a better welfare of the animals shall contribute to a broader public acceptance of pig farming. Moreover the liveability in rural areas will improve: the manure is processed on site which leads to a decrease in road transport of semi-liquid manure. Also the pig farmers have a healthier work environment in their sties.

"The worldwide market for glass fibre composites amounts to a turnover of 50 billion euros. Imagine us replacing 10% of that with biocomposites. That would mean large profits for our company and serious benefits for the environment"

Transition to a biobased - or green - economy by developing high quality new industrial non-food products based on renewable biomass

Biocomposites are environmentally friendly and lightweight

In conversation with Willem Böttger, general manager at NPSP Composites

Is it technologically and economically feasible to produce high-quality composites made out of natural fibres and biobased resin? This was the research question of NPSP Composites during a three-year project *Nabasco® – Nature Based Composites* within the framework of *SBIR Biobased economy* set up by the Ministry of Economic Affairs, Agriculture and Innovation. The result is the new material Nabasco®. Extensive interest has already been expressed in this environmentally friendly and lighter alternative to synthetic glass fibre materials made from polyester.

The green economy is an increasingly frequent topic in the European Parliament. Meanwhile, in the Netherlands, the number of road markers for bicycles made from biocomposites is growing. They are made from the environmentally friendly Nabasco® material developed by NPSP Composites. This innovative manufacturer from Haarlem replaces parts of synthetic material with 'green' composites of bioresin, flax, jute, cotton and hemp. These biocomposites do not use up scarce raw materials such as petroleum, are climate-neutral, healthier to work with, lighter than the glass fibre alternatives, and form a cradle-to-cradle cycle.

All natural fibres

Government parties and automotive firms: all are interested in the green version of glass fibre for use in plastic products. Prior to participating in SBIR, NPSP Composites could only replace up to 80% of synthetic products with natural fibres, but it has now proven to be technologically and economically feasible to make products out of 100% biocomposites. 'During the feasibility study, we succeeded in producing samples consisting of 100% natural fibres, which adhere well,' Willem Böttger says.

Glass fibre versus biocomposites

Despite the innovation, series production of this new 100% green version of Nabasco® has not yet taken place. Nevertheless, according to Böttger, participating in this SBIR has accelerated marketing of products from biocomposites by at least five years. Moreover, since participating in SBIR, what had previously been a niche market mostly limited to the Netherlands now holds the international spotlight. "This is why I now have more confidence in a breakthrough," says Böttger. "Legislation is also changing in favour of biocomposites. It is a logical step, because the advantages in comparison with glass fibre are numerous." Böttger is excited about current developments.

"The worldwide market for glass fibre composites amounts to a turnover of 50 billion euros. Imagine us replacing 10% of that with biocomposites. That would mean large profits for our company and serious benefits for the environment."

Sustainable recreation in places of cultural and historical interest

In the Netherlands, it is important to deal cleverly with the scarce amount of available space. People appreciate recreation, but it should not be harmful to the quality of the landscape. As a part of the *SBIR Sustainable recreation and landscape quality*, the *De Panoven* country estate has developed an innovative concept aimed at doing better business while retaining respect for the landscape.

Development and conservation of landscape quality together with the development of a sustainable and profitable recreation sector

De Panoven Country Estate is part of Dutch industrial heritage. It's a former roof tile and brick factory dating from 1850. The company has been run by the Kruitwagen family since 1930. The present generation gives priority to preserving this heritage. They provide recreational experiences: for exemple a caring-learning-working-staying overnight concept for young people who need special care. These young people help to maintain the gardens and the buildings.

This new concept focuses on cooperating with new parties in the care and educational sectors. They look for win-win situations: participating parties benefit economically while at the same time boosting an area's landscape quality and its cultural and historical interest value. With this corporate social responsibilty, *De Panoven* gives a new interpretation to area conservation by developing the landscape, increasing its cultural and historical value, and enabling people to experience old trades.

Cost reduction

Heritage sites like De Panoven offer special experiences, but they also bear the burden of considerable regular expenses for maintenance and energy which leave little room for conceptual development. By participating in this SBIR the Kruitwagen family was able to develop a concept to reduce these expenses. It also allowed them to assume social responsibilities, show respect for the landscape, and create facilities with added value, which will eventually lead to larger profits.

Dijk van een Delta

With their caring-learning-working-staying overnight concept the Kruitwagen family is giving shape to their their social responsibilities and their stewardship of the landscape. *De Panoven* will expand from a resort to an estate. De Panoven is also a leading example and pilot in the national photo reportage *Dijk van een Delta* ('Wonderful Delta region and Delta's Dykes'), which brings a number of recreational gems to form an attractive and meaningful tourist landscape. A boat tour combined with overnight stay packages will be an exceptional way for visitors to experience these gems once again.

Sustainable recreation in a hikers' cabin

In today's society, there is a strong need for sustainable recreation. Stichting Natuurkampeerterreinen, SNK ('Foundation for Natural Campsites') aims to develop a prototype for a sustainable hikers' cabin and launch it on the market in 2012. In this project SNK will cooperate with Stichting Trekkershutten Nederland, STN ('hikers' cabins foundation') and Eindhoven University of Technology (TU/e). SNK's feasibility study for *SBIR Sustainable recreation and landscape quality* set up by the Ministry of Economic Affairs, Agriculture and Innovation proves that the market is ready for a no-maintenance, near-self-supporting 'green cabin'.

SNK is a trade organisation for small-scale campsites in the natural environment of the Netherlands. At the moment, 140 nature campsites are affiliated with the organisation. SNK is also responsible for marketing the member campsites. Various natural campsites offer hikers' cabins by STN. In their feasibility study for the first phase of SBIR, the two foundations state that the development of a sustainable version of the hikers' cabin can give the existing market a boost.

Imitation cabins and dead wood

Currently there are many illegal and imitation hikers' cabins in the Netherlands. This is a problem for the sector, because it harms the good reputation of the real hikers' cabins. Imitation cabins are often less than optimal in quality and are not maintained very well, resulting in rotting wood or stale air. Imitation cabins do, however, benefit from the good name of hikers' cabins. By developing a completely sustainable cabin, SNK and STN hope they will distinguish themselves in the market. Moreover, a prototype of a sustainable hikers' cabin is in line with the policy of local, regional and central government to counteract the proliferation of different types of residences in the Netherlands.

Self-supporting cabins

The knowledge about sustainable building technologies, energy supply and water technologies has advanced to the point that the development of a new hikers' cabin that is cradle-to-cradle and near-self-supporting is technically possible. TU/e will supply its knowledge about sustainability and will develop the technical aspects of the hikers' cabin. Fontys University of Applied Sciences has also shown enthusiasm for the project. SNK and STN will work in cooperation with TU/e to map out the sustainable preconditions for the hikers' cabins.

Visible sustainability

The sustainable hikers' cabin will have a clearly educational and inspirational element: the visible sustainability of the hut will inspire and convince parents and children that it is possible to live in a sustainable house. According to SNK and STN, the renewed and sustainable hikers' cabin will meet the increasing demand for fixed short-stay accommodations.

Five years of SBIR in the Netherlands Reflections by the public and private sector

The SBIR programme was evaluated in early 2010. Companies are distinctly enthusiastic. The five ministries using SBIR procurements are very satisfied with the instrument.

SBIR accelerates the time to market

Entrepreneurs value the fast procedure, accessible registration and low administrative costs. Companies are distinctly enthusiastic about the opportunity SBIR provides to mobilise their entrepreneurship and innovative strength to help the government solve societal issues. SBIR offers companies funds to finance the first, high-risk phases of an innovation. SBIR is meant to accelerate the time to market. Many companies indicate that without SBIR the innovation would not have been developed, or would have taken place in a much larger timeframe. In the past years, SBIR has also shown itself to be a particularly suitable instrument for SMEs.

SBIR, a results-oriented assignment

Companies experience the phasing of SBIR as logically and neatly arranged, corresponding closely to their own operational management. Phase 1 is the feasibility study, phase 2 is research and development, and phase 3 consists of marketing the innovation. Companies consider being granted an assignment at a fair market price for phases 1 and 2, a key success factor of SBIR. The SBIR project is a results-oriented assignment and has high priority within a company. The focus on marketing the innovation in all phases and the opportunity to work together with other companies and research institutes are also considered success factors by companies. They observe that being awarded an R&D contract from the government helps them achieve a stronger position in relation to collaborating partners, clients, backers and the government (as a procuring party).

The ministries perceive that SBIR procurement often results in special and highly inventive solutions for societal problems.

Societal engagement and sustainability

SBIR gives governments the possibility to promote market developments, thus challenging companies to opt for societal engagement and sustainability. SBIR helps ministries to realise their policy goals relatively quickly. Companies develop several solutions in the form of commercial products and services and market these solutions. Ministries notice that SBIR truly allows them to capitalize on the innovative strength of businesses, especially SMEs.

Government adoption and specific needs of ministries

End 2010 twenty-eight SBIR competitions had been launched by the ministries of Economic Affairs, Agriculture and Innovation; Defence; Infrastructure and Environment; Education, Culture and Science; and Health Welfare and Sport. Theses ministries are very pleased with SBIR. In implementing SBIR procurement processes, they can rely on support from NL Agency, which has acquired the expertise in the past years to run the complete process efficiently and fast. SBIR is made to measure and can be adapted to specific needs of the government. This flexibility is greatly appreciated by ministries. Other appreciation points are the options of limiting and defining the societal need in the SBIR challenge and options of adapting the enrolment strategy.

The right target group

SBIR appeals to the right target group of companies. The programme is being used by various SMEs which are not yet directly linked to the ministries in any other way or involved in other innovation projects.

Cost efficiency

It is still too early to reach a verdict about SBIR's cost efficiency. Companies developing products and services within SBIR have good expectations for the results. This positive attitude also applies to the marketing their innovations.

Recommendations from the evaluation

The ministries or other public authorities should also keep track of the companies in the third phase. Even though the funding ends after the second phase, an SBIR project is not finished until completion of a successful third phase.

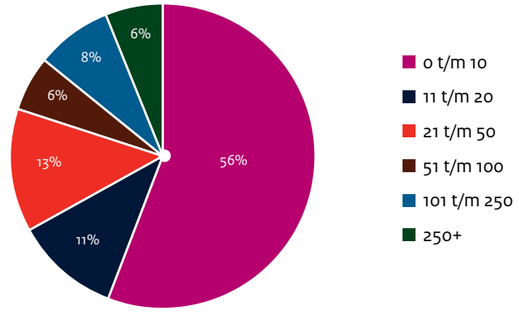
The Ministry of Economic Affairs, Agriculture and Innovation is advised to explore the roles that the government could play in SBIR's third phase. Options include non-financial support for companies and assistance in promoting new markets.

In cases where the government is an important potential buyer itself, it should consider the role as a first buyer at an early stage.

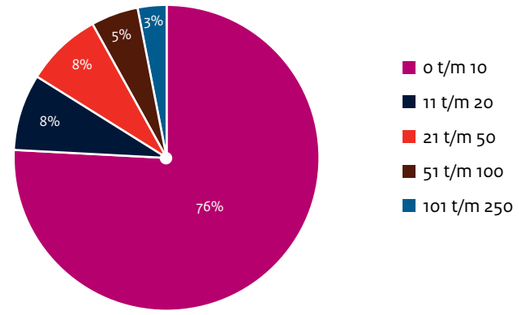
The Ministry of Economic Affairs, Agriculture and Innovation is advised to retain the programme's flexibility, which entails that each SBIR procurement continues to be tailored to that specific situation. The Ministry is therefore advised to restrict the implementation of SBIR tenders to one party, preferably NL Agency. This approach will allow all parties to learn from experiences in various SBIR projects.

The evaluation has been carried out by Technopolis Group, at the request of the Ministry of Economic Affairs. The SBIR evaluation with an executive summary in English can be found at http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2010/03/04/eerste-evaluatie-small-business-innovation-research-sbir-programma-s-in-nederland.html

Amount of employees SBIR (winnaars) with a phase 1 contract (n=173 and 2)



Amount of employees SBIR (winnaars) with a phase 2 contract (n= 39)



The majority of SBIR contract is awarded to small companies.

Radar sensors predict movement of ships

The Netherlands Royal Navy attaches great importance to the safety of personnel and equipment at sea. In severe weather conditions, high waves and strong winds make landing a helicopter on the afterdeck of a sailing and wildly rocking frigate a hazardous undertaking. The company Tech5 offers the Ministry of Defence a system that can predict the movement of ships, making it possible for helicopters to land on deck safely in severe weather conditions.

The Ministry of Defence wants to improve the safety of equipment and personnel at sea. Through the *SBIR Maritime operations in severe weather conditions*, the Ministry of Defence invited enterprises to come up with innovative technological solutions to this issue. Ships move more violently in severe weather conditions. This intensified motion makes operations harder to perform and increases risks. A system that informs crew members aboard a ship when a safe landing is possible will increase on-board safety. For this SBIR, a number of companies presented technologies for effectively predicting the movement of ships in severe weather conditions; several of these companies were subsequently contracted to conduct a feasibility study.

Mapping out waves

The system proposed by the firm Tech5 turned out to be the most feasible alternative. The Ministry of Defence is currently running a pilot to demonstrate and test the system on a ship. The system operates as follows. A radar sensor maps out the waves in front of the ship. Using a model of the ship and the pattern of built-up waves, it becomes possible to predict ship movements for several minutes. This is how the Tech5 system can give real-time advice on a time slot in which the ship will be moving less violently. This is the time for a helicopter to safely touch down on the helicopter landing platform. Phase two of this first pilot, the online movement predictions, started in 2009 and is progressing as planned.

Juice production using healthy vegetables leftovers

In conversation with Piet Nell, CEO of Provalor

Every year 40 million kilos of healthy, valuable vegetables from the Dutch greenhouse farming industry end up on the compost heap. It all adds up to approximately three thousand lorries filled with tomatoes, sweet peppers, aubergines, cucumbers and courgettes that are rejected by the supermarket because of their colour or size. Provalor explored the feasibility of using these healthy vegetables to make vegetable juice. The project was part of the *SBIR Reducing transport of agricultural products* set up by the Ministry of Economic Affairs, Agriculture and Innovation.

Nowadays more and more of the vegetables we eat are sold in pre-prepared form. Although it saves time in the kitchen, it means that a lot of vegetables are lost. Piet Nell, CEO of Provalor, explains: "In the carving process roughly 40% of the vegetables are dumped for aesthetic reasons. In the case of canned food and deep-frozen vegetables, about 20% is rejected, while 'only' 2 to 5% of greenhouse vegetables are discarded. However, greenhouse vegetables are a relative luxury and comparatively expensive." Provalor came up with a solution: why not collect all these remaining products and turn them into vegetable juice? After all, demand for healthy juices is increasing. Nell: "It's a good idea, but transporting all these remaining vegetable products to juice producers requires an enormous amount of transport. So we turned the process around, and designed a compact mobile installation which can transform leftover vegetables on-site into high-quality juice." Provalor is therefore seen as a front runner in the field of recycling food and reducing food wastage.

Tomato juice and vitamins

Provalor explored the practical implementation of the machine, working together with Prominent (a vine tomato producer) and The Greenery (a fresh food logistics company). Nell: "Half of the vegetables that go to waste in greenhouse farming are tomatoes. To make sure that the bitter-tasting green stalks and sepals of these tomatoes do not end up in the juice, we developed a technology to remove these stalks." The partners also explored the feasibility of deriving usable materials such as amino acids, food fibres and vitamins from the pulp-like vegetable mass which is left over after the juice has been squeezed out of the tomatoes. The substance that finally remains can be used as biomass to produce bioenergy using a biofermentation installation. Food wastage is reduced and the sustainability of the greenhouse farming sector is increased. It also represents a step towards a green economy, as well as opening new markets for the Dutch greenhouse farming industry in the health and pharmacy sectors.

Recycling and savings in transport costs

Provalor has been selected to develop this innovation further in SBIR phase 2. A number of important partners in the food chain are involved in this R&D phase, who will eventually be the first buyers. This approach adds to the profitability and sustainability of the greenhouse vegetable cultivation sector. It also makes an important contribution to the reduction of waste material transport. The environment is treated better and there is less wastage. Soon, usable vegetables will no longer end up on the compost heap, but will be consumed.

Green waste as raw material for cattle feed

In conversation with Christy Kool, Quality and HR Manager of Kruidenier Groep

Kruidenier Groep was contracted within the *SBIR Reducing transport of agricultural products* by the Ministry of Economic Affairs, Agriculture and Innovation. The wholesaler in fresh daily products and groceries intends to reduce the use of soy by *producing high-quality cattle feed from organic waste*. This practical use of biomass will result in less transport and therefore less emission of CO_2.

Cows, chickens and pigs unintendedly cause great indirect damage to nature because of their food requirements. The fact is that to be able to grow soy, the raw material most often used to make feed concentrate, large areas of jungle are being cleared. This deforestation is speeding up global warming and may lead to the extinction of various plant and animal species.

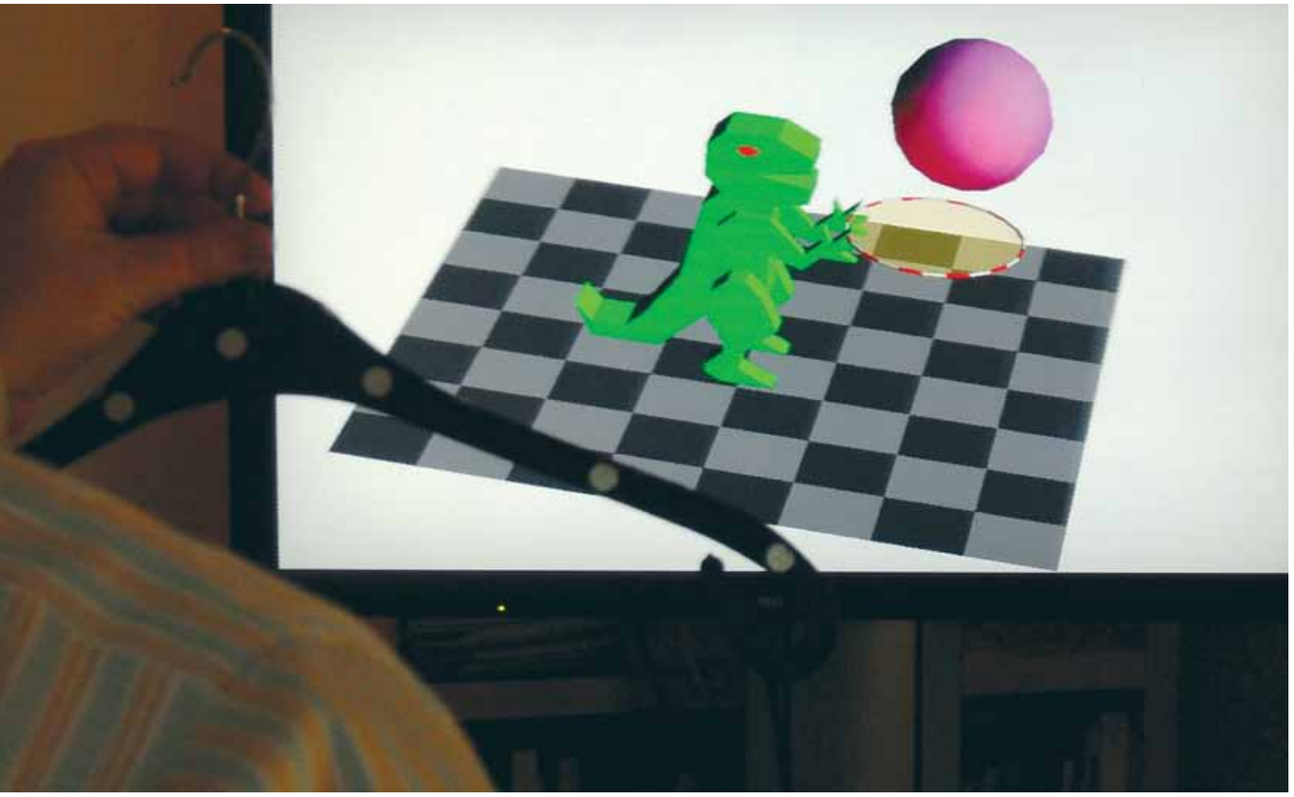
Financial, economic and technological feasibility

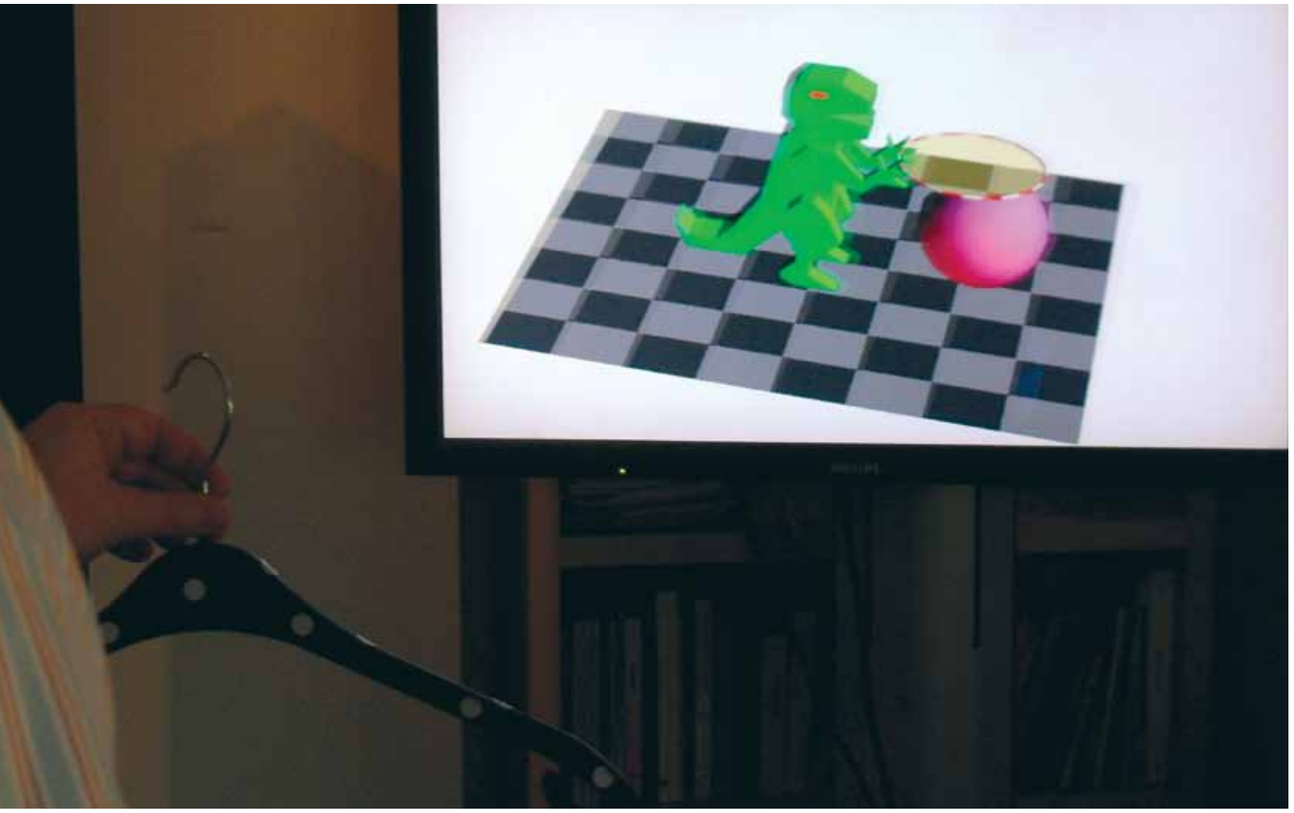
To combat this scenario, Kruidenier Groep invented a 'cradle to cradle' concept to produce cattle feed differently. Their innovative solution: let us recycle our own daily green waste, tons of food leftovers, into the production of cattle cakes. The feasibility study into this economic and environmentally-friendly solution focused on the question of how much CO_2 emission this innovative solution could reduce. In the first phase of this SBIR, Kruidenier Groep also considered the financial, commercial and technological feasibility of producing cattle cake from green waste. The company also investigated whether there was support in the agribusiness chain for setting up a logistic process to do so.

Cattle feed from green waste reduces CO_2 emissions

Christy Kool, Quality and HR Manager, looks after all aspects of Kruidenier Groep's corporate social responsibility and sustainability. She says that the feasibility study came to a successful conclusion: "The feasibility study showed that the production of cattle cake contributes to a CO_2 reduction of 20% in 2012 in the agrologistic sector." Kool also believes that there is a sound basis for the logistic process of collecting these green waste flows. "We are currently waiting for the go-ahead for phase two, in which we want to work out this logistic process, amongst other things. We will do so using our own vehicle park in combination with help from partners in the chain."

In the meantime the Kruidenier Groep has been awarded a contract for SBIR phase 2.





Longer independent and healthy living for the elderly with new products and services developed by the health sector together with other sectors

Exercise for the elderly

Prevention is better than cure. Not just for the person involved, but also for the health system as a whole. Consequently, the Care Innovation Platform (ZIP) on behalf of the ministry of Health, Welfare and Sport went looking for innovations which lead to enhance a longer and healthier life for older people and make it easier for the elderly to continue living on their own. In the *SBIR Longer independent living* Personal Space Technologies (PS-tech) proposed using computer game technology to monitor the quality of movement in the elderly.

PS-tech started in 2005 as a spin-off from CWI, the national research centre for mathematics and computer science in the Netherlands. The company develops 3D visualisation and 3D interaction technologies and products for various clients, including the medical sector. One technology used at PS-tech is 3D tracking, an optical technology used to follow randomly moving objects in a space. Combined with visualisation, this technology offers options for making computer games. It is already possible for a gamer to hold a clothes hanger and move it in such a way that he can virtually throw a small ball through a hoop on the screen.

In this example a cloth hanger is used to virtually move a small ball through a hoop. If the player succeeds, he gets a signal. In this case the bal changes colour: from pink to yellow.

Useful and fun

According to PS-tech, interactive games are very suitable for prevention and rehabilitation of movement-related health problems, for example among the elderly. If they move an object or simply move their bodies, the movement will be precisely copied by objects on screen. This is how practitioners accurately check the movement capacity of their patients and see if their mobility has changed. Presenting the exercises in a computer game ensures that these sessions are also fun to do. PS-tech carried out a feasibility study of this idea.

"It is almost past belief that visually handicapped people still use ordinary canes, even though today there are increasingly advanced navigation tools on the market"

Blind trust in indoor navigation

In conversation with Hans Slijp, CEO of I-Cane social technology

The plan was not new: I-Cane social technology BV had already intended to explore the possibilities of using indoor navigation technology to help blind and visually impaired people find more easily their way inside buildings. The *SBIR Longer independent living* set up by the Care innovation platform (ZIP) on behalf of the Ministry of Health, Welfare and Sport was just the boost I-Cane needed.

"It is almost past belief that visually handicapped people still use ordinary canes", says Hans Slijp, CEO of I-Cane social technology. "The only innovation in decades has been that these canes are now made of lighter material and can be folded up. Blind people are still enormously restricted in their mobility. A cane and a guide dog might stop you from bumping into things, but they don't lead your way, even though today there are increasingly advanced navigation tools on the market."

A tactile arrow in a white stick

The I-Cane Foundation has therefore been studying the possibilities of integrating navigation tools in aids for the blind and visually impaired since 2004. In 2008, I-Cane social technology Ltd was set up to develop the 'intelligent white stick'. To this end I-Cane also uses another invention: the touch-perceptible arrow, a moving disk built into the handle of the white stick. The arrow indicates whether the user should turn left or right. "If the system detects an obstacle or a threshold on the way, the disk on the handle moves out in warning," Slijp explains. "And if you approach a hole or a step down, the disk gets pulled inside. The system is easy to use and works very intuitively. And the target group has responded very enthusiastically."

Accidentally standing in the road

I-Cane's next step was to develop outdoor navigation: 'GPS+' in a white stick, also communicated by touch. Slijp: "We've come a long way with this, and with no commercial funding. Unfortunately the big industrial players are not interested; they consider the target group too small and the development costs to make the product applicable too high. And it is, in fact, quite a sophisticated application, based on more technology than just GPS. After all, with GPS you can geo-locate to within a few metres, but for a visually impaired person, that isn't good enough: they could end up standing in the road instead of on the pavement."

Indoor navigation too

I-Cane has been able to develop outdoor navigation aids thanks to donations and subsidies. Consequently, the market is also taking an interest in indoor navigation. "The technology of an indoor navigation system is different from outdoor navigation systems," says Slijp, "because inside buildings the satellite signals are too weak." But I-Cane did not have the funding to develop both indoor navigation and outdoor navigation. The SBIR challenge was therefore a godsend: the ZIP was looking for *innovations to improve the health of the elderly (aged 55+) and to enable elderly to stay active members of society.* Slijp: "A large part of our target group is aged 55 or older, so this matched our profile exactly. Thanks to this SBIR we are now exploring the most appropriate technology and we are designing the device. It has also given us the opportunity to find out what future users actually want. Without the SBIR programme, we couldn't have started this survey until 2012 at the earliest."

"We will soon be opening a pilot plant where we will process fish-offal. It will generate fuel suitable for fishing boats. If we succeed in the fishery sector, I would also like to see the idea applied in other sectors"

CO_2-neutral fishing using fish-offal

In conversation with Peter van der Klok, CEO of TCE GoFour

The fishery sector is looking for more sustainable fishing methods. TCE GoFour develops an innovative solution involving the *transformation of fish-offal into shipping fuel* under contract of *SBIR Dutch biomass for the biobased economy*. By using this fuel for their own ships fishermen can sail CO_2-neutrally.

Fishing at sea produces a great deal of fish-offal, which is currently simply thrown back into the sea. "A pity," according to Peter van der Klok, CEO of TCE GoFour. This company invents 'green' products for living, working, buildings and mobility. "Fat fish like herring, mackerel, sardines and salmon contain usable fats and oils. If you extract them, you turn fish-offal into biodiesel. Fishermen can then provide their own fuel supply." This innovation means that the fishing sector is well prepared for ever-stricter European environmental standards. It also results in an improved turnover for the fishery sector. Van der Klok: "And if fishermen are self-supporting as far as fuel is concerned, they are less dependent on fossil fuels."

Fish-offal biofuel

In 2009 the company participated in the *SBIR Dutch biomass for the biobased economy* set up by the Ministry of Economic Affairs, Agriculture and Innovation. Van der Klok: "I had been considering the idea of fish-offal biofuel for some time, but did not have the financial means to explore the feasibility. This SBIR allowed me to demonstrate that the idea is very feasible." During the study, TCE GoFour explored the composition of the enzyme mixture used to process fish-offal into biofuel. He also investigated options for the transport and storage of biofuel in on-board tanks. "We will soon be opening a pilot plant where we will process fish-offal. It will generate fuel suitable for fishing boats. We want to get to the point where we can equip a fishing vessel with its own biofuel installation, so that fishermen can process fish-offal into biofuel directly, on board of their own ships."

Great expectations

Van der Klok has great expectations of his innovation, and is confident of an international breakthrough. "The fishermen are very interested and enthusiastic," Van der Klok says. "We are very busy thinking about the best way to market the innovation. If we succeed in the fishery sector, I would also like to see the idea applied in other sectors. For instance, it might also be feasible to make slaughterhouses more sustainable by extracting fuel from meat scraps. But that is still in the future; for now we are focusing on the fishing industry."

Duckweed: key to a short nutrient cycle

High-protein duckweed seems to be an ideal substitute for soy in cattle feed. Groot Zevert Vergisting carried out a feasibility study into cultivating duckweed for use in feed. It was done within the framework of *SBIR Dutch Biomass for the biobased economy* set up by the Ministry of Economic Affairs, Agriculture and Innovation. There are major environmental benefits: less soy in animal feed means less destruction of tropical rainforests for soy fields, lower emissions of greenhouse gasses CO_2, methane and nitrous oxide, and also a decrease in the import of nutrients and minerals.

Groot Zevert Vergisting (owner of a biogas installation) participated in this SBIR together with Thecogas (design and realisation of fermentation installations), CC Advies (specialist in cultivating techniques for aquatic biomass) and ForFarmers (feed manufacturer). They called their project *Duckweed, the key to a short nutrient cycle*.

High-protein duckweed

Duckweed, small floating water plants with a diameter up to about 2 centimetres, can contain up to 35% proteins. In favourable conditions, the amount of duckweed grows rapidly, increasing as much as 50% per day. The structure of duckweed resembles soy and other sources of protein used in feed. One of the very attractive benefits of duckweed is that it can be used for cattle, poultry and fish.

Production and nutritional value of duckweed

The feasibility study focused on the nutritional value of the different types of duckweed, the production and the economic side of the project. Its conclusion: the cultivation of duckweed can be profitable if it uses a growth medium made up of fermented animal dung (digestate) as a source of nutrients and minerals. This digestate also makes it possible to cultivate duckweed through a short nutrient cycle and to partly replace soy as a substitute source of protein in existing cattle feed. This in turn results in a considerable reduction of emissions of CO_2, methane and laughing gas (N_2O), and also lowers the need to import nutrients and minerals into the Netherlands.

Reduce the emission of particulate matter by developing air treatment systems used in intensive livestock farming

Positive charge against particulate matter

Emissions of ammonia, odours and particulate matter by the agricultural sector are a major problem for both humans and animals. That is why Environmental Nano Solutions Europe (ENS Europe) developed a new air-scrubbing system for cattle farms within the framework of the *SBIR Air treatment systems for live stock farming* set up by the Ministry of Economic Affairs, Agriculture and Innovation. The system is able to catch large amounts of particulate matter in the outgoing air of a poultry shed by using positive ionisation.

In the first phase of SBIR, ENS Europe tested the feasibility of *a combined system to reduce emissions of ammonia, odours and particulate matter*. In the second phase, the company developed a system for poultry sheds which reduced particulate matter. The ionisation technology that ENS Europe uses for catching particulate matter is energy-efficient, because it is based on the physical properties of air particles. This approach reduces emissions of particulate matter by over 80%. ENS Europe also intends to use the system for incoming air, which will improve animal welfare. It will provide sheds with a better air quality and reduce the risk of infection by airborne bacteria and viruses.

Ionisation

Positive ionisation means that particles in the air are positively charged and sent to a point of interception. After the air has been cleaned from larger particles, outgoing air arrives at the particulate matter interception module. This module was developed in cooperation with Delft University of Technology. Two positively charged wires run through the top of the module; below them are the interception racks to which the particles cling. Due to positive ionisation, the particles form a chemical bond with the rack, preventing them from breaking free again. Current systems which are based on negative ionisation are detrimental to health and produce large quantities of ozone. Neither of these disadvantages applies to positive ionisation. Moreover, the system is energy-efficient and uses solar energy.

The new air-scrubbing system was already very successfully tested at a laying-hens shed in Mierlo. The next step is to combine the system with an ammonia and odour-reducing module. So the system will also be widely applicable for pig farming.

Reduce the emission of particulate matter by developing air treatment systems used in intensive livestock farming

Easy prevention of odour emissions with plasma

T&K service Ltd submitted a proposal for the *SBIR Air treatment systems for live stock farming* set up by the Ministry of Economic Affairs, Agriculture and Innovation and the Ministry of the Environment for optimising air-scrubbing technologies in livestock farming. The company developed *a system for the removal of odours using a non-thermal plasma reactor*. With relatively minimal effort, this technology can be applied in all kinds of air ducts, thus easily preventing odour emissions.

A non-thermal plasma reactor consists of a very strong electric field in which air molecules are converted into oxygen radicals. These oxygen radicals oxidise the odours. This process uses little energy what makes it different from other air treatment systems. It does not produce waste, nor extra CO_2 emissions nor other emissions and it does not make noise. Moreover, costs are acceptable, not least because the technology can be used in combination with other air-scrubbing technologies.

Japan

The effect of plasma removal of odours was probably first demonstrated in Japan at the University of Kyoto in 1990-2000. However, reactors tested there have not been implemented, because they used too much energy. With the research made possible by SBIR T&K service realized that it is possible to conduct the non-thermal plasma treatment with plasma reactors that can be connected to affordable commercial power supplies. These reactors are not sensitive to air humidity and can be placed directly in the air current. Moreover, they use little energy and are still capable of optimal odour reduction. Using one quarter of the power used in previous plasma techniques, an odour reduction return of 85% was achieved.

Coffee-roasting houses

The commercial power supply and the high odour reduction return make the new product easily accessible. That is why it is not only ideal for use in livestock farming. It might also attract a variety of new potential buyers whose business activities are now limited because of their odour emissions, such as compost firms, waste-processing companies, coffee-roasting houses and spice factories.

Entrepreneurial policy officials use SBIR

"SBIR gives inspiration"

The dedication and passion of individual officials are crucial in encouraging ministries to use SBIR to find new solutions and achieve policy goals. Cornelis Mijnders and Malti Ramdharie are two enthusiastic public servants who have experienced working with SBIR. Even though Mijnders has already four years' experience with SBIR and Ramdharie one year, they both had a similar start.

Inspiring examples

The Ministry was working on a specific societal issue. Management had only a small budget and wanted to use SBIR to address this societal challenge. They started looking for information about and experiences with SBIR. Mijnders: "I was invited to join a trip to the United States, and became enthusiastic about the great results I saw over there and about the effects of SBIR: concrete solutions for societal problems." He was also impressed by the recovery of government costs. "In the United States I learned that a quarter of the SBIR companies, thanks to the prototype, the product or service, generate more than US$ 1 million turnover within two years."

The best instrument

At Malti Ramdharie's ministry management indicated that it wanted to use SBIR to address a societal challenge. The budget was 800,000 euros. Ramdharie: "We only knew SBIR by name, so I first worked out what SBIR stood for. Then I went looking for colleagues within the ministry who had experience with SBIR. The newsletter *Kennis en Innovatie Kien* (about knowledge and innovation) proved to be very useful, it included an overview of the available instruments."

The more Ramdharie discovered about SBIR, the more she felt the need to convince her manager that it was the best instrument. "Both in contributing to the solution for a societal problem, and in stimulating innovation," according to Ramdharie. The budget of 800,000 euros turned out to be unrealistic for this SBIR. "By explaining the power and effect of SBIR, I managed to make a larger, more realistic budget available", says Ramdharie. However, she then also faced prejudices about subsidies to companies from acquaintances inside as well as those outside government institutions. These prejudices included the idea that subsidies are 'gifts' for companies and that their outcomes take too long to appear and are too hard to demonstrate.

During one of her talks with her superiors it became clear that they wanted to change the concept of SBIR in order to bring down costs. The idea was to combine the three phases into one. "Fortunately it soon became apparent that it is not advisable to modify the SBIR concept", Ramdharie relates. She explained SBIR's concept and structure: a result-oriented assignment, the appeal to entrepreneurship, the independent committee, etc. As a result she was given full support and the management team's trust.

Strict and expert selection

Mijnders agrees that the SBIR concept should be adhered to and protected: "The core of the concept is that it is neither subsidy nor research. It is a response to a societal challenge that enables entrepreneurs to develop innovative solutions and market them. The three-phase approach means that the innovation will be on the market five to seven years after the start of an SBIR. An independent expert committee is essential. Thanks to committee's strict selection procedures, companies which are not granted the SBIR assignment nevertheless do receive good feedback on their plans, which may help them further."

Both Ramdharie and Mijnders value the fact that SBIR is slowly but surely becoming a brand. Companies have started framing their certificates and nailing them to the wall. "SBIR should stay special," says Ramdharie. "At SBIR meetings with entrepreneurs you can feel the energy that is created when entrepreneurs meet and inspire each other to develop even better and more innovative products and services."

Energy and inspiration

Mijnders says: "SBIR provides an opportunity to reflect on policy. Using an SBIR makes policy tangible." Ramdharie agrees: "As a policy official you stay involved and interested in the SBIR, compared to other policy instruments. It so happens that some SBIR project proposals stick in your mind, including those that were not contracted. If you can only grant eighteen SBIR projects, that doesn't stop you thinking about how you could help the projects which did not make it. After all, you are aiming for an unchecked spread." For SBIR, implementation and policy are closely linked.

"SBIR is quite time consuming", admits Ramdharie. "But it does not feel like that at all. It gives you energy and inspiration." SBIR really touches policy officials: "It pushes different buttons. In an SBIR you deal with problems in a different way. You have to stop thinking about limitations, rigid frameworks, even one's own Ministerial perspectives and 'regular clients'." Mijnders: "Entrepreneurs come up with plans that offer unforeseen solutions. So close, intensive cooperation with companies is inspiring and provides new insights."

SBIR focuses on opportunities. "Public officials are used to avoiding and preventing risks. So we tend to make the SBIR phases too complex," says Ramdharie. "But it is important that SBIR is, and remains, available to everyone: small and medium-sized enterprises, wacky inventors, and even the next-door neighbour."

Greater output from solar panels and in-glass solar cells

What will be our energy source in the future? Electrical engineering firm Betronic Solutions and engineering office Movares point enthusiastically to the sun. Betronic is developing a system to draw more energy from solar panels, and Movares is developing glass roofs with integrated solar cells – both within the framework of *SBIR Integration of solar panels in buildings.*

Getting more out of the sun

Betronic has brought its invention into a new company, Femtogrid Energy Solutions, and is now studying ways of further developing and marketing its *Femtogrid system*. Femtogrid is a direct-current network for storing, transporting and delivering sustainable energy as efficiently as possible. Thanks to smart electronics and parallel connections the network can deliver up to 30% more energy from photovoltaic (PV) solar panels. Another advantage is that any type of solar panels can be linked to the system. Improved, web-based information on management and maintenance also make Femtogrid a particularly user-friendly solution.

In-glass solar

The engineering office Movares explored the feasibility of their own invention together with the engineering and construction firm BRS and ECN (Energy research Centre of the Netherlands). The office was looking to install PV systems in roofs in an efficient, safe and aesthetic way. This led to a cold-bent glass panel construction with solar cells sandwiched between the glass laminates. The bent glass provides the carrying capacity and light admission into the building; the glass panels are self-cleaning in rain; and separate solar panels are unnecessary as the cells are built into the glass itself. According to Movares the construction does not weigh much and is easy to transport because the glass is bent on-site. The Dutch train station Utrecht-Zuilen is the first to use these glass PV roofs, and all the platform roofs of Utrecht Central Station will soon be fitted in the same way. They will contribute to the energy supply of the station, but Movares also expects these special PV systems to give the station a green image and a positive image to its users.

Development of new technical tools that help skippers sail more energy efficient and save fuel

In smooth waters with the Alphamulticourse

Ships that make continual track and steering adjustments use much more fuel than necessary. Alphatron Marine has developed Alphamulticourse, a software and hardware system which combines a joystick/autopilot system for sea and river navigation. It can be given full control of a vessel's motors and steering. The development was financed by the *SBIR Energy efficient inland shipping.* Alphamulticourse makes it possible to automatically keep a vessel's motion and steering behaviour constant under all circumstances, thereby saving fuel and reducing CO_2 emissions.

Alphatron Marine developed the Alphamulticourse, that takes into account vessel type, speed, draught, wind forces, and the horsepower of the propulsion chosen. The software applies the powers of rudders, motors and bow thrusters accordingly. Manual steering requires frequent corrections, for example if the captain's attention has been distracted for a moment. This costs fuel. The system makes these steering corrections unnecessary or more gradual.

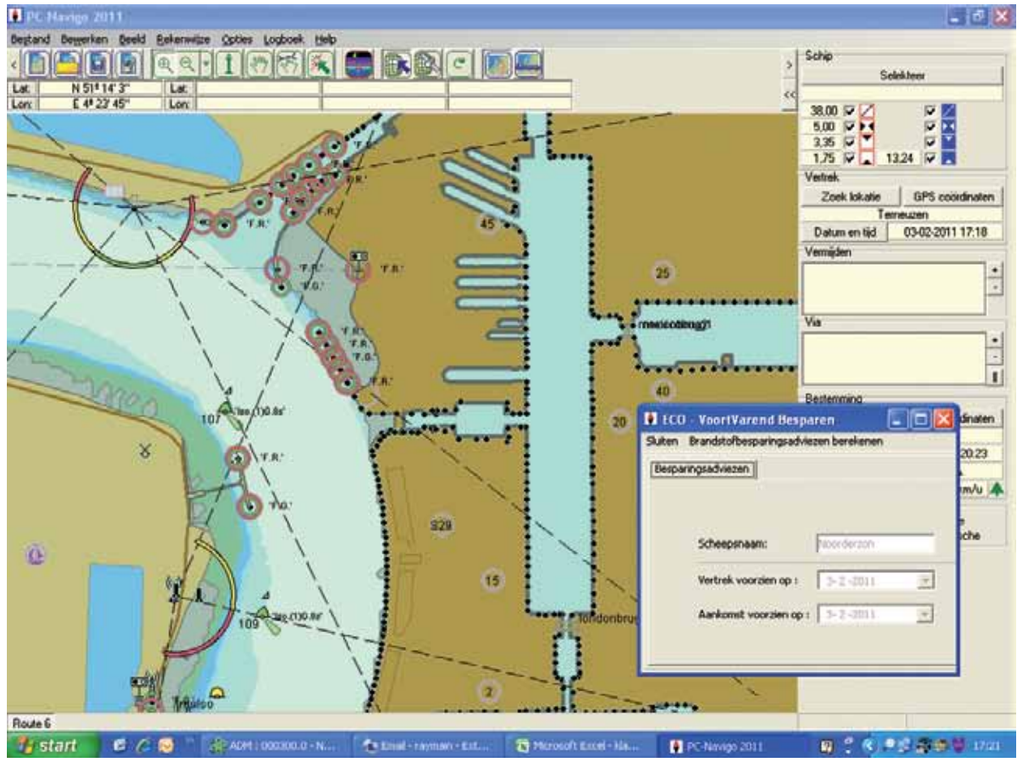
Proven success

Ships fitted with Alphamulticourse perform fewer helm deflections and therefore use less fuel. The special control joystick is also an ergonomic improvement for captains. Alphatron Marine has since brought Alphamulticourse to the market for ships of 20 to 65 metres in length. It will be used mostly in working vessels and government patrol boats. After the proven success of trials in two ships operated by Rijkswaterstaat, the executive arm of the Dutch Ministry of Infrastructure and the Environment, responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands. Alphatron expects other government services, including the National Police to adopt the system, as well as ten city ferries in Rotterdam and several Multicats, work boats with a winch and a hydraulic crane, in Gorinchem. The system will also be installed in a new fire-float for the fire brigade in Bremen, Germany.

Larger ships

Alphatron's next challenge is to further develop the system for application in larger ships with varying steering conditions. The algorithms used in the current Alphamulticourse are geared to ships of between 20 and 65 metres; adapting these algorithms for larger ships under a variety of different load conditions will require a completely new arithmetic model and software.

Fuel reductions thanks to PC-Navigo Eco



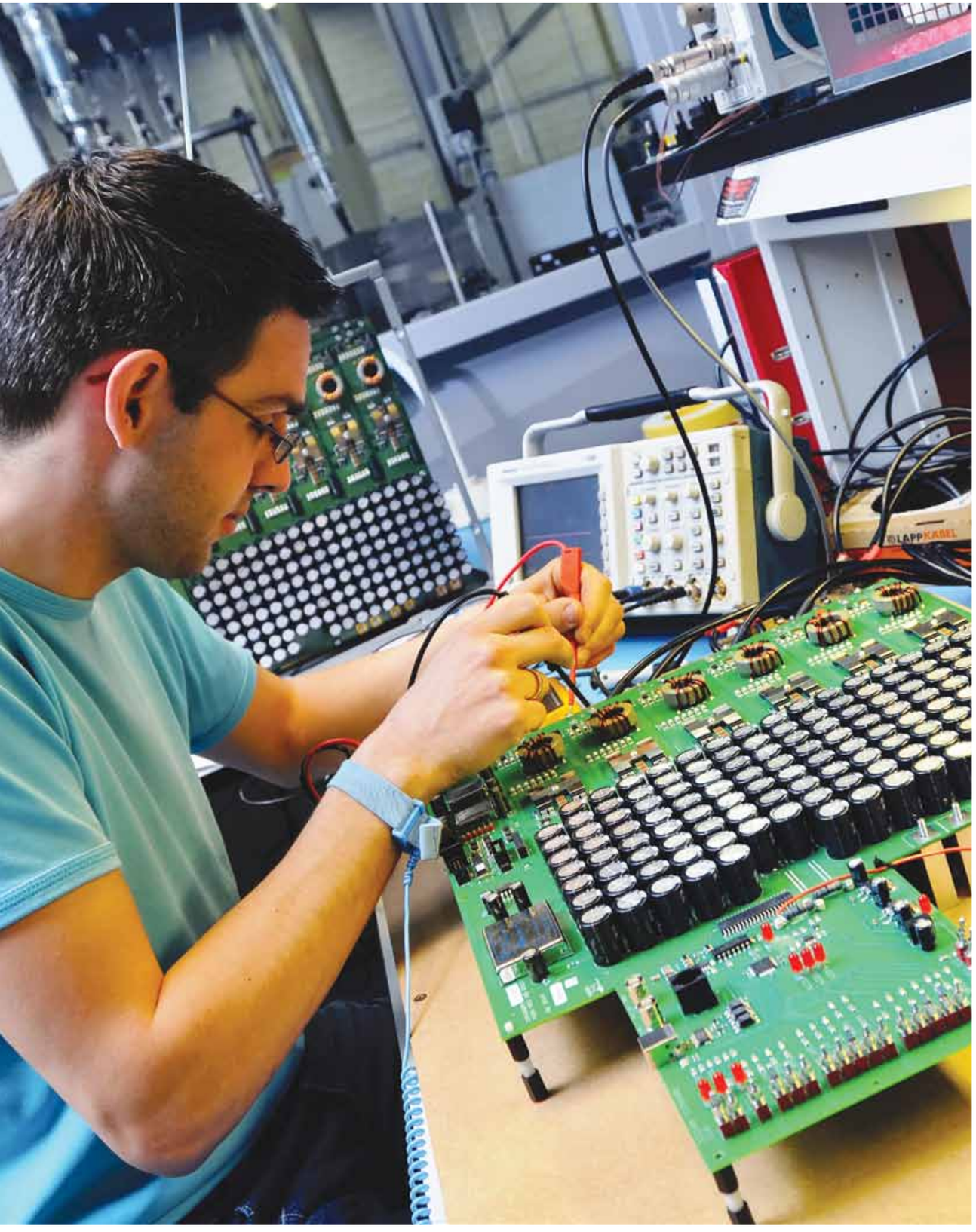
How can a ship's captain save on fuel without losing transport speed and efficiency? Shipping software producer Noordersoft developed the software tool PC-Navigo Eco while participating in *SBIR Energy efficient inland shipping* set up by the Ministry of Infrastructure and the Environment. This tool calculates the likely fuel consumption for different speeds (and therefore arrival times), enabling captains to make their own choice while saving a maximum of fuel.

PC-Navigo Eco is a modular supplement to the existing software application the PC-Navigo, a journey planner and map viewer programme for the inland shipping industry previously developed by Noordersoft. The most innovative feature of the PC-Navigo Eco is its ability to exactly determine en-route current speeds. These data are calculated on the basis of known relationships between water level, water level differences, and river's surface current speed. The speed of these currents is one of the most important parameters of fuel usage in transport by water. Their exact determination enables captains to analyse the consequences of certain choices in journey planning much more precisely than before. For all water levels, for instance, it can be determined whether it is more profitable to travel at a higher or a lower speed.

Time gains and fuel savings

The application module visualises possible time gains during the route. Captains can also elect to lower their waiting times and save fuel by slowing down without losing profits. The PC-Navigo Eco also communicates with the place for unloading in order to gear transport speed and turnover rate to each other. Captains have only to fill in a few basic details; the PC-Navigo Eco takes these as the starting point for its calculations of fuel usage under specific circumstances.

During this SBIR, Noordersoft tested whether these fuel savings were influencing the results and efficiency of actual operations. The company elaborately monitored fuel usage for a variety of water levels and current speeds. The Eco module turned out to be an excellent supplement to the PC-Navigo. Because the Eco module is designed to connect seamlessly with the PC-Navigo, the software is easily implemented in existing set-ups. This also makes it relatively easy to market the product.



Technique innovation for energy-efficient production of shaving heads

In conversation with Hans Pol, director of PBF Group

PBF Group, switched mode power supplies manufacturer, developed an energy-saving power supply for electrochemical machining (ECM). The result: a sustainable alternative for the energy-consuming spark erosion machine. Participation in the *SBIR Electromagnetic power technology for energy conservation and sustainability* from the Ministry of Economic Affairs, Agriculture and Innovation accelerated the development of this technology. This energy-saving power supply is now being used by Philips Consumer Lifestyle for the production of razors shaving heads.

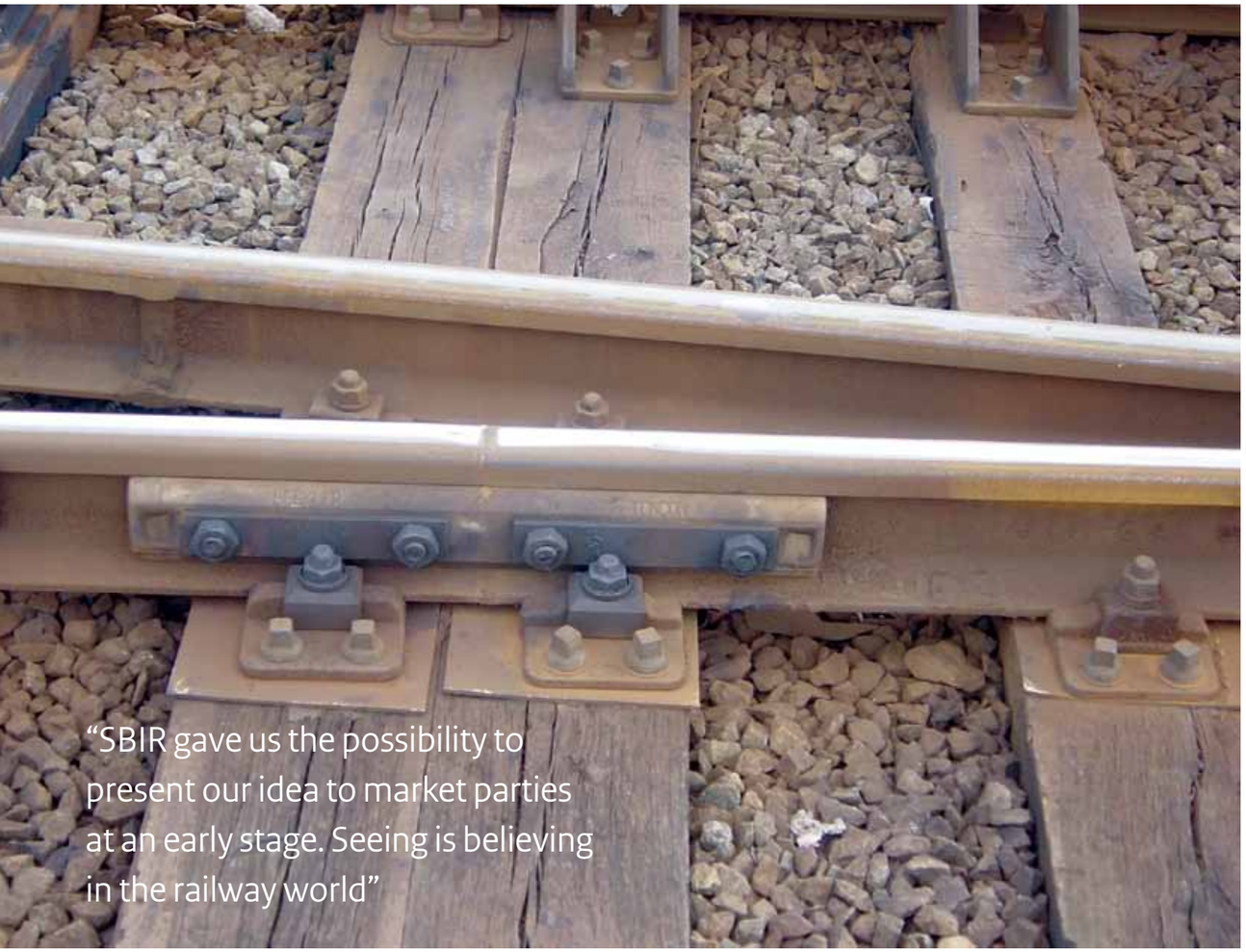
During the feasibility study, PBF Group already contacted Philips and PEMTec. Prior to phase 2, both companies were prepared to sign a declaration of intent to purchase the product. Director Hans Pol believes that success factors for the project are trust and courage, the competition in the tender and the feasibility phase. Hans Pol is very enthusiastic about the SBIR initiative: "SBIR helps companies to get the most out of their knowledge. Product development always takes more money and time than expected. SBIR was a good start in approaching the customer with a simulation model."

First client: Philips

PBF Group developed an energy-saving power supply now used by Philips Consumer Lifestyle in Drachten for a number of machines that process razor blades for shaving heads. Surplus metal in the razor blades is removed by very small electricity impulses. This is a very high-precision task, accurate down to nanometres. This new power supply increases the output of the machines from 80 % to 90 %. With the help of PBF Group's technology, Philips not only processes the shaving heads more precisely than before, with less waste, but also achieves enormous cost savings. Philips now uses three production lines equipped with the new energy-saving power supply and is setting up a fourth. The energy saved per production line equals the energy consumption of two hundred households. PBF Group's managing director Hans Pol says that participating in this SBIR made the successful route with Philips possible. "The development of the technology was accelerated by SBIR's funding," according to the director.

After elaborate tests PEMTec has put the first ECM machine using PBF Group's power supply in the market. When fitted to the ECM machines, these power supplies increase the energy efficiency of machines from the current 50% to over 90%. Which means considerable energy savings in a production with ECM machines. Hans Pol has high expectations: he expects to provide 50 power supply units to PEMTec per year.

PBF Group is now also working on building a patent portfolio. For this purpose, the company has linked up with a former Philips patent agent. The technology which was developed by PBF Group for Philips and PEMTec has more applications than just the ECM machine. It is now being used for several products, such as electron microscopes. In the future PBF Group also expects to play a role in energy conversion, for example in decentralized power generation, the redistribution of energy and the development of hybrid vehicles in the transport sector.



Electromagnetic power technology enables sustainable railway traffic

In conversation with Bas Gravendeel, director of Early Minute

Electromagnetic power technology offers a solution to defective working of signals. The *SBIR Electromagnetic power technology for energy conservation and sustainability* set up by the Ministry of Economic Affairs, Agriculture and Innovation gave two engineering companies – Early Minute and Rail Road Systems – the opportunity to present their joint invention *Insulated rail joints with magnetic field control* to the international railway world.

Accumulating iron particles on rails as a result of abrasion cause many signal failures every year. The resulting alternative routes lead to unnecessary extra train kilometres per year. Installation of insulated rail joints with magnets ensure that iron particles are drawn away from the failure-sensitive points in the rails. This leads to fewer signal failures, fewer extra kilometres, and therefore less maintenance and energy. Participating in this SBIR enabled inventors Early Minute and Rail Road Systems to develop a prototype insulated rail joint and test its efficacy on rails.

Seeing is believing

Without the SBIR programme Early Minute would not have had the finances to develop a prototype of their idea, says director Bas Gravendeel of Early Minute. “It gave us the possibility to present our idea to market parties at an early stage,” Gravendeel says. “Seeing is believing in the railway world.” The prototype has now also been tested on Dutch rails. “The technology worked fine in practice,” says Gravendeel. It functions so well that the prototypes are now being tested in dozens of places abroad. For example, the United Kingdom has bought a hundred sets of insulated rail joints, which are now being tested on British tracks.

International prestige

After phase 1 the evaluation committee of this SBIR decided that the product was sufficiently advanced to put on the market. This assumption of the committee is indeed effectuated. Although it has now been launched, it has not really taken off yet. Gravendeel thinks this could change overnight: “We are now demonstrating our product at fairs and are positioning ourselves as an innovative company.” An unexpected side effect of participating in this SBIR is the prestige it gives the invention abroad, according to Gravendeel. The fact that the Dutch government supports the development of the technology is an indication that it must be worthwhile, is the line of thinking. Whether more countries will be interested in purchasing in addition to the United Kingdom is a matter of patience, Gravendeel believes: “It usually takes about ten years for a new product to conquer the railway world.”

Development of new proteins for human consumption based on proteins from plants, algae, seaweed, fungi, insects or cultivated meat

New proteins from the vegetarian butcher

If consumers want to eat more sustainable food, they should be offered sustainable alternatives for the animal proteins produced by conventional agriculture. De Vegetarische Slager ('The Vegetarian Butcher') has developed a concept store as part of the *SBIR New proteins on the menu* set up by the Ministry of Economic Affairs, Agriculture and Innovation. This new generation of delicatessen sells tasty, innovative products with a nice bite, but without meat.

The products and dishes made with meat substitutes offered by De Vegetarische Slager are almost indistinguishable from meat with respect to taste and texture, even though they are actually made with soy, lupine and other proteins that can be produced on Dutch soil in an environmentally-friendly way. The company thereby counteracts wastage in the food chain and contributes to building a sustainable chain. De Vegetarische Slager aims to provoke and surprise people, make them laugh and give them food for thought.

The empty spot on their plate

Contributing to a sustainable vegetarian economy in the Netherlands means promoting the consumption of vegetable proteins. De Vegetarische Slager markets meat substitutes in a new way. The company's products resemble real meat because studies have shown that although many people would like to cut down on meat consumption they do not know how to fill 'the empty spot on their plate'. A sustainable chicken saté by De Vegetarische Slager cannot be distinguished from a real chicken saté and this makes the company's products satisfying and healthy alternatives for meat and fish.

Vegetarian products with a bite

De Vegetarische Slager was set up as a concept store and trial studio, a relaxed and surprising environment in which consumers can try and buy meat substitutes based on vegetable proteins. The concept was a joint idea of biological crop farmer Jaap Korteweg, top chef Marco Westmaas, innovation platform Kiemkracht's director Rob van Haren and concept developer Niko Koffeman. They all share the opinion that vegetable meat substitutes should have a good structure, bite and taste, and wanted a range of identifiable products to demonstrate that meat-free food can be of a high quality. Together, they 'slaughter' the concept that there is no such thing as great-tasting food without meat.

Less animal proteins with Meatless

The growing world population and increasing wealth is making sustainable food production more important than ever. Meatless has therefore developed a hybrid technology which makes it possible to apply vegetable products in foods of animal origin. In a feasibility study, Meatless explored whether it was also possible to fortify other products than meat using its Meatless product, for example in cheese and fish. The study was part of the *SBIR New proteins on the menu* set up by the Ministry of Economic Affairs, Agriculture and Innovation.

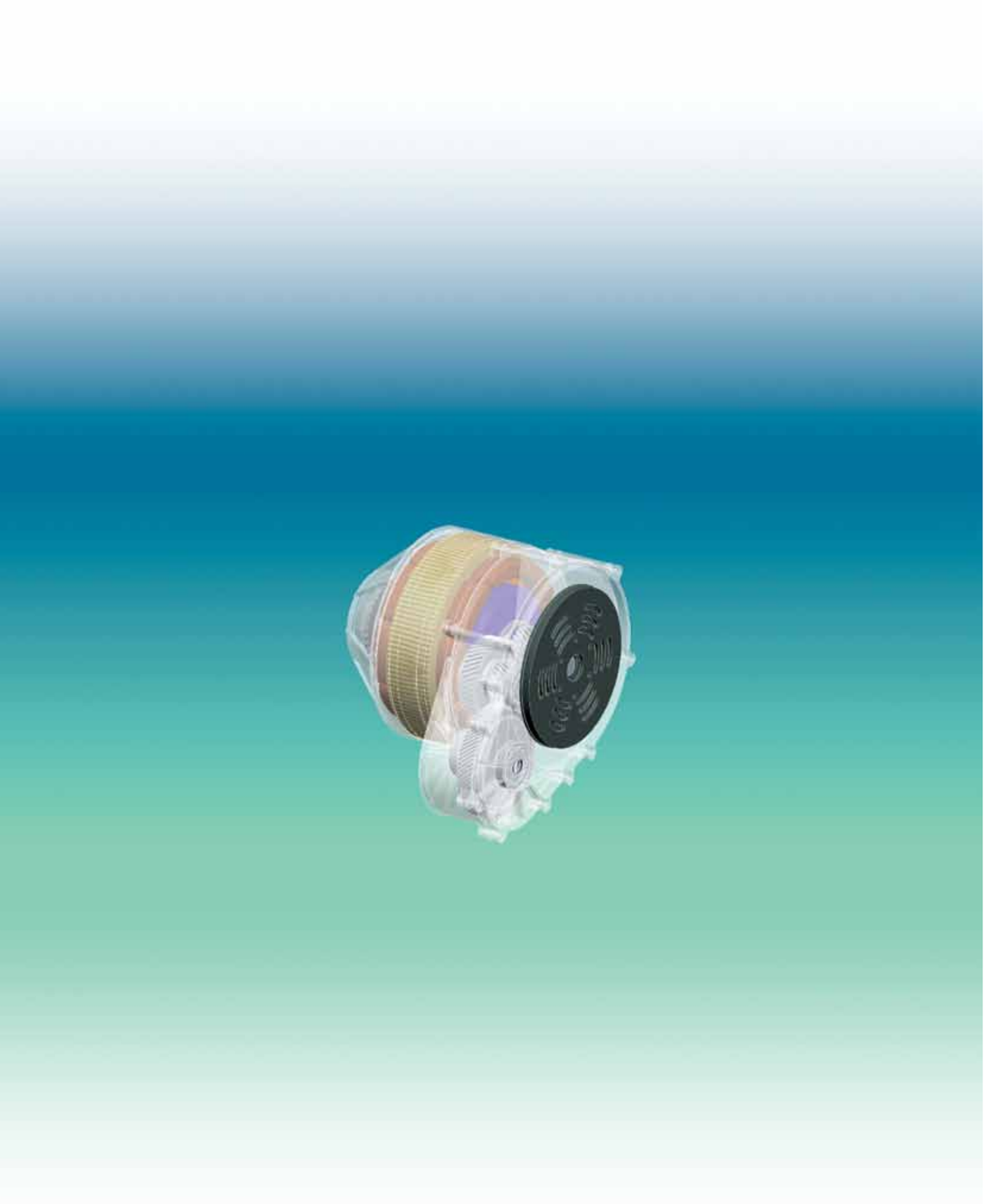
Meatless substitutes animal proteins in products with high-quality vegetable proteins, in order to contribute to the prevention of food and raw materials shortages. Meatless aims to develop and produce foods that are healthier, but which also have a smaller impact on the environment. That is why Meatless focuses on how their product can contribute to the nutritional value and sustainability of products such as meat and fish.

Eating habits

Meatless provides opportunities to people who are conscious of their own health and the future of the planet, but who cannot or do not want to change their eating habits. Meatless positively influences the nutritional value of products, so people do not have to modify their eating habits. The food does not change quantitatively or qualitatively. In addition, the production per kilo of Meatless has much less impact on the use of land, energy, water and on CO_2 emissions than many animal products, but on top of that also less than most meat substitutes.

Scaling up

In the course of the SBIR project the technical properties of meat combined with vegetable raw materials were improved. Meatless also looked for a wider acceptance of combined products by processing companies and consumers. Meatless hopes that technological process improvements and a clear scientific case for the health and sustainability aspects will lead to a breakthrough in processing methods. The knowledge gained about meat products can then be applied to other product groups such as fish and cheese. And this will lead to new, healthier, and more sustainable products being produced on a large scale.



Better hybrid cars thanks to electromechanical, continuously variable transmission

A project by the Jacques van Rooij research foundation and the Altramotive enterprise is taking an important step towards the hybrid car of the future. The partners are working on an electromechanical, continuously variable transmission (ECVT) for a more efficient drive train in cars. They were contracted within the *SBIR Car of the future* set up by the Ministry of Infrastructure and the Environment.

In the 1950s Hub van Doorne of DAF (Van Doorne's car factory) in Eindhoven developed the first gearbox with a stepless adjustable transmission ratio. This continuously variable transmission (CVT) became known as 'the smart gear stick'. The 'stepless' transmission automatically selects the ideal engine speed for any given road speed.

And now another completely new transmission has been invented in the Netherlands. It also involves a CVT, but this time it is an entirely electromechanical device, which makes it particularly well suited to hybrid engines.
The ECVT ensures an even more intelligent use of the combustion engine, making the most optimal use of the possibilities of a hybrid: economical electric driving and the recapture of braking energy. This leads to further reductions in fuel consumption and less emission of CO_2 and other greenhouse gases.

Mobility research

The ECVT's environmentally-friendly effects are in line with the goals of the Jacques van Rooij research foundation. Stichting Jacques van Rooij was founded in 2006 to study technologies which improve the mobility of people and goods in an environmentally-friendly way. The focus is on the reduction of fuel usage and harmful emissions.
The foundation nurtures technological talent by supporting good ideas on vehicle propulsion coming from individuals and small companies which do not have the independent means to realise them. Founder Jacques van Rooij also set up Gear Chain Industrial BV, an innovative company which has developed a unique chain technology for continuously variable transmissions. In the future a new company will be established to market the ECVT.

An instant start with the Impulse Start/Stop System

With fossil fuels running out, it has become crucial to develop innovative low-energy systems for vehicles. Drivetrain Innovations BV is currently developing the Impulse Start/Stop System (ISS) within the framework of the *SBIR Car of the future* set up by the Ministry of Infrastructure and the Environment. The ISS is a third-generation motor start/stop system for passenger and transport vehicles which saves energy by extracting energy from braking power.

The new Impulse Start/Stop System (ISS) uses a very compact flywheel system, due to this a vehicle can start rapidly. When the vehicle brakes, the flywheel is electrically charged, with 'free' braking energy via activating the existing dynamo. When stopping the vehicle, the motor is automatically turned off. When the driver starts driving again, the stored flywheel energy is instantly delivered to the combustion engine. In this way, the energy used to start the vehicle is derived directly from its stored braking energy. In this way the driver can start up the vehicle instantly. The exact energy savings depend on the situation – city, motorway or traffic jam – and vary between 5 and 20%.

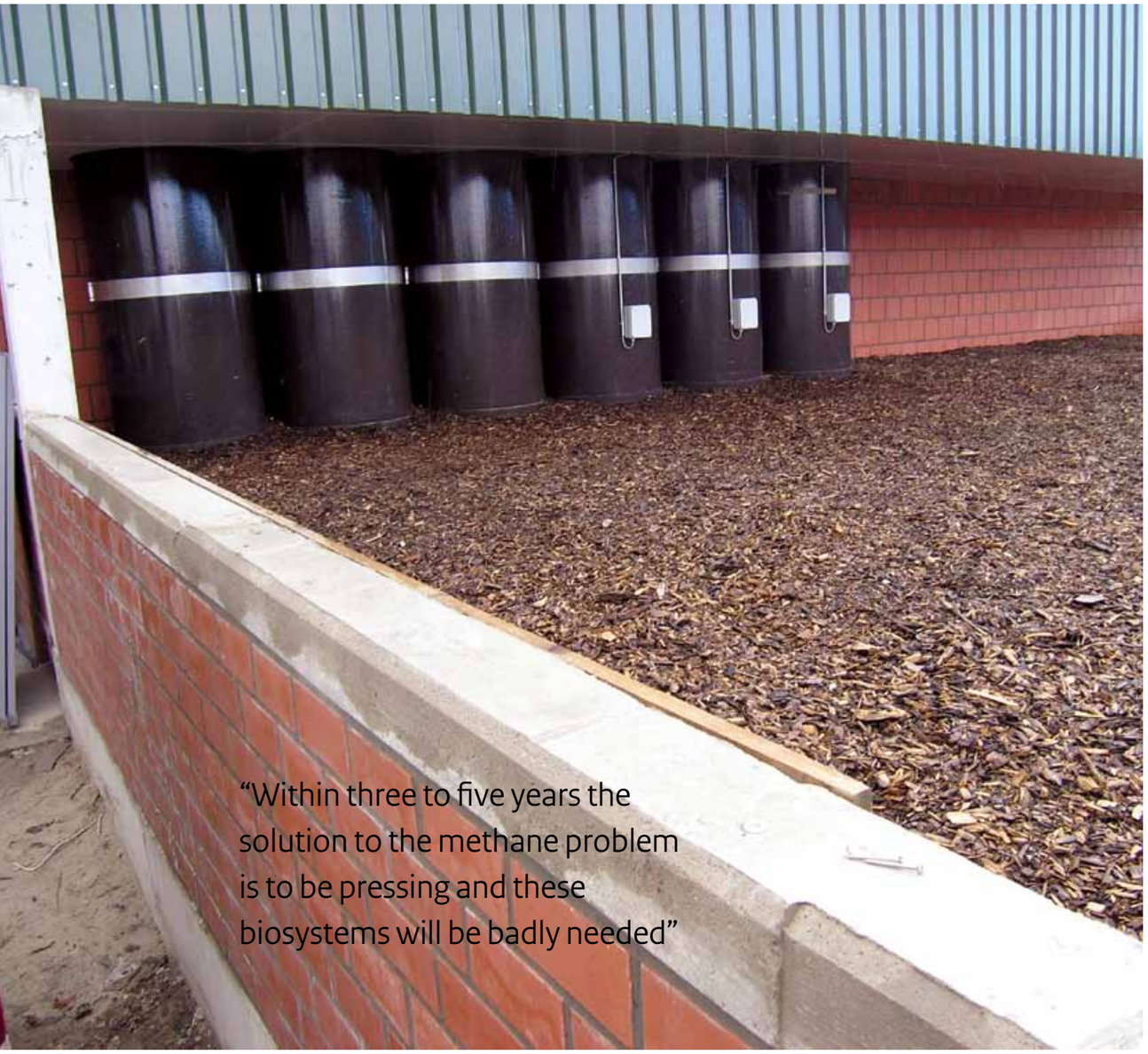
Reduced battery demand

A vehicle fitted with ISS uses less fuel, that is for certain. The system also greatly reduces the burden on the vehicle's existing electrical system; the battery wears out less rapidly and it may also improve the cold start. The ISS is independent of the chosen transmission technology; whether the vehicle has manual transmission, automatic or CVT, the driver behaves normally when stopping and starting and does not have to do anything new. This is an advantage over existing start/stop systems. Another big advantage is that ISS can be integrated into existing starters or belt-drive battery systems.

Pioneer in innovation

In the future, Drivetrain Innovations (DTI) plans to start producing small specialist series themselves. For mainstream applications it is looking for large and medium-sized automotive Tier1 suppliers, who can produce under licence and deliver to original equipment manufacturers (OEMs). DTI already has licence contracts with a number of national and international OEMs and international suppliers, with OEM clients such as MAN, DAF, BMW, Opel/GM, PSA, Renault, Fiat, and Volkswagen/Audi.

DTI is a spin-off from Eindhoven University of Technology. It is a role model in transferring knowledge from Eindhoven Brainport and the Eindhoven-Leuven-Aken technology triangle (ELAt) into commercially viable products. The innovative company, which was established in 2003, is a forerunner in marketing unique cost-effective drive systems for vehicles.



Methane reduction using biofilters

In conversation with Wim Wielaard from Wielaard technology

Wim Wielaard, director of Wielaard technology, has found solutions to all kinds of specific problems. He especially focuses on biosystems. Within the framework of the *SBIR Ammonia and odour reduction in farming* set up by the Ministry of Economic Affairs, Agriculture and Innovation, he investigated if it would be feasible to reduce methane emissions in farming with the help of biofilters. It turned out to be possible. However, his project *Bio filters for reduction of emission of methane from outside storage* did not make it to the second phase of SBIR and has therefore not yet been developed.

Methane emissions are 23 times more harmful than CO_2 and are produced when organic products start to digest in places with little or no oxygen. Wim Wielaard is perfectly able to explain where methane emissions occur: “My father used to be a cattle farmer. Now and then we had to bleed gas from the stomach of a cow, using a small tube.” Methane also develops when organic waste is stored, but industrial storage rooms these days have practically all been adjusted to accommodate this. “Agriculture is currently responsible for the largest production of methane in the atmosphere.”

Wielaard was already working on biofilters and air quality in live stock breeding industry. He had very successfully used biofilters in poultry sheds; this system also turned out to be a successful method for catching particulate matter. “I was wondering if such a system could also reduce methane”, Wielaard explains. For this SBIR, he studied scientific literature to explore the feasibility of a biosystem for the emission of methane. He found information about research carried out in Canada and New Zealand, where specific types of bacteria had been used to convert methane in the air of a slurry depot into other materials. This technique has much ground in common with the systems Wielaard was working on. Moreover, it could be applied in a relatively simple filter.

Financially, Wielaard’s biosystem turned out to be feasible, even on a small scale. However, the study did not make it to SBIR’s second phase, the research and development phase. Nevertheless, Wielaard is glad he carried out the research. “SBIR has the advantage that you are confronted with particular issues at an early stage,” he says. At the moment, there are no funds to continue developing his product, but he is being informed about new developments in New Zealand and Canada. Wielaard expects the solution to the methane problem to be more pressing within three to five years: “By that time, these biosystems will be badly needed.”

Reduce the emission of ammonia and odour by developing air treatment systems used in intensive livestock

Blocked air scrubbers are history

In conversation with Maurice Ortmans, CEO of Inno+

Many cattle breeders face the problem of blocked air scrubbers. Dust dissolves in the wash water, which then forms a breeding ground for mould, yeast and bacteria. Soon the filter is covered by a film of slime which gradually blocks it up. Inno+ has successfully tackled this problem, and is now marketing a biological system which requires much less maintenance. This was done within the framework of the *SBIR Air treatment systems used in intensive livestock* set up by the Ministry of Economic Affairs, Agriculture and Innovation. The new system also reduces energy costs by 40%.

The fouling and blockage of air scrubber filters is a constant problem for the livestock industry. The filters have to be regularly rinsed clean in order to prevent their complete blockage. This is a time-consuming job in a hot, noisy, dusty pressure chamber, and most farmers would rather not have to do it at all. Blockages also waste energy, because the ventilator has to work harder to push air through a partially blocked filter. More energy means higher costs. Another disadvantage is that the air scrubber operates less efficiently, resulting in higher ammonia emissions and odour nuisance – which means that farmers have to drain the system more often.

Slime

"We started by studying the wash water", explains Maurice Ortmans, CEO of Inno+. "We found all sorts of materials: particulate matter, enterobacteria, moulds and yeasts. Besides identifying the different particle types, we also determined their sizes." At first Inno+ used a mechanical filter system. "We soon found out that mechanical filtering was not the solution to the problem", says Ortmans, "because even with filters with a 50 µm pore size, most particulate matter went straight through." Most of the particulate matter turned out to be smaller than 50 µm, which meant that too little was being filtered out and the resultant film of slime blocked the filter.

Scrubber filter before cleaning

Scrubber filter after cleaning

Inno+Clean water sedimentation tank + denitrification reactor

Particulate matter consists of organic materials such as skin flakes, biomass and manure, which form an important source of nutrient for living organisms. These organisms cause the slime which blocks the filter. "Another filtering option uses a membrane technology", explains Ortmans. "It can completely remove organic particles from wash water, both particulate matter and organisms, but this technology is far too expensive." The process is energy-intensive and uses sulphuric acid and caustic soda to clean the membrane.

Flocculates

Inno+ went back to the drawing board. Since mechanical filtering was not the answer, several other options were studied. "In the end we came up with a flocculating agent around which the dust particles coagulate and sink", says Ortmans. Inno+ uses InnoClear, a flocculant specially developed for this application, which creates larger 'flakes'. A small percentage of these flakes will float, but most sink to the bottom in a special sedimentation tank with vertical partitions and an overflow. Clean water is sent back to the scrubber. The sedimentation tank is automatically emptied, and an extra filter fitted to the overflow ensures that no flakes end up in the scrubber. "InnoClear is a great flocculant, but it must never come into contact with the bacteria in a biological air scrubber", Ortmans explains. "So we placed this filter as an extra precaution." Inno+ has now taken out a patent on this air cleaning concept.

Different sties

Inno+ went to great lengths, testing this combined water filter and biological air scrubber in three types of sties: for meat pigs, meat chickens, and sows. In all three sties the number of hours spent on maintenance was cut by 85%. Drainage water use also went down drastically in combination with denitrification. For meat chickens and meat pigs, annual water use was cut by over 90%, and for sows by 75%. "We worked tremendously hard for five months, seven days a week", says Ortmans, "and sometimes we felt a bit like missionaries, but slow and steady wins the race." One of the problems Inno+ had to deal with was the system's pH value. This was extensively tested. "The flocculant worked best from pH 5, while the bacteria in the scrubber preferred a pH of 6.5 – 7", Ortmans explains. "We finally concluded that a pH of about 6.5 yields the best return. The flocculant still does its job and the scrubber removes 80 to 90% of ammonia from the sty air." Inno+ is still investigating how to best keep the pH constant. "Of course, lowering it by using sulphuric acid is out of the question", Ortmans explains. "The bacteria would no longer function, because the acid would take over the ammonium binding. But we are hopeful that we will be able to use another product which will both stabilise the pH value and serve as nutrient for the bacteria."

Government aid

Inno+ received government aid to develop this combination of a water filter and a biological air scrubber: first by way of a subsidy for technological modifications to air scrubbers, and then by participating in the SBIR.
The subsidy exists to make current air scrubber systems easier to use, more attractive, and more user-friendly.
The water filter in the sedimentation tank is an excellent example of this aim, so Inno+ will also market this technology separately. Farmers who have already bought a scrubber need only buy the water filter system.
The sedimentation tank can be attached to existing systems very simply, especially to chemical scrubbers. SBIR funding enabled Inno+ to successfully complete this project.
"We are already seeing a lot of interest in the system", says Ortmans. "The IPPC Directive will stimulate demand for air scrubbers in more and more European countries. The market can only get bigger. Combining the water filter and the air scrubber is the answer to one of farmers' most pressing problems today. What more can we ask?"

Transition to a biobased - or green - economy by using renewable biomass for high quality new industrial and strongly improved industrial non-food products

Grass-based packaging

The inedible parts of plants can be used as packaging material, thus contributing to a biobased economy. This ingenious idea was submitted by engineering firm Ingenia and product developer GKID (Gidy Knoors Innoveer Duurzaam - Gidy Knoors Innovate Sustainably) for the *SBIR Green raw materials for non-food products* set up by the Ministry of Economic Affairs, Agriculture and Innovation. They developed Haynest®, a new packaging material consisting of grassy fibres instead of polystyrene. Haynest® was developed as part of their project *Biodegradable EPS substitute on the basis of organic residues.*

Haynest®, a textured material, has the same characteristics as expanded polystyrene or EPS, which is widely used in product packaging. Unlike polystyrene, however, it is completely organic in origin. It is made out of natural grasses and therefore completely biodegradable. Haynest® is a new material introduced in an existing market. It is the first biofibre-based packaging material that protects products the same way polystyrene does. Haynest® reduces the use of fossil fuels and the accompanying CO_2 emissions.

Unrefined fibres

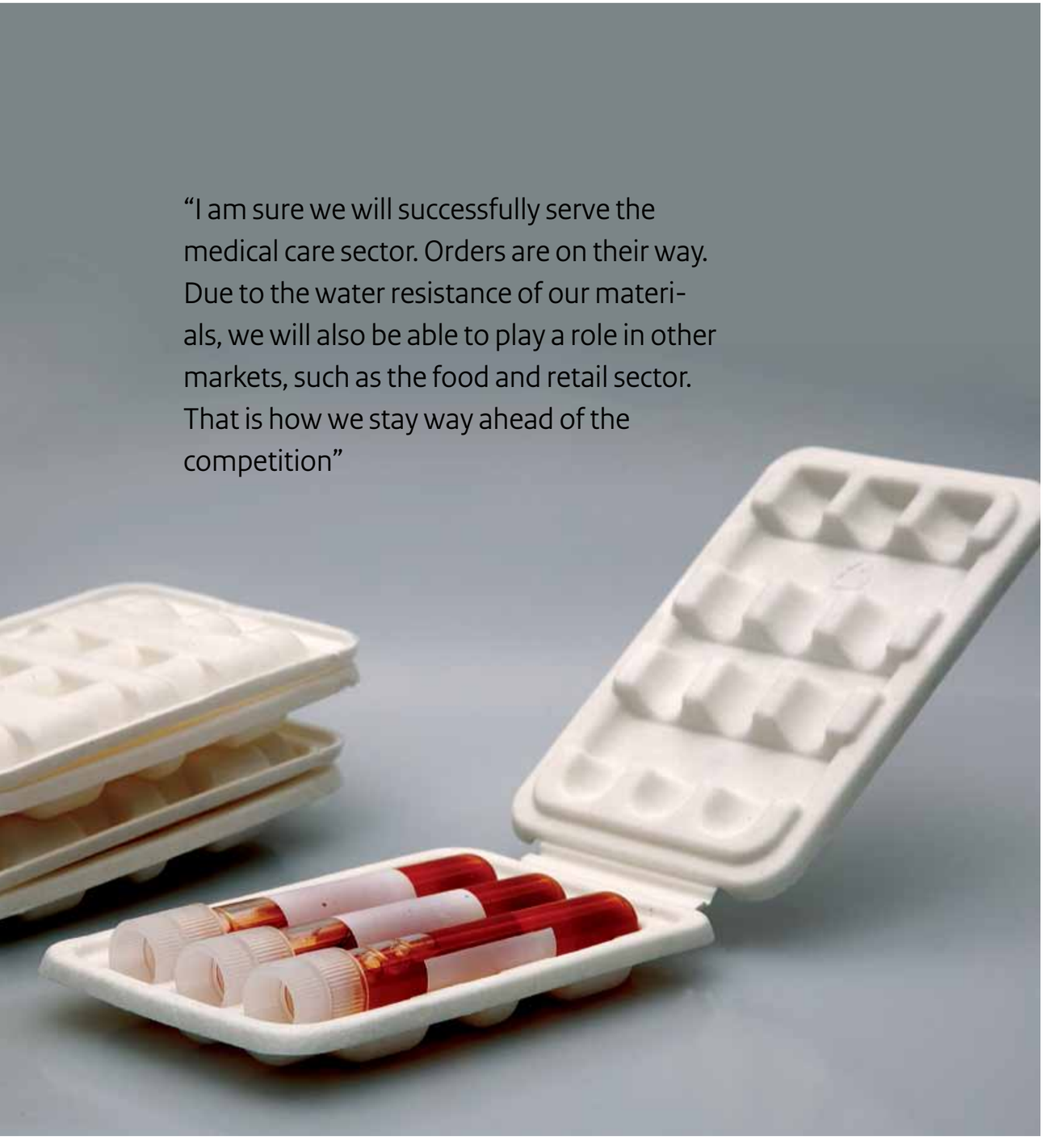
Haynest® is produced using raw, unrefined fibres, which are a by-product of other processes. Unlike many other biobased fibres, the fibres used in Haynest® are not grown especially for use in the packaging material. Roadside plants and other natural grass are already being mowed and harvested. Moreover, after customers use the Haynest® package, they can return it to the compost cycle through the green compost bin collected by municipalities. As a result of this cradle-to-cradle lifecycle, producing Haynest® requires a relatively low amount of energy.

Reducing the use of fossil fuels

Haynest® will primarily be used to replace existing EPS packaging. It can be used as industrial packaging, but potential applications also include secondary packaging for organic foods, such as egg crates and fruit trays. Consequently, Haynest® also contributes to reducing the climate change, making a positive contribution all along the line, from waste cycles to the distribution of environmentally hazardous waste. Moreover, it limits economic dependence on fossil fuels, which are becoming increasingly difficult to find.

Entrepreneurship

Haynest® is successfully produced by a cooperative effort involving three companies: engineering firm Ingenia, product developer GKID and Wolters Europe. They combined their knowledge and experience to process the organic raw materials and turn them into a viable product which can be put on the market. Various packaging end users have already enthusiastically embraced Haynest®. Several firms have agreed to evaluate the packaging, with the aim of starting to use Haynest® themselves.



Biobased packaging for the health care sector

In conversation with Mark Geerts from PaperFoam

In a country of potato eaters, innovation sooner or later had to result in a special application of starch, and PaperFoam has made it happen. This firm in Barneveld develops, produces and sells biobased packaging material made from foamed starch. “And thanks to SBIR, it’s also available for the health care sector,” says CEO Mark Geerts.

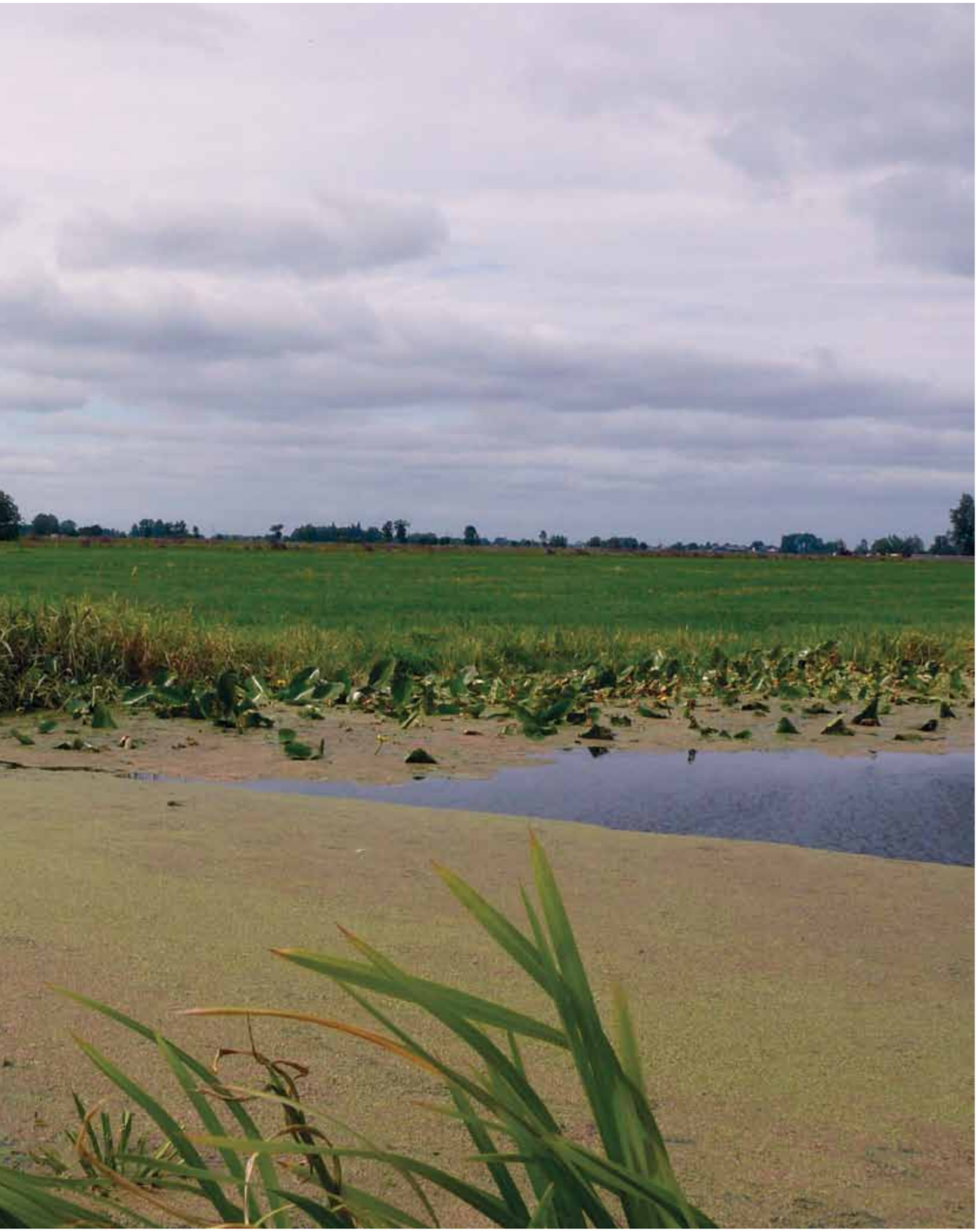
Forget about polystyrene; foamed starch rules, as far as packaging manufacturer PaperFoam is concerned. “Starch is a rich molecule, a beautiful material with many applications, and environmentally friendly too,” Geerts explains enthusiastically. “Combined with wood fibre, for example, it is an excellent ingredient for protective packaging. But also for egg crates – after all, we are from Barneveld, the poultry capital of the Netherlands.”
Anyone who hasn’t heard about the versatility of foamed starch yet must not have been paying attention for the last twelve years. PaperFoam has been producing biodegradable packaging in all shapes since 1998, serving a growing group of clients, including Apple and Motorola.

80% less CO_2

The ‘bioplastics’ produced by PaperFoam® are not just biodegradable. Compared to normal plastics, the production process of these organic plastics is much more environmentally friendly: 80% less CO_2 is emitted. Such a green product would be perfect for the health care sector, Geerts realised. “Our products help hospitals and care institutions to reduce their carbon footprints. What is more, our material does not attract as much dust as standard paper pulp packaging. This is a big advantage in sterile environments where dust is out of the question.” To be used effectively in the health care sector, bioplastics have to be strong enough to safely transport heavy medical devices; in addition, they must be water and radiation proof.

Waterproof

PaperFoam decided to submit a proposal for the *SBIR Renewable biomass* for the green economy set up by the Ministry of Economic Affairs, Agriculture and Innovation to study the feasibility of the use of bioplastics in the health care sector. “On the basis of the first results, we decided to continue studying the water resistance of our materials,” Geerts says. “In order to make the materials water resistant up to a specific point, all we had to do was adjust the recipe. If you really want materials to be fully waterproof, it is possible to coat or laminate them.” Geerts emphasises that he would never have been able to reach this conclusion so quickly without the support of this SBIR. “After all, research takes time and money. The confidence we have gained thanks to the study is equally important. I am sure we will successfully serve the medical care sector. Orders are on their way.
Due to the water resistance of our materials, we will also be able to play a role in other markets, such as the food and retail sector. That is how we stay way ahead of the competition.”



Adapting to changing circumstances

A changing climate calls for water management measures in the Netherlands, both now and in the future. Twenty companies were contracted for phase 1 in the *SBIR Climate adaptation and water* set up by the Ministry of Infrastructure and the Environment. Two examples: energy innovation office Investments in Sustainable Innovations (ISI) focuses on plastic (street) litter in public areas, and Hensen Consultancy focuses on improved water storage in the Netherlands.

Filtering plastic out of water

Enormous amounts of plastic litter are floating in the oceans worldwide. ISI investigated how the disposal of even more 'plastic soup' and other litter can be limited or stopped. In a consortium with a Dutch marine designer and a hydraulic supplier (Bakker Sliedrecht Electro Industrie B.V. and Hofman Sliedrecht B.V.), ISI developed a chain innovation for a system that can trap and process plastic litter in Dutch rivers. Once litter is caught a multifunctional vessel converts it into biofuel and/or electrical energy. Therefore, this system is self-supporting with respect to energy and raw materials, thus proactively improving the environment at considerably lower costs. Application on a larger scale may even result in a profit from this processing method. The consortium concluded that the use of this system makes it organizationally, environmentally, technologically and economically possible to remove plastic and other pollution from the environment.

More water storage in peat areas

Hensen Consultancy explored the development potential and market chances of *TOPSURF*. TOPSURF is made of organic residues, e.g. mud, manure and plant material. If a layer of TOPSURF is spread on top of peat, the supporting power of peat increases. The extra layer also puts a stop to continuous subsidence in peat field areas. That is good news for peat area managers and managers of water systems. Because the differences in height between internal water and outside water remain limited, it is easier to keep peat areas dry and more water can be stored in these areas. Moreover, TOPSURF contributes to better water quality and the reduction of CO_2 emissions due to peat oxidation.

The rise of SBIR in Europe

In 2007 the report *Precommercial procurement* was published, in this report the European Commission elaborates its method for procuring R&D in Europe. This report acknowledges the Dutch SBIR program and made it possible for the United Kingdom to start its own programme in 2008, the Small Business Research Initiative (SBRI). This program has a lot in common with the Dutch SBIR. In the Netherlands and the UK programmes a lot of companies work nowadays on groundbreaking innovations.

SBIR and SBRI did not go unnoticed in Europe. Other countries are also looking for new ways to encourage innovations for societal issues. Innovation was, and is, essential if Europe is to compete with countries such as China, India and the United States. SBIR stands out because it appeals to the innovative powers of small- and medium-sized enterprises. Success factors are contracts and agreements about intellectual property rights.

Sharing experience

In Europe there is a need to explore the experiences with national programmes and to learn from each other. Delegations from many European governments have visited the Netherlands and the United Kingdom in recent years. In 2010, the INNO-Partnering Forum, a joint project of several European innovation agencies, reviewed SBIR and SBRI. Other countries can use the resulting format to set up their own precommercial procurement programme.

A lot of European countries have taken an interest and may want to start their own SBIR-like programme. In order to stimulate the launch of such programmes, the European Commission has made funds available through the InnoPartnering Forum to support a twinning programme. Participating countries without prior experience will be given the chance to learn from the Netherlands and the United Kingdom.

... and European action

The European Commission has also actively started using pre-commercial procurement. In 2009 the first PCP tenders were launched in the field of health and transport, within the framework of the European Seventh Framework programme for research and technological development (KP7). In these projects companies, governments and procurers from several European countries explore how they can achieve successful PCP tenders. The European Commission is observing SBIR developments in the Netherlands, and is exploring options for a European SBIR with EC support.

Future

Experience shows that PCP, SBIR and SBRI occupy an important place in the European innovation landscape. Governments which would like to use their procurement power sustainably to promote innovation will find that PCP, SBIR and SBRI offer good methods for achieving that goal. Countries jointly explore how they can best link innovation with businesses, governments and buyers in order to meet the grand challenges in national and European contexts. The European Commission acknowledges PCP, SBIR and SBRI as important steps towards a valuable European PCP programme.

Generating cleaner and quieter mobile energy

In conversation with Paul Schurink from Bredenoord Aggregates

SBIR Hydrogen and fuel cell applications in civil works set up by the Ministry of Infrastructure and Environment gave Bredenoord Aggregates in Apeldoorn and NedStack in Arnhem the oppurtunity to develop a power aggregate to provide mobile electricity based on new technology. Their _Purity_ uses hydrogen and is therefore quieter and more environmentally friendly than diesel-powered generators.

Family firm Bredenoord Aggregates in Apeldoorn supplies electricity in places where there is no mains voltage, such as along motorways, at events or in case of a power failure. The company has been working for years to improve diesel generators and find alternatives. As fossil fuels become scarcer, the market increasingly demands solutions with lower carbon emissions. That is why Bredenoord decided in 2007 to sit down with NedStack to come up with a more sustainable alternative to diesel-powered generators. NedStack develops the central modules of the Polymer Electrolyte Membrane (PEM) fuel cell, and Bredenoord integrates everything into a generator to be marketed. While participating in this SBIR, Bredenoord built the Purity, a 5 kW fuel cell generator that can be used anywhere.

Purity at pop festivals

Whether the latest Purity can supply enough power for all purposes still remains to be seen. Where a normal diesel generator produces up to 1000 kW, the Purity only produces 15 kW at the most. “On the other hand, this is already three times more than the first prototype,” says Paul Schurink, business developer with Bredenoord. “During further development, we also ran tests replacing hydrogen by bioethanol. Hydrogen is often still too expensive, because the infrastructure has not yet been developed. Unfortunately, tests showed that it was technically impossible to turn bioethanol into hydrogen-rich gas suitable for fuel cells.” The Purity runs well on hydrogen: in the summer of 2010, it successfully supplied renewable electricity to a floating stage at the popular Dutch Lowlands music festival.

Waiting for a breakthrough

Schurink cannot yet predict when hydrogen generators will break through. It depends on the demand and on dropping prices for components and available hydrogen. As a result of this SBIR,
Schurink has noticed that the building sector shows great interest in the Purity. In the meantime, NedStack is working on reducing the price of components for the Purity. “SBIR has enabled us to make a big leap forward,” says Schurink. The Purity has been admired throughout the Netherlands during demonstrations and has successfully been used in field tests carried out by clients. The fuel cell generator recently became part of a pilot project: from November 2010 on, the Purity has been supplying green energy for an ecological land bridge for animals to cross the A28 motorway at Hulshorst. Schurink is confident that new energy technologies such as the Purity will conquer the world. “Once hydrogen breaks through in the market and becomes available on a larger scale, we possess the know-how to give clients a superb standard of service – just as we do now with diesel, biogas and synthetic diesel.”

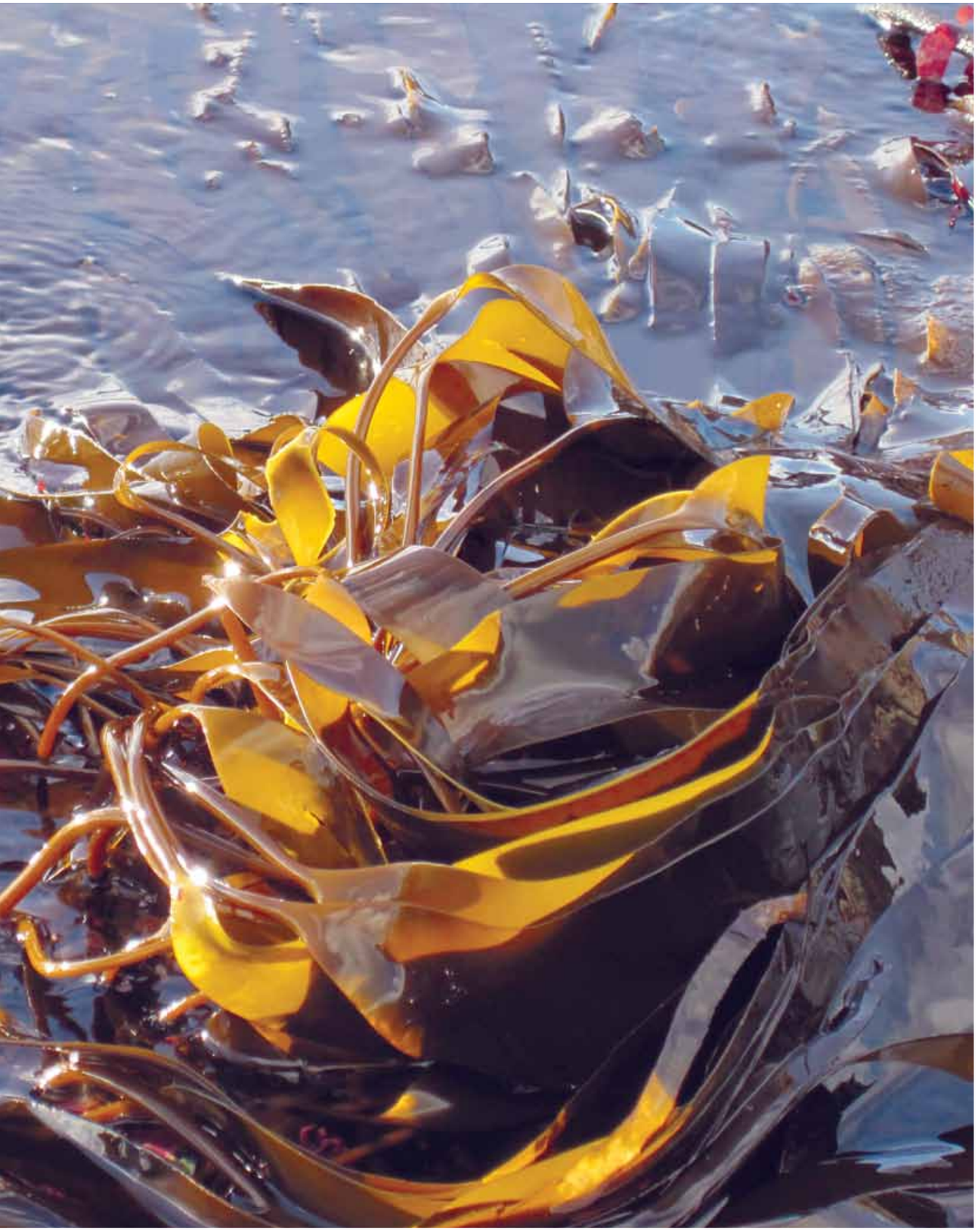
Hybrid mobile variable message signs as an alternative to diesel generators

The diesel generators generally used in civil works cause noise nuisance and harmful emissions. Brinkmann & Niemeijer Motoren (B&N) has developed an environmentally-friendly hybrid traffic information panel in cooperation with JD Nederland Traffic Safety Systems and sustainable energy consultancy Ecofys, within the framework of *SBIR Hydrogen and fuel cell applications in civil works.*

In the Autonomous Fuel Cell project, the trailer mounted variable message signs conventional diesel generator is replaced by a small reformer which turns fuel into hydrogen for a fuel cell system. After completing the feasibility study B&N and JD Nederland chose the Emerald, a system produced by the English company Voller Energy. This is a plug & play system which uses LPG fuel and an integrated reformer, fuel cell, voltage regulator and balance of plant to charge the battery pack. Voller went bankrupt during the project, but by that time the partners had learned much about other available fuel cell systems and saw enough market opportunities to carry on.

Successful demonstration

The SBIR project led to a successful demonstration at the Intertraffic Fair in April 2008. After the fair the Swedish Road Administration (TrafikVärket) and the city of Stockholm invited for offers for environmentally-friendly, noise-free information panels. For these panels the project partners use the Direct methanol fuel cell technology made by Smart Fuel Cells, portable fuel cells. The text trailers have four large built-in solar panels and a fuel cell system. The Stockholm traffic control centre programs and monitors the trailers. Operators at the traffic control centre are in complete control of the text trailers, and use wireless access to monitor the fuel level, the LED display, the opening of compartments, battery voltages, and any tilting or movement. A silent, clean, and sustainable solution for the city of Stockholm.



Use seaweeds as a source of renewable biomass by developing cultivation and harvesting systems for seaweed

Seaweed cultivation near wind turbines at sea

How can native seaweeds be profitable cultivated near offshore wind generator parks? Research and consultancy firm Ecofys used the *SBIR Cultivation and harvesting of seaweeds* set up by the Ministry of Economic Affairs, Agriculture and Innovation to explore how seaweed from the North Sea can be viably cultivated and harvested within the infrastructure of a wind-energy park at sea.

The number of off shore wind-energy parks will increase in the coming years. Farming of seaweed in their vicinity has therefore potential. Participating in this SBIR gave Ecofys the opportunity to explore the innovative application of seaweed cultivation near wind turbines at sea, with the prospect of a consequent boost to Dutch aquaculture, its energy sector, and its fishing and offshore industries. After all, seaweed can be used to develop renewable biomass and renewable energy while at the same time reusing nutrients from the sea.

Renewable energy and seaweed cultivation

Ecofys' research is intended to provide insight into the economic and technical aspects of seaweed cultivation, but also into its manageability when introduced beneath an existing wind farm. Attention is being given both to the ecology and to the safety and continuity of the operation of the wind farms. Ecofys is a reputable sustainable energy consultancy firm and was involved in the first development and construction of offshore wind turbine farms.
The bureau has also spent some years studying concepts for the cultivation of aquatic biomass for bioenergy purposes. For this project, Ecofys is working together with the energy company Eneco and the The Energy Research Centre of the Netherlands (ECN). Both companies aim to make the sypply of energy more sustainable. Also Ocean Fuel is involved. This company developed an efficient an cost-effective seaweed cultivation system to crop carbohydrate-rich seaweeds for a number of applications.

Use seaweeds as a source of renewable biomass by developing cultivation and harvesting systems for seaweed

Sustainable seaweed cultivation in sea farms

Seaweed is used in more and more products: in food, cosmetics and health care, for example, but also as a renewable biomass for bio fuels and even as a water purification system. Within the *SBIR Cultivation and harvesting of seaweeds* set up by the Ministry of Economic Affairs, Agriculture and Innovation, Hortimare has explored how seaweed can be produced sustainably and on a large scale.

Hortimare literally means *garden in the sea*. The company specialises in the selection, propagation and preservation of seaweeds. For the SBIR project *Sustainable sea farm*, Hortimare investigated the preconditions for a viable seaweed horticulture. One precondition was that the seaweed is produced in a sustainable manner. Hortimare focused especially on the cultivation of starting material. If it is possible to cultivate and market young plants, this could form the basis for the wider cultivation of seaweed: a crucial step in a viable line of business. In this project Hortimare cooperated with the Royal Netherlands Institute for Sea Research (NIOZ), Plant Research International, and Deltares.

Seaweed specialisation

The seaweed production chain is still very limited and will only develop further with the emergence of specialisations in the chain, just as in the land-based horticultural industry. This is why Hortimare's feasibility study asked specific questions about growth and cultivation, and the factors which play a role in these processes. The firm also looked at location factors: does distance to the shore, in relation to nutrients (manure), light, and water temperature, influence seaweed cultivation? The company did further research into seaweed adherence in order to determine which kind of system can function as a carrier. If the seaweed is attached to a suitable carrier, several types of young seaweed plants will then become available for experimental work and commercial production.

Hortimare developed its seaweed cultivation technology in collaboration with a number of research institutes. Some local companies were also involved, and have taken an interest because the cultivation of seaweed represented a clear opportunity for the expansion and broadening of their current activities.

Aerating manure to prevent methane formation

In the oxygen-poor environment of liquid manure, anaerobic bacteria produce the greenhouse gas methane. KWA Business consultants and Stefos Ltd., a manure storage systems producer, have developed a combined system which mixes manure with air and aerates manure during storage. Their idea was contracted within the *SBIR Reduction of methane emission from outside manure storage sites* set up by the Ministry of Economic Affairs, Agriculture and Innovation and the Ministry of Infrastructure and the Environment.

The system used by KWA and Stefos is an alternative to the so-called propeller mixers which are currently often used to homogenize manure. What is innovative about their methane reduction system is that the aeration which homogenizes the manure, if applied in the right dosage, also reduces methane production levels. The advantages are lower energy consumption and reduced greenhouse gas emissions. The system also reduces ammonia and odour levels from the storage silo. The electrically-driven compressor is also cleaner and quieter than the tractors often used for mixing slurry storages using one or more propeller mixers.

Prevention of laughing gas formation

The SBIR feasibility study carried out by KWA Business Consultants and Stefos included a risk assessment of the new aeration system for the potential user. Methane reduction is an advantage, but the aeration process risks the formation of laughing gas (N_2O), an especially potent greenhouse gas. The formation of laughing gas could nullify any achieved gains in methane reduction.

So the feasibility study focused on finding the aeration conditions under which no (or a minimum amount of) N_2O was formed. The study came up with positive results. An analogy was found in the purification of water in sewage treatment plants, where aeration has long been used. Research into this method showed that the risk of laughing gas formation in the intended aeration regime is zero. Methane formation is substantially reduced by the system; the amount of this reduction depends on the type of manure.

Opportunities for the aeration of manure

The new manure aeration system is especially suited to larger manure storages. Conventional propeller mixers can easily be replaced by aeration mixers. The additional costs are limited, especially as it entails a replacement investment for a mixer system. The scale-up in the agricultural sector offers opportunities for the economic viability of aeration-based mixer systems.

Methane oxidation from the top layer of manure storage sites

When storing manure in places without air, methane is produced. OonKAY!'s solution for reducing methane emissions from manure storage sites is the biological conversion of methane in the top layer of the surrounding soil. OonKAY! explored the feasibility together with PAS Mestopslagsystemen (PAS slurry storage systems) within the framework of *SBIR Reducing methane emissions from manure storage sites* set up by the Ministry of Economic Affairs, Agriculture and Innovation and the Ministry of Infrastructure and the Environment.

OonKAY! participated in this SBIR with an innovative idea for reducing methane emissions from manure storage sites. Their solution to lower the contribution of manure storage sites to the greenhouse effect is to bring methane into the surrounding soil, where it is biologically converted. The soil surrounding manure storage sites functions as a kind of biofilter.

Methane reduction at little expense

The aim of this SBIR was to develop a system reducing emission of methane by at least 75%, at little expense and without adverse effects to other environmental issues. The system designed by OonKAY! and PAS Mestopslag-systemen does in fact meet these criteria. The two companies developed a cheap way to reduce methane emissions from manure storage sites. This form of methane reduction is based on widely accepted measures for greenhouse gas reduction and costs less than other ways of reducing methane emissions.

Reductions in odour and methane emissions

In the Netherlands and internationally, the possibility to use the surrounding soil as a biofilter for rubbish dumps had already been researched and proven to be effective.

The feasibility study carried out by OonKAY! and PAS Mestopslagsystemen proved that this system is both technically and financially viable and safe for all current types of manure storage sites. Methane can be easily captured from the slurry depot and transported into the ground, where it is then converted. Bad odours are also converted, lowering public inconvenience near manure storage sites.

Pilot at a slurry depot

In the second phase of this SBIR, OonKAY! and PAS Mestopslagsystemen are cooperating with the University of Hamburg, which has a lot of experience with oxidation of methane in dumps. The aim of the second phase is to built a pilot system to assess the system's performance and to determine a number of more detailed design parameters. In the future, the reduction of methane emissions through the oxidation system will need to be reported to the UNFCCC (United Nations Framework Convention on Climate Change). In order to be accepted, OonKAY! and PAS Mestopslagsystemen are seeking to have their study published in a leading scientific journal on technology.

Barge Trucks enable emission-free inland shipping

The firm Dutch Logistic Development, which is now part of Maritime Research Institute Netherlands (MARIN), was commissioned to explore the feasibility of marketing environmentally-friendly small inland vessels, so-called Barge Trucks. This was done within the framework of the *SBIR Inland shipping in small waterways* set up by the Ministry of Infrastructure and the Environment. Barge Trucks make it possible to use small waterways as a clean way for transport. For example, they can be used to transport waste out of large cities.

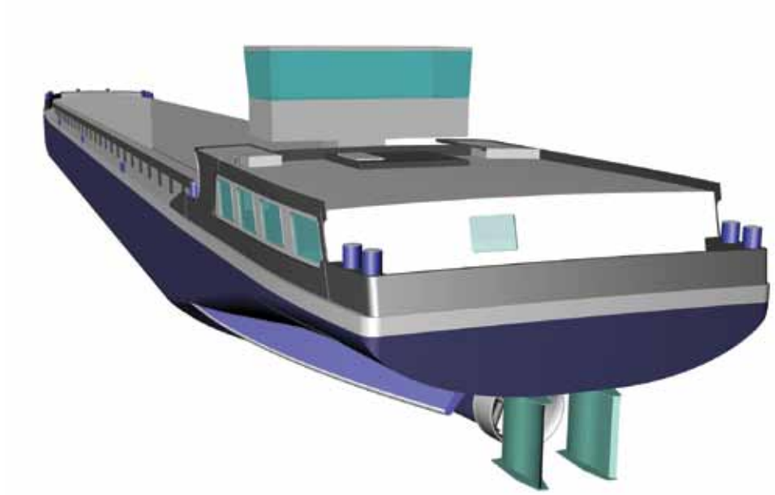
Congestion of traffic on the road and the regulations governing road transport are becoming ever stricter. A Barge Truck combines a clean push boat with cargo barge units that can each carry 600 tons of cargo and are particularly convenient for transporting containers or bulk cargo along small waterways. This system is cost-effective on small waterways outside urban areas. If necessary, the barges can be propelled independently using a small clean motor (pump jet). The barges are linkable and can be expanded to the maximum size the local waterways allow. Using the Barge Truck results in at least 20% lower pollutant emissions then with of road transport.

Viable Barge Trucks

Together with EVO (Network organisation for logistics and transport) and Mokum (Amsterdam) Mariteam, MARIN explored the feasibility of the innovative idea of the Barge Truck. Two of the three studied business cases were completed in 2009, with a positive outcome. Existing transport modes for domestic and industrial waste around the Dutch city of Alkmaar were mapped out. The researchers took into account both the costs and the emissions of the Barge Truck. The Barge Truck can be emission-free in operation and is ideal for use in narrow waterways, such as the Class II waterways built in the Netherlands by King William I at the beginning of the nineteenth century. In Amsterdam, smaller Barge Trucks could be used for transporting waste, building materials, sand and gravel. The larger Barge Trucks are convenient for the small waterways outside urban areas, for example, in the provinces of Brabant and North-Holland and in the polders.

SBIR phase 3: marketing

In SBIR's second phase the Barge Truck was technologically optimized. Barge Trucks require little energy, reduce emissions, and are generally manoeuvrable and easy to link together. The HuisVuil Centrale (domestic waste processing facility, HVC) in Alkmaar and a group in Brabant (Hendrix UTD in Helmond, Inland Terminal Veghel, and the Province of Brabant) have expressed their interest in using Barge Trucks. HVC may possibly opt for Barge Trucks running on biogas to transport waste in a sustainable way. In that case the containers will mostly be transported to the waste incineration plant in Alkmaar for generating energy. The Brabant group may also choose the Barge Truck option in order to safeguard the transport by water in the future.



Reducing freight traffic on the road by more inland shipping on smaller canals

Training and a franchise formula as a solution to inland shipping personnel shortage

Mercurius shipping group (MSG) participated in the *SBIR Inland shipping in small waterways* set up by the Ministry of Infrastructure and the Environment. To combat the impending shortage of personnel in the inland shipping industry, MSG wants to bring to the market 25 small, environmentally-friendly inland vessels having a capacity of up to 1,000 tons. Entrepreneurs can operate these vessels by way of a franchise system and are trained to become captain of a barge.

The MSG project to address the shortage of qualified inland shipping personnel is called M-Factor transport concept. A feasibility study of this concept, carried out by the Expertise- en InnovatieCentrum Binnenvaart (inland shipping expertise and innovation centre, EICB), Delft University of Technology, and Rotterdam University was completed in July 2008. In the second phase of the SBIR programme, MSG did systematic research to find out whether the innovation could be put into actual practice and whether the definitive innovation would meet market demands.

Breaking down barriers for future captains

The outcome of the study is a design for a small inland vessel which can both make a professional profit and successfully compete with road transport. The modular structure of the design enables four different versions and makes it possible to cater flexibly to market demands. During the second phase of the SBIR, MSG also developed a franchise-based operations system, with the aim of breaking down barriers for entrepreneurs and affording them easier entry to the inland shipping market.

Mercurius both coaches and funds interested franchisees. With no previous experience or starting capital, after one year they are enabled to enter the professional inland shipping market and successfully operate an inland vessel.

New-style captains

The operations model includes a specific training course. Lateral-entry captains can be trained to become an inland vessel captain within a year, by way of abridged vocational training. The market has specified the demands for the training *New style captain*, and a vocational training expert was engaged to translate these market demands into work processes which fit into the normal training system.

The new small inland vessel was built in MSG's own shipyard in Serbia and launched in 2011.

Mowing without harming nature

Sometimes innovation is not about re-inventing the wheel; sometimes all you need to do is find new wheels. While participating in *SBIR Environment-friendly operations,* De Beijer Bladel, a company from Hapert, developed a mowing machine with wheels which do not damage nature: caterpillar tracks. Its innovative mower is called the Multitrack.

De Beijer Bladel is an agricultural engineering contracting firm that recycles greenwood and scrap wood. In 2007, it submitted a proposal within the framework of SBIR Environment-friendly operations. The Ministry of Economic Affairs, Innovation and Agriculture was looking for innovations which would limit damage to nature in the course of operating a business or conducting other activities in open spaces. De Beijer Bladel invented a mowing machine suitable for mowing wet grasslands, something which the Dutch Forestry Commission has been advocating since the nineties. The study resulted in the Multitrack. The Multitrack is a converted Snowcat, a truck from the United States designed for moving around on snow.

Low load

Participating in this SBIR enabled De Beijer Bladel to develop the Snowcat into the Multitrack mowing machine. The low weight of the Snowcat was combined with caterpillar tracks, which meant that the Multitrack places a minimal load on the ground. The load of the Multitrack basic machine without tools, for example, is three times less than the average walker. This is why the Multitrack is ideal for mowing in vulnerable wet natural areas that cannot tolerate much weight, such as grasslands. The low load is also an advantage when carrying out refining work in woods or managing roadsides. The Multitrack causes little to no harm to the soil in those nature areas to be maintained.

Unknown markets

One ground condition the Ministry pointed out was that the machine had to be put on the market. Its market launch is now happening. Natuurmonumenten, a Dutch nature conservation organisation, has approached De Beijer Bladel about the Multitrack. Other potential markets are also open. For example, De Beijer Bladel is considering mowing golf courses or roadsides. The possibilities are almost endless.

SBIR: sustainability, innovation and corporate social responsibility (CSR)

Van Loenen en Roos talk about the playing field of innovation, sustainability and corporate responsibility in which SBIR is situated.

"Government is co-responsible for creating a sustainable society", says Dries van Loenen, head of the Department of Sustainable Entrepreneurship at the Ministry of Economic Affairs, Agriculture and Innovation. His colleague André Roos, programme manager SBIR who recently joined the same department, adds: "SBIR contributes by enabling companies to develop their innovative products quickly."

Since 2011 SBIR is part of the Department of Sustainable Entrepreneurship at the Ministry of Economic Affairs, Agriculture and Innovation. Dries van Loenen is very enthusiastic about this expansion of his department. "The SBIR instrument ties in very well with the government's innovation policy. It encourages also companies to take social responsibility." Van Loenen says that SBIR and the department strengthen each other: "We serve the same cause: solving societal problems in a sustainable way and with respect for the environment."

Green procurement equals procurement of innovations

To make society more sustainable, the government starts by being a good example. Roos: "The government as a procurer can play an important role in sustainable entrepreneurship, innovation capacity, and sustainability." The total government procurement budget amounts to 70 billion euros. "Something that has not yet been created may well be worth developing. SBIR is a very suitable tool for this. It quickly results in real products, and it stimulates competition. The government can then buy the best product for the best price, as can other companies and customers." The economic crisis makes it particularly important that government shoulders its responsibilities and sets a good example in terms of innovation and sustainability. Green procurement therefore equals procurement of innovations.

Green growth

"It is still a challenge for the government to procure green, and to procure innovations", says Van Loenen. "SBIR helps in this search." This type of procurement comes into play if there is a direct need to solve a societal problem in a practical way. For example, SBIR supports projects which strengthen a green economy. They fill a need for biodegradable materials which are also strong. This way economic growth goes hand in hand with stimulating sustainability in a socially responsible manner. Roos: "Moreover, the way SBIR is organised is attractive to companies: SBIR takes care of the funding and so provides continuity in developing the new product.
We also get feed back that companies value the opportunity to create solutions which contribute to society."

This is a publication of:

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SBIR programme
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NL Agency is a department of the Dutch ministry of Economic Affairs,Agriculture and Innovation that implements government policy for sustainability, innovation, and international business and cooperation. It is the contact point for businesses, educational institutions and government bodies for information and advice, financing, networking and regulatory matters.

The division NL Innovation helps Dutch businesses to innovate, by providing finance, advice and contacts.