



vito VISION

James
Bint says,
**“ENJOY
BELGIAN
FRIES”**

VITO VISION / VOLUME 2017 / JANUARY EDITION

COVER STORY

WEBTOOL HELPS
PREDICT POTATO
HARVEST

EFFICIENT AND
SUSTAINABLE CHEMICAL
PROCESSES

FRESH CAPITAL FOR DRONE
PLATFORM UNIFLY

COVER STORY

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Dear Reader,

For 25 years, VITO has been making a priority of sustainable energy. In 2016, we lived up to our name as research centre when we drilled two wells 3.6 kilometres deep to obtain piping-hot water from the Kempen underground. We will soon be heating the buildings of VITO/SCK and Belgoprocess with geothermal energy.

VITO's research focuses on cleantech and sustainable development. This edition of VITO Vision also puts exciting projects in the spotlight. One of the research lines of VITO, for example, focuses on process intensification, i.e. making production processes more efficient and more sustainable. In the pharmaceutical and chemical industries, traditional separation processes – essential to production – use large amounts of energy. VITO-patented membrane technology is capable of cutting this energy consumption by more than half. VITO/EnergyVille in turn is creating a reduced-regulation test zone for projects with solar and thermal energy. And with the ESTMAP project, we are making planning and decision-making about the future energy system in Europe easier.

Would you like to know more about VITO Middle East, the CON4EI project and our first business games? Read on!

I hope you enjoy reading this edition of our VITO VISION,

Dirk Fransaer
Managing director VITO

NEW WEBTOOL HELPS PREDICT
POTATO HARVEST

COVER STORY

The research project iPot was launched in June 2014. Together with three partners, VITO created a system for the Belgian potato sector to monitor the growth of potatoes. In 2017, the commercial version of this webtool will be marketed under the name Watch iT Grow.

iPot is an initiative of VITO in collaboration with Belgapom (the professional association of the Belgian potato industry), CRA-W (the Walloon Agricultural Research Centre in Gembloux) and the University of Liege. Isabelle Piccard of VITO: "We are developing a web application that helps potato traders and the processing industry to monitor the growth of the potatoes. By using weather data, satellite images, aerial images (taken with drones) and data from ground measurements, users are able to follow whether the crops emerge properly from the ground, how the growth is developing, whether diseases might be present, when farmers can start harvesting ... The University of Liege combines the collected data into crop growth models. Using this, the webtool is able to predict the expected yield per plot."

Sustainably increasing potato
production

Belgium is the largest exporter of frozen potato products in the world. Romain Cools of Belgapom: "Each year, Belgian companies process four million tonnes of potatoes into French fries, potato chips and other products. To

continue to grow, we need more potatoes. But expansion of agricultural land is not an option. Using Watch iT Grow, we are better able to monitor potato production and increase yields. This allows us to ensure and further expand our role as a global player in the potato industry."

The iPot project ends in May 2017. What started as a research project, funded by the Federal Public Planning Service for Science Policy (BELSPO), has grown into an innovative webtool. From the spring of 2017, not only the academic world but also industry and farmers will be able to use the tool. Romain Cools: "The tool helps farmers optimise their available surface area, so they can continue to grow in a sustainable way. We thus are strengthening the Belgian economy and ensuring that Belgium remains the largest exporter of frozen potato products."

The commercial webtool will be called Watch iT Grow. "The application will be provided free of charge during the first year, after that it will be a paid service," says Isabelle Piccard. "Users can continue to rely on expert support. In the future it will also be possible to monitor crops other than potatoes."

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Isabelle Piccard (VITO) and Romain Cools (Belgapom)



Screenshot of the webtool Watch iT Grow



5 MILLION EUROS IN FRESH CAPITAL FOR DRONE PLATFORM UNIFLY



JAPANESE MARKET LEADER CONFIRMS CONFIDENCE IN VITO SPIN-OFF

A drone to study agricultural crops, to inspect solar panels, to deliver packages ... As the number of applications for drones grows, so does traffic in the airspace. UniflyUTMS is a software platform developed by Unifly that informs drone users where and when they can legally fly. The VITO spin-off recently obtained 5 million euros in fresh capital.

The rapidly-growing market for drones or UAVs (Unmanned Aerial Vehicles) is creating a greater need for systems that ensure safety and enforce the newly-introduced regulations. Unifly develops and markets a platform to safely integrate drones in the airspace. The system includes air traffic control for drones (Unmanned Traffic Management, UTM) and operational management of drone activities. Drone users who register receive an overview of the airspace and the ability to plan a flight with a drone via a user-friendly interface. This is no luxury since there are a lot of no-fly zones in Belgium: restricted zones include densely-populated areas, the airspace over weekly markets or events, over army bases and around wind turbines.

Market confidence

Unifly was founded as a VITO spin-off in 2015, and in June 2016 was already receiving financial support from the Flemish region (SOFI Fund) and the investment fund Qbic. On 17 November 2016, the VITO spin-off completed a second round of financing for a total of 5 million euros. Eighty percent of this comes from Terra Drone, the Japanese market leader in drone management and systems integration. The additional funding will allow Unifly to develop the



Official signing for the additional funding

UniflyUTMS platform more quickly into a de facto standard for UTM. "The investment by Terra Drone, along with that of Qbic and the investment company PMV, shows the market's confidence in our technology," says Unifly CEO Marc Kegelaers. "With the new funding, we aim to become a global player in the domain of UTM."

More employees

As a direct result of the investment, Unifly will grow from twelve employees today to over forty in 2018. This is partly

thanks to the Flemish government, which invested very early in the young high-tech company and thus gave private partners the confidence to do the same. Unifly's technological head-start, its in-depth industry knowledge and the fact that Unifly is a partner in international initiatives around standardisation and regulation, are additional strengths to succeed in the highly specialised drone world.

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"TOP EXAMPLE OF VITO'S VALORISATION STRATEGY"

Unifly is a fine example of the valorisation strategy used by VITO in recent years. The combination of advanced technology and market opportunities ensured that the start-up quickly evolved into a successful company in a future-oriented sector. Walter

Eevers, Research Director at VITO: "We are proud of the Unifly team. They have proven to be capable of conquering the world on their own, and of contributing to the safe integration of drones in the skies."



FLEMISH INNOVATION POLICY SUPPORTS BLUECHEM



3.4 MILLION EUROS IN EUROPEAN FUNDING FOR SUSTAINABLE CHEMISTRY INCUBATOR IN ANTWERP

At the end of November 2016, the Flemish Government announced it was granting 3.4 million euros in European funding to BlueChem, the future incubator for sustainable energy in Antwerp. The incubator aims to valorise knowledge and experience in the chemical industry through the creation of new companies. The investment is part of the renewed Flemish innovation policy that designates chemicals and plastics as a spearhead cluster.

Antwerp is home to one of the world's largest chemical complexes. Yet it is not easy to valorise all the knowledge and experience accumulated there. The BlueChem incubator aims to help start-ups and innovative projects in sustainable chemistry grow and succeed. The 3 375 m² incubator, located in the Blue Gate Antwerp business zone, will offer a mix of flexible workplaces for starters, and individual offices and labs for SMEs, large enterprises and research institutions. The building will cost a total of 8.68 million euros. Its opening is scheduled for early 2020.

Robust service

For construction of the incubator, the Flemish Government awarded the project 3.4 million euros in European aid. Eight partners are supporting the project: essenscia (the federation of the chemical and life sciences industries), Bopro (BSI), DEC (DEME Environmental Contractors), VITO, the Provincial Development Agency (POM) Antwerp, PMV, AG VESPA and the city of Antwerp.

The wide-ranging chemistry knowledge of the various partners involved

ensures that the start-ups will be well served. Moreover, BlueChem is working closely with the University of Antwerp and Catalisti (formerly FISCH), in which VITO is also participating.

Bert Bouwman, Unit Manager Sustainable Chemistry VITO: "With our commitment as a co-operating partner in BlueChem, we aim not only to strengthen VITO's research programme in sustainable chemistry. VITO also wishes to assist in the development of start-up companies and their innovative sustainable chemistry projects, and to put them on track for further growth. In this way, we aim to anchor the chemical industry in Antwerp and Flanders, and to further increase its competitiveness on the world stage."

Important export sector

The Flemish Government's investment in BlueChem is part of the renewed Flemish innovation policy that designates

the chemical sector and the plastics industry as a spearhead cluster. Along with pharmaceuticals, chemicals and plastics are Flanders' principal export sector. They are crucial for employment and the competitiveness of the Flemish economy. With its strategic choice, the Flemish Government is supporting the many innovations in the chemical and plastics processing industry that are looking for alternative or bio-based raw materials, greater energy efficiency and the reuse of waste and incidental flows in a circular economy. The 'Chemicals and Plastics spearhead cluster' will build on the experience of Catalisti and Flanders' PlasticVision (FPV). VITO was actively involved in the creation of the new spearhead cluster and will continue to support it.

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PRODUCING MUCH MORE WITH MUCH LESS

VITO OFFERS COMPETITIVE ALTERNATIVES FOR THE PHARMACEUTICAL AND CHEMICAL INDUSTRIES

Continuing to produce top quality pharmaceutical drugs and fine chemicals while limiting costs and energy consumption is a challenge that VITO is addressing, alongside the pharmaceutical and fine chemicals industries. VITO develops practical solutions to improve industrial processes. In this, sustainability is still the guiding principle, with cost reduction, energy saving and higher product yields the result.

To remain profitable, the chemical and pharmaceutical sectors must undergo a process of reinvention. "VITO develops technologies that accelerate this process," says Marzio Monagheddu of VITO. "We focus among other things on process intensification, making processes more efficient and more sustainable. In this, low consumption of energy and other resources are an absolute necessity."

Process optimisation 2.0

"Of course, these industries have progressed during the past few years," continues Roel Vleeschouwers of VITO. "Many companies have already invested heavily in process optimisation. They look for disruptive solutions that outperform the traditional chemical methods: process optimisation 2.0, as it were. VITO offers innovative technologies and state-of-the-art test infrastructure at lab and pilot scale and conducts techno-economic feasibility studies. As a neutral research partner, we are able to give objective advice, independent of third parties. Our customers also benefit from our extensive network in the research community and industry.

They gain access to complementary expertise and collaboration."

Different needs per player

VITO targets R&D players as well as manufacturers, explains Metin Bulut of VITO. "R&D players aim at the shortest possible time to market, a higher success rate and higher performance. When they encounter technical problems such as process inhibition, they can come to us. For one R&D company, we are for example investigating the enzymatic synthesis of an industrial protein."

"Organisations that manufacture for pharmaceutical companies on a con-

tract basis can also call on VITO, for example, to reduce their production costs without sacrificing product quality. Looking at it this way, they too are focused on innovation. Large pharmaceutical companies are driven to innovation by time to market and the need to reduce production costs. VITO provides solutions for these challenges, such as our patented VID technology."

50 to 90 % lower energy costs

Industrial processes often involve complex separation steps in which components are isolated, purified or concentrated. On the one hand, VITO offers solutions for downstream processing in which target molecules are

purified to a final product in successive steps. On the other hand, VITO works on the integration of separation and conversion. "In each case, membranes are key to reducing energy costs," says Roel Vleeschouwers. "Traditional separation processes absorb energy: from 40 to as much as 70 % according to a detailed study of industrial chemical processes. In comparison with conventional processes such as evaporation and distillation, membranes are much less energy-intensive, since the separations generally take place at room temperature, without the different components undergoing a phase transition. Thanks to membrane technology, energy costs can be reduced by 50 to 90 %. Moreover, higher product quality can be obtained for temperature-sensitive molecules. Organic Solvent Nanofiltration (OSN) is an interesting example of the evolution in membrane technology that is contributing to sustainable chemical processes. Also, the compactness and the possibility of scaling up a modular system are major industrial benefits of membranes."

Functional membranes

And development continues. VITO together with the University of Antwerp has developed a new generation of functional membranes with the patented FunMem® platform. Marzio Monagheddu: "FunMem® allows separations to be performed based on affinity, not just based on size. Specific organic groups applied to the surface of ceramic membranes make the membrane functional. An interesting application is the removal of impurities from so-called Active Pharmaceutical Ingredients or APIs. Another example is the separation of catalysts from the production process, so that they can be reused. For example, we succeeded in recovering the expensive noble metal palladium, a widely used catalyst in the chemical industry."

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OPTIMIZATION WITH VID TECHNOLOGY

So-called substrate inhibition occurs in certain chemical reactions. When this inhibition of the process takes place, high concentrations of substrate can lead to the formation of undesirable by-products, with reduced yield and lower product quality as a result.

For this reason companies prefer to perform these vulnerable reactions in a highly-diluted medium. This has a major disadvantage: you need large quantities of solvent and bulky reactors to create small amounts of a final product, for example 6 000

litres of solvent for only 50 kilograms of product.

Roel Vleeschouwers: "VITO's patented VID technology (Volume Intensified Dilution) integrates membranes directly in the process, so that more product can be made with smaller reactors and less solvent. VID makes inhibited reactions much more efficient by reproducing a diluted reaction mixture in a smaller reaction vessel. Sending the reaction mixture over a membrane allows the solvent to be reused. Some reactions benefit from efficiency increases of more than 80 %."

CHEAPER WITH FUNMEM® MEMBRANES

Chiral molecules have two forms: they look the same, but in fact are each other's mirror image. But this distinction is crucial. One form has the desired therapeutic effect, while the mirror image can result in life-threatening side effects.

Metin Bulut: "Traditional chiral separation is done using chromatography, but this is expensive and time consuming,

uses a lot of solvent and is detrimental to the environment. We are now examining whether we can perform chiral separations using FunMem® membranes. A test case for chiral amines has already shown that membrane separation is economically viable if we combine the right membranes. It's promising for the pharmaceutical and chemical industry."

BDM TEAM

The VITO business development (BDM) team for sustainable chemistry focuses on the European pharmaceutical, food and flavour & fragrance industry and (fine) chemistry. Bio-engineer Roel Vleeschouwers has over twenty years of experience, eleven of which have been at VITO. His expertise lies mainly in membrane technology and its integration into a wide range of processes. Metin Bulut has a bioengineering doctorate in catalytic technology and worked as a VITO contract researcher on more than forty projects on process inten-

sification. Doctor in chemistry Marzio Monagheddu works from Switzerland. He spent the last fifteen years in technical and commercial positions in the chemical industry.



Roel Vleeschouwers, Metin Bulut and Marzio Monagheddu



VITOFOAM ALLOWS IMPLANTS TO ATTACH THEMSELVES STRONGLY IN THE BODY

VITOFOAM is a patented process for manufacturing titanium foam. In short, titanium powder with water and other substances is whipped to a foam structure, creating a porous metal. VITO developed the alloy foam for hip and other implants: thanks to the foam structure, human bones attach themselves to the implants more quickly. "Titanium is biocompatible and the structure of the titanium foam approximates the composition of the sponge-like interior of a bone," says Steven Mullens of VITO. "By giving parts of an implant a rough, porous exterior, bone ingrowth is possible and the implant becomes firmly anchored in the body."

VITO recently sold the patent for VITO-FOAM to the Chinese high-tech company BZHB. It aims to bring hip and other implants to the market in the short term. At the request of BZHB, VITO gave the titanium foam custom shapes - such as the 'socket' of a hip implant. Marleen Rombouts of VITO: "A knowledge transfer from VITO to BZHB will take place over the course of 2017, so that the company itself can produce titanium foam and give it the desired shape. The patent transfer presently applies only to the Chinese market, but this can be expanded later."

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RESEARCH INTO SUSTAINABLE ENERGY SUPPLIES IN CITIES



VITO/ENERGYVILLE WANTS REDUCED-REGULATION ZONE FOR ENERGY TESTS

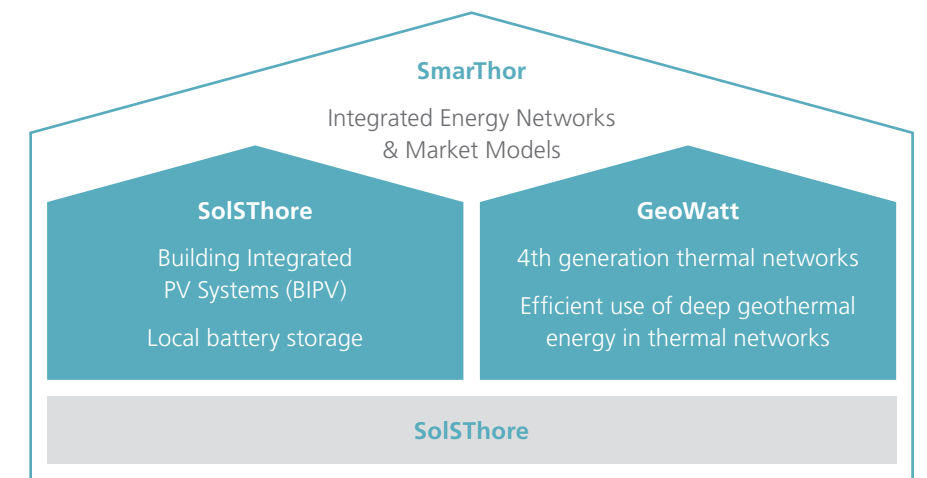
Integrating energy research and encouraging innovation around sustainable urban energy: that in a nutshell is the goal of the VITO/EnergyVille project 'Towards a sustainable energy supply in cities'. EnergyVille wants to create a reduced-regulation zone for new projects with solar and thermal energy: "Such an experimentation space is invaluable in testing the energy systems of the future."

'Towards a sustainable energy supply in cities' is a joint project of VITO with the KU Leuven, imec and Hasselt University. The partners wish to explore energy opportunities in an urban context: harvesting renewable energy close to the user and coupling electric and thermal energy. This project is part of the SALK Strategic Action Plan for Limburg and is supported by the European Regional Development Fund (ERDF).

Sun and heat

"In this project we are working on three major objectives: improving the laboratory infrastructure of EnergyVille, integrating research projects to create technological innovation, and showing this innovation on the basis of demonstrators," says Bert Gysen of VITO/EnergyVille. "A clear proof of the possibilities of a new concept can attract both local industry and international partners."

The new project consists of three work packages. Two of these focus on solar energy and heat. Bert Gysen: "Within SolSThore, we are working



The project consists of three work packages: SolSThore, GeoWatt and SmarThor.

on Building-Integrated PhotoVoltaics (BIPV): how can we integrate solar panels into buildings? How can we link these PV systems to an intelligent electricity network? And how do we achieve maximum energy yield by also connecting batteries to the BIPV? We also develop a better-performing battery management system for this battery. GeoWatt places the focus on fourth generation thermal networks, which balance local demand and the local supply of heat and cold. We are also examining the buffering capabilities of flooded mines in combination with district heating networks."

Smart systems

The third work package, SmarThor, is examining the techno-economic framework needed to implement smart, CO₂-neutral energy clusters. Bert Gysen: "In SmarThor we are

examining the possibilities of interweaving electric and thermal energy vectors. Specifically, in Thor Park, where EnergyVille is located, we wish to set up a reduced-regulation zone that would give us more freedom to try out innovative ideas. Such an experimentation space would be invaluable in thoroughly testing new market models for multi-energy networks."

The project 'Towards a sustainable energy supply in cities' was launched on 1 July 2015 and runs until 31 May 2018. Funding is provided through the ERDF, the Flemish Government, the Province of Limburg and partners.

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KNOWLEDGE VALORISATION AT VITO

VITO MIDDLE EAST GUIDES SUSTAINABILITY ANALYSIS OF BUILDINGS IN QATAR

With VITO Middle East, VITO is giving a boost to its activities in Qatar, Oman and the United Arab Emirates. The regional company is for example working on a new sustainability label for buildings in Qatar.

VITO Middle East is VITO's second international company, following VITO Asia. The division in Qatar has been in place since late 2015 and is focusing on the transition to sustainable energy and buildings. An important partner of VITO Middle East is GORD, the Gulf Organisation for Research and Development. This research institute is currently working on a GSAS label (Global Sustainability Assessment System): a certification system that describes a building's sustainability. VITO is supporting GORD in the implementation of the new evaluation system.

Carolyn Spirinckx of VITO/EnergyVille: "The GSAS system comprises multiple categories: materials and raw materials, energy, water, location, urban connectivity, indoor environment, cultural and economic value, management and operation. The total score of all results indicates how sustainable a building is. In the past, we already developed a web application for GORD that assists building owners in applying for GSAS certificates. Currently we are supporting them in the implementation of the 'materials and raw materials' category. For this category, building owners in the Middle East can request from VITO a Life-Cycle Analysis (LCA) and Environmental Product Declaration (EPD) for their building materials. This gives them extra points."

Open communication

VITO has concluded a framework agreement with GORD to prepare LCAs and EPDs for local building and project developers. The experts at VITO and GORD in the Middle East are responsible for organising a kick-off meeting, conducting interviews and explaining to companies which data they need to collect. Carolyn Spirinckx: "When all the data is available, we at VITO can calculate the environmental performance of building materials. This usually happens in Belgium. After a preliminary analysis, we draw up an initial environmental profile and point out possible improvements to the producer. In total, it takes at least three to four months to conduct a full LCA and to prepare the EPD."

"In the LCA, we analyse the environmental performance of the selected building materials throughout their life-cycle. What is the environmental impact of the extraction of raw materials, transport to the factory, the production processes used and the use of the material in the building? Are there any possibilities for reuse or recycling? The results go to GORD in the form of an EPD. The EPD then receives the Gulf Green Mark EPD label. Companies that communicate transparently about their environmental impact through the EPD, receive a better sustainability score in the GSAS certification. Of course there is also a verification process to check the methodology used, the data and the manner of reporting."

Additional incentive

Building owners are not required to request a GSAS label for all their designs. Yet this is happening more often, and for



GORD hands Carolyn Spirinckx a certificate of appreciation for her work during the GORD Green Expo Forum 2016.

good reason. Carolyn Spirinckx: "GORD has negotiated with the government of Qatar, in the context of FIFA 2022, the requirement that all new buildings, renovations and infrastructure must have a GSAS certificate. This has motivated many building owners to request the label. We have similar systems in Europe, but these are usually non-binding. In the Middle East, the mandatory GSAS label is an additional incentive."

Due to the growing number of applications for LCAs and EPDs, VITO is gradually becoming a familiar name to manufacturers of building materials in the Middle East. "The project is great for our visibility," says Carolyn Spirinckx. "In the Middle East, VITO is increasingly requested as a speaker at conferences on sustainability. We can now translate to the Middle East the knowledge and experience we have acquired in Europe over ten years: an exciting challenge."

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REMOTE SENSING CO-CREATION PROJECT TO BE CONTINUED

VITO completed its co-creation project around remote sensing at the end of 2016. Ten innovative companies together with VITO experts sought new opportunities in agriculture, infrastructure, safety and the study of vegetation. The participants were able to count on the expertise of VITO, including in the field of satellites, drone images, data analysis and 3D visualisation.

Market potential

"In 2017, we will be further developing in follow-up projects the three ideas with the most market potential," says Bart Dooms of VITO. "The first is 'damage detection' in agriculture, a methodology that uses drone images to identify damage to crops. At the first try-outs, our results were almost identical to those of the claims manager. The legislation on drone use has been in place for a few months and this is certainly a possible business for a drone company. A second use case is the Green Buddy, a set of sensors that monitor the state of a

lawn and send the results to VITO through the Internet of things. VITO visualises and enriches the information with other data. A football field or golf course manager can in this way know, for example, whether it is necessary to irrigate. Finally, there is Solar Parks Infrared Detection: we fly with a thermal camera over solar panels to check which ones need to be replaced. Solar panels are connected in series: if one fails, you lose the yield of an entire series. By intervening quickly, efficiency remains high."

"In the coming months we will see which partners we can involve in these projects in order to increase their chances of success. VITO will also continue to start new co-creation projects in 2017. The themes will be announced shortly."

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REMAKE FOR BRILLIANT KNOWLEDGE PLATFORM: "MORE DIALOGUE WITH OUTSIDE WORLD"

On 16 October 2016, VITO launched a remake of Brilliant, the knowledge bank of sustainable innovations that saw the light of day a year earlier. "The remake allows for greater dialogue and information exchange between VITO and the outside world," says Nathalie Barthels of VITO. "We want to optimally tailor our research to the needs of society. For this, communicating with technology companies and stakehold-

ers is essential. The revamped Brilliant portal offers among other things new functionalities to easily contact us for innovation opportunities. We will also be organising workshops and events to discuss together the technology trends and sustainability. This will also give us the opportunity to find partners that can deploy our technologies. In order to allow the Brilliant community – which now has more than three hun-

dred members – to grow rapidly, we have greatly simplified the membership procedure."

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EYE IRRITATION TESTS WITHOUT ANIMAL TESTING



CON4EI DEVELOPS NEW STRATEGY WITH MIX OF LABORATORY TESTS

Since August 2015, VITO has a leading role in CON4EI, an international project investigating eye irritation. The goal: demonstrating that animal testing is not necessary to examine whether substances irritate the eye. The project partners combine a mix of technologies into an innovative strategy: "We hope to have our proposal included in the new OECD laws (Organisation for Economic Co-operation and Development)."

Each chemical that enters the market in Europe is tested for consumer safety. The conditions that substances must meet are laid down in the REACH legislation (Registration, Evaluation, Authorisation and Restriction of Chemicals). "Traditionally eye irritation is tested with experiments on rabbits – the Draize test – but Europe aims to abolish animal testing wherever possible," says An Van Rompay of VITO. "Many in vitro tests have been developed in recent years, but everyone uses different tests and test combinations. This is not optimal, therefore the European Chemical Industry Council (CEFIC) last year issued a call to develop a reliable test

strategy and database for in vitro tests. CON4EI was chosen (CONsortium for in vitro Eye Irritation testing strategy)."

Optimal combination

CON4EI uses a combination of eight test methods to test and classify eighty different substances. An Van Rompay: "By comparing the results with known results of animal testing, we are able to develop an integrated testing strategy. Which test do we use for an initial screening? Which tests are suitable for classifying products? VITO carries out three tests itself: the BCOP (a test on the eyes of slaughtered calves), the BCOP-LLBO (a refined BCOP test with laser light), and the SkinEthic HCE (an in vitro test using cultured cells). Our partners handle the other tests. Based on the test results, we develop a strategy with an optimal test combination. Once all European countries approve the strategy, it can become part of the new OECD laws."

New technology

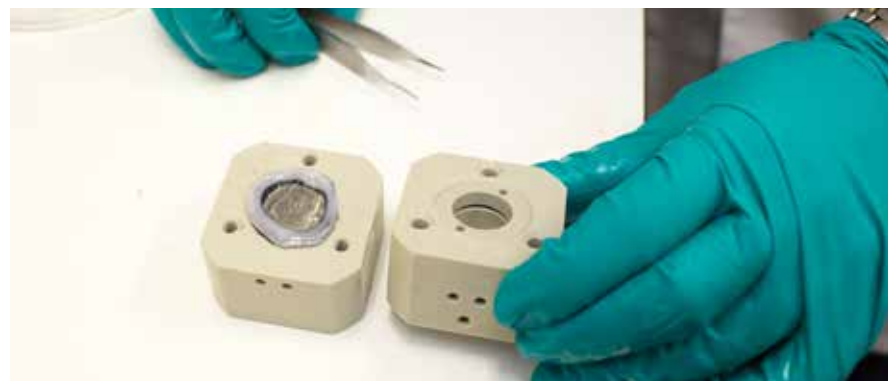
The BCOP device with laser light was developed by VITO. Now that the

WHO IS PARTICIPATING?

CON4EI is a consortium of VITO and seven partners: Adriaens Consulting bvba, L'Oréal Research & Innovation, Institute of Industrial Organic Chemistry, Envigo, MatTek In Vitro Life Science Laboratories, Ghent University and Cypotex US. In the creation of the BCOP-LLBO test, VITO worked with technology partner Peira Scientific Instruments.

CON4EI project has demonstrated that the method has advantages, VITO will actively promote the device. Sandra Verstraelen of VITO: "The traditional BCOP test is carried out with a device that measures the light transmittance or opacity of the cornea. The disadvantage is that such a test merely shows damage to the centre of the cornea. Along with Peira Scientific Instruments, we replaced ordinary light with laser light, allowing us to measure damage to the entire cornea. The CON4EI tests demonstrate that the laser-based opacitometer yields better results. These results are now being checked during a validation process in which other labs make the same measurements with the camera. We hope to include the device in the Directive for the BCOP at the end of 2017."

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Testing on the eyes of slaughtered calves is part of the CON4EI test strategy.



SUSTAINABLE BUSINESS: A GAME?

BUSINESS GAMES FACILITATE DISCUSSIONS AROUND SUSTAINABLE THEMES

BOARD GAME ON CIRCULAR ECONOMY

Risk & Race: Entrepreneurship in a Circular Economy is a board game with a message. Participants experience in a playful way the impact of certain business decisions.

In Risk & Race: Entrepreneurship in a Circular Economy, a board game developed by VITO, four players (or teams) assume the role of a company. Each player is given a budget with which he or she can buy raw materials, pay employees, invest in recycling, more efficient processes or sustainable technology ... During the game, the environmental factors are changed several times. Environmental legislation can be amended for example, or raw materials can become more expensive. The winner is the one who has the strongest company at the end of the game. This strength is measured not only in money, but also in employees, investments, a sustainability score

and customer relations. The game consists of ten rounds and takes two to three hours. It is aimed primarily at students and entrepreneurs.

Enlightening

Saskia Manshoven of VITO: "The game is conceived educationally: it starts with an introduction to the circular economy. There are multiple reflection moments during the game: Is this a good way to work? Are there alternatives? The participants learn in this way what challenges they will face and which strategies the circular economy offers as a response. The game can be very enlightening. What happens if my raw materials become

more expensive or less available? Is my company still profitable enough? How can I arm myself better against shocks from outside my company? This game offers a new and exciting way to learn about entrepreneurship and to understand the principles of the circular economy. The game elements can then form the basis for strategic discussions and reflection in a specific sector or company."

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BUILD A BIO-BASED VALUE CHAIN YOURSELF

BIOBUILDER® consists of a set of wooden tiles that each represent an aspect of the bioeconomy. The discussion tool aims to make it easier to develop new organic bio-chains.

BIOBUILDER® is a tool that facilitates the exchange of ideas on the bioeconomy. The game was developed by VITO and Hasselt University. Ruben Guisson of VITO: "BIOBUILDER® is a set of hexagonal wooden tiles with each tile representing a part of the bioeconomy. These can be input streams, processing technologies or output streams. The tiles are placed next to each other and together form bio-based chains. Which chains are formed, how they integrate and which variants are made depend on the players' goals. BIOBUILDER® is interactive: it brings about

dialogue between the users in a spontaneous and natural way. The tool makes the bioeconomy theme visible and tangible. BIOBUILDER® helps users identify the strengths and weaknesses of a chain in the areas of policy, environment, economics and technology."

Easy to use

"BIOBUILDER® is used for different purposes," continues Ruben Guisson. "Stakeholders in the bioeconomy can use it as an aid in making decisions on new value chains. For students, it is an interesting tool

to nurture discussions and obtain insight into the bioeconomy. The concept is simple and therefore easy to use during consultations without requiring a long briefing or introduction. Experts at VITO and Hasselt University provide support and guidance."

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KHIEM TRAD, BATTERY AND
ENERGY STORAGE RESEARCHER AT
ENERGYVILLE

“I BELIEVE IN A FUTURE
WITH SUSTAINABLE
ENERGY”

VITO/EnergyVille is developing smart energy systems for a sustainable urban environment. As a senior researcher, Khiem Trad conducts research on how sustainable energy can be efficiently stored.

How did you end up at VITO?

“I’m from Tunisia and studied Material Science in France. After my PhD at the University of Bordeaux, I moved to Belgium. Flanders has few specialists in my field – materials for batteries and energy storage – and it was easy for me to find work at the Flanders’ DRIVE research centre. But I wanted to work for VITO because the sustainability aspect appeals to me. After I responded to a job opening, I was invited for an interview.”

Could you describe your job?

“Together with my colleagues I work on research into energy

storage. We design tests for lithium-ion batteries, often for companies, and conduct these tests ourselves in our battery lab. I also do research into the ageing process of batteries so that we can develop methods for batteries to last longer.”

“All of our projects revolve around sustainability. Among other things, we use batteries in smart grids to store wind and solar energy. This is necessary because the supply of renewable energy can be very erratic, depending on weather conditions. We also test batteries for electric vehicles: cars, bicycles ... And we do a lot of research on rechargeable batteries. How and when to best charge them? Under what circumstances do they retain their maximum energy? Rechargeable batteries are more sustainable than the alkaline batteries

that we need to replace with a new battery after use.”

How do you see your future at VITO and EnergyVille?

“I’ll continue to work on similar projects in the short term, because there is still a lot of research to be done. We are gaining experience and expertise, and seeking partners to bring new technologies to market. Currently I’m working with my team on a battery management project: we’re developing a device that allows us to better control the functioning of batteries. Here at EnergyVille, we all believe in a future with intelligent, sustainable energy and electric mobility. I want to be an active part of this.”

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SUSTAINABLE ENERGY STORAGE FOR THE FUTURE

ESTMAP MAKES PLANNING AND DECISION-MAKING ON ENERGY STORAGE IN EUROPE EASIER

As Europe produces more sustainable energy, the demand for energy storage grows. People wish to cook and shower, even on a windless winter evening. But how much storage is needed? And should we opt for central or distributed energy storage? ESTMAP maps out the opportunities and challenges of energy storage in Europe.

A well-functioning internal energy market is a top priority for Europe. The central supply of nuclear energy and fossil fuels is gradually being replaced by decentralised sustainable energy. But how can we align supply with demand? The ESTMAP project (Energy STORAGE Mapping and Planning) makes system modelling, strategic planning and decision-making on the EU’s energy system easier. The project has two parts: a geographic database on energy storage, and energy models to calculate the role of storage in the future European energy system.

Above and below ground

“The energy storage database contains maps and data for existing and potential underground energy storage locations and aboveground storage facilities,” says Frank Meinke-Hubeny of VITO/EnergyVille. “We provide an overview of all the possibilities for hydropower plants (pumped-storage hydroelectricity), compressed air, hydrogen, thermal energy ... The potential for underground energy storage, for example in depleted mines, is calculated based on

existing studies and information. We supplement this information with data on the technical and economic parameters on the facilities that are needed to use the storage site. The database also contains information on technical and economic parameters on the facilities for aboveground storage options. The European Commission is planning to grant access to the database as a basis for further research.”

System modelling

The information from the database was integrated into a Geographic Information System (GIS). It calculated the costs necessary to connect potential storage facilities to the energy grid. Frank Meinke-Hubeny: “We calculated the impact at European level with a European energy system model (TIMES-PanEU). Then a more detailed analysis was performed for Germany, the Netherlands and Belgium. The resulting model of the European energy system shows where the main growth of renewable electricity can occur, where electricity storage is needed and where bottlenecks in transport might arise. The model allows Europe to better plan the development of its energy storage capacity.”

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The ESTMAP project ran from January 2015 until December 2016 and was funded by the European Commission. VITO/EnergyVille was involved in the collection of geological data and the energy system analysis with modelling on a TIMES basis.

WHO IS PARTICIPATING?

The ESTMAP consortium consists of the Dutch Organisation for Applied Scientific Research (TNO), the Bureau de Recherches Géologiques et Minières (BRGM), the Czech Geological Survey (CGS), consulting firm Ecofys, the Institut für Energiewirtschaft und Rationelle Energieanwendung (IER) and VITO. In order to collect data across Europe, the consortium worked with Euro-GeoSurveys (EGS) and ENeRG (European Network for Research on Geo-Energy).



AERIAL IMAGES INCREASE VISIBILITY OF NO₂ POLLUTION

In urban areas with high levels of industry or traffic, people are often exposed to high concentrations of nitrogen dioxide (NO₂). The existing methods for measuring NO₂ locally do not allow a proper assessment of the extent of the health risks. Measurements from ground stations, located at fixed sites, cannot simply be extrapolated to an entire region. Satellite images in turn are not detailed enough to provide reliable information.

Koen Meuleman of VITO: "In the BUMBA project (Belgian Urban NO₂ Monitoring Based on APEX remote sensing), we use hyperspectral images to map out NO₂ pollution levels. This bridges the gap between the limited data from ground stations and the coarse data from satellite images. To estimate the NO₂ concentrations, we worked with the Belgian Institute for Space Aeronomy (BIRA-IASB). VITO Remote Sensing provided the hyperspectral data, tailored to the application being used."

In 2015 and 2016, several flights were made above Antwerp, Brussels and Liege. The NO₂ concentrations that were derived from the APEX data were very similar to the results of the ground measurements. VITO and BIRA-IASB will now be translating the data from the aerial shots to NO₂ concentrations on the ground. This allows better identification of human exposure to the harmful gas and allows policy-makers to take the right decisions.

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uv-vis.aeronomie.be/airborne/bumba.php

NO₂ concentrations in Antwerp on 15 April 2015
(up: APEX image; down: NO₂ map). The major
sources of nitrogen dioxide in the port are clearly
visible.

