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Vision on technology for a better world

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VITO EMPLOYEE IN THE SPOTLIGHT

Dear readers,

After a summer in which the coronavirus was never completely gone and it became clear that we still have to live under strict measures for months to come, we see our society and our economy facing an enormous challenge. The devastation caused by the corona crisis makes an ambitious recovery policy vital. We would not be VITO/EnergyVille if we did not want to play our full part in this.

Just as every crisis opens doors, so too does corona. As we get our economy and society back on its feet, we can and must seize the momentum to speed up the transition to a sustainable future. Now is the perfect time for this.

Last summer, with VITO Connect, we organised a series of roundtable discussions in which 'thought leaders' from companies, governments and knowledge organisations shared their vision of a sustainable future. This always with the (preliminary) lessons of the corona crisis in mind. After all, for various sectors, the crisis can be regarded as a real stress test. We consulted experts in the areas of Energy & Climate, Built Environment and Circular Economy. All three play a key role in the transition to a sustainable future.

Ironically, last spring's lockdown was particularly convenient for the production of renewable energy: due to the temporary drop in demand, power generation was dominated more than ever by renewables. A look ahead to the future, in which greater flexibility and the gradual phasing out of fossil fuels should encourage the transition to a sustainable energy system. At the same time, however, stability is also needed, both in terms of legislation and regulation. After all, energy companies need to know what they can expect in the coming years and decades. Everyone agrees that the European Green Deal will play a pioneering role in this respect.

The corona crisis also shows that some companies are more resistant to this than others. A survey conducted by Circular Flanders showed that as many as two thirds of circular companies were not facing shortages - this despite the fact that the supply chains in various sectors have been under pressure in recent months. An economy based on circularity is therefore not only better for the environment and climate, but also helps to make our economy less dependent on, for example, the uncertain import of raw materials.

In this issue, you will read more about what a sustainable recovery policy can look like. In addition, we highlight our 'normal' business operations, which continued unabated. From the transformation of Thor Park in Genk into an energetic 'living lab' over the development of a business game for circular entrepreneurs, to our efforts to better reconcile health data with privacy. You can also read how Flanders can become a model region for efficient use of water.

Together we are evolving towards a sustainable society.

Enjoy reading this issue of VITO VISION,

Dirk Fransaer
Managing Director of VITO



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MAKING EXPLORING THE CIRCULAR ECONOMY FUN

With Risk&RACE, VITO has developed a 'business game' in which the players step into the roles of circular entrepreneurs – ideal for inspirational business workshops or a teambuilding event. International interest has since grown. The game is now even being translated into Chinese.

Players of Risk&RACE are leading a company and are presented with all manner of challenges that are typical of the circular economy. 'For example, they have to deal with scarcity of raw materials, legal obstacles or shifting consumer demand towards more services,' says Saskia Manshoven from VITO. 'They then have to respond to this by investing in circular business strategies. They could handle raw materials more economically, for example, replace them with alternatives or focus more on recycling, remanufacturing or turning products into services. The end of the game will reveal whether or not they've made their company more resilient, and whether their choices were the right ones.'

Training or teambuilding

This so called 'business game' was developed by VITO in 2018 – with support from the European subsidy programme EIT Raw Materials. It

cannot be bought freely, but is offered as a training or teambuilding tool. 'We're targeting consultants guiding businesses with an interest in the circular economy, as well as lecturers at universities and schools who want to use the game in their lessons,' says Manshoven. The training courses for game leaders are organised by VITO and take two days. The next training session will take place on 26 and 27 November 2020.

The aim of Risk&RACE is that the participants are inspired by the circular economy, circular entrepreneurship and circular business models. The game is embedded in a half-day workshop, led by a trained game leader. Manshoven: 'The intention is for the players to take on an active role. The game raises questions, provoking discussions with the other players. The game leaders explain the underlying circular principles that come up. That's how an afternoon's Risk&RACE becomes a leverage towards more circular thinking within an organisation.'

Interest from Asia

In the meantime, the business game has been catching on abroad too. In Hungary and Slovakia, the game (conducted in English) has already been picked up by organisations affiliated to VITO. And interest is growing in

the Far East as well. In September 2019, Risk&RACE was demonstrated to Taiwanese sustainability managers and CEOs during a large event around the circular economy that the island organises every year. This has since prompted the demand for a Chinese translation of the game to be brought to the Asian market. 'Business games have been popular as training tools in Asia for a long time,' says Philip Marynissen, Business Development Manager at VITO. 'And they know of Risk&RACE in Singapore now too, where consultancy bureau Terra is using it in training courses organised by the government and in schools.'

Earlier, in 2019, Risk&RACE won the prize for best non-digital game at an international conference on business games in Lisbon.



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SEED BREEDERS RECEIVE AERIAL SUPPORT VIA MAPEO

Sugar beet seed company SESVanderHave is breaking into remote sensing through a strategic collaboration with VITO. By monitoring its trial fields for crop breeding with drones and analysing the data obtained via the MAPEO platform, the company's 'phenotyping' is now better and more efficient. For the multi-national, headquartered in Tienen, this will not only strengthen their position in a highly competitive market, but will also help to make European agriculture more sustainable.

An efficient phenotyping method is indispensable for raising the yields of agricultural crops. After all, this allows for optimum assessment of experimental crop varieties or treatment methods, which are then selected on the basis of their outward characteristics. This traditionally takes place by hand, which unfortunately is time-intensive and gives only a fragmented and often subjective picture. There is an alternative to this method which is based on drones. This technology is faster and allows for complete, clear and objective phenotyping.

End-to-end solution

In its service provision to agricultural firms through its remote sensing applications, VITO is also concentrating on the seed breeding and crop protection sectors. This includes the use of drones. They can scan entire plots in a short time, after which the images are sent to VITO for processing. This last part takes place via the MAPEO platform, an end-to-end solution from VITO for analyses of agricultural plots based on drone imagery. 'Ultimately, this platform outputs the data the customer is interested in – for example, crop height, growth speed, leaf surface, blossom density, number of fruits per plant or symptoms of disease,' says Jürgen Decloedt from VITO. 'This allows seed breeders and crop protection firms to use drones to speed up their cultivation and selection programmes.'

The MAPEO platform has been operational since spring 2018 and is now being used around the world. 'We process data from customers and trial fields in Belgium and abroad, from other European countries through North and South America and South Africa to Japan,' says Decloedt. In the commercial collaboration, VITO is responsible for the data processing. The drone flights are carried out by the customers themselves – or outsourced to freelance drone pilots through the VITO spin-off Sitemark (formerly DroneGrid), which connects the pilots to MAPEO.

In the meantime, VITO has been steadily building up its expertise in terms of phenotyping via drone imagery, which also takes place in close collaboration with private partners. In the spring, VITO entered a new strategic collaboration with SESVanderHave, a globally operating sugar beet seed company headquartered in the 'sugar city' of Tienen.

Positive first impression

SESVanderHave and VITO were already working together before. Four years ago, they were both involved in a research project around disease resistance in sugar beets, whereby this was evaluated for different breeds using drones – this Beetphen project, as it was called, is now complete and was financed by BELSPO. Following this positive first impression of remote sensing, SESVanderHave decided to start exploring and investigating the technology's potential and added value more actively. The company chose to embark on this again with VITO. 'Our initial collaboration as part of the Beetphen project was very pleasant and constructive, and we soon felt that there was a potential for synergy,' says Maarten Vanderstukken from SESVanderHave. 'The close contact with the researchers from VITO and the ability to raise problems and new challenges quickly contributed to this.'

This initial collaboration has since borne its first fruit. 'The first use cases with drones are presently finding their way to implementation further down the line in our operations,' continues Vanderstukken. 'The results show that we can evaluate a number of beet plant characteristics more accurately with drones than with the traditional, visual method. We can even truly quantify some crop characteristics for the first time now. That means that today we can already select beet breeds for these characteristics better and more efficiently.'

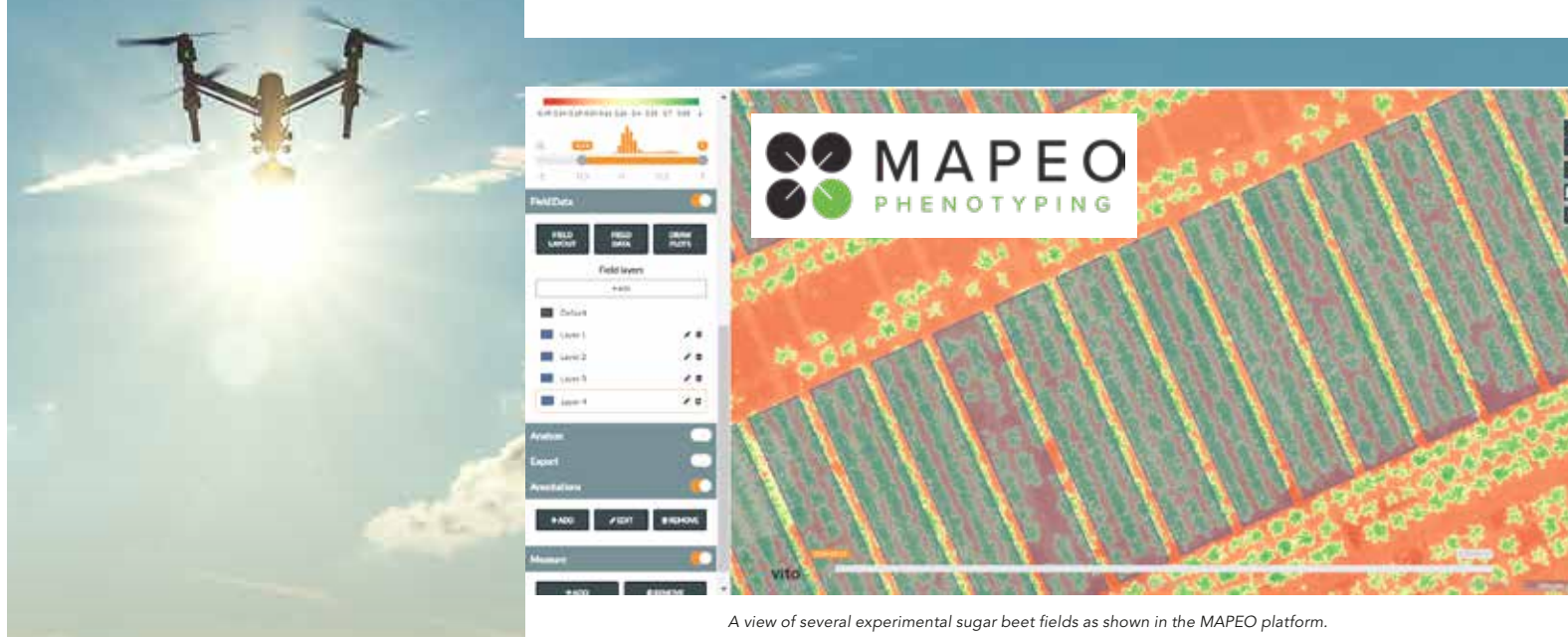
Competitive advantage

Nonetheless, these initial results will not lead to an immediate competitive advantage for SESVanderHave – something that is very welcome in the highly competitive market in which the firm from Tienen is active, considering the competition from cane sugar producers from low-wage countries. Vanderstukken: 'The average development time for a new breed is ten years, while our breeds only stay on the market for four years on average.' While the initial successes of the use of drones are impressive, there are plenty more larger and more impactful applications in the pipeline. 'This is about a lot more than a few separate initiatives. We've only just broken into remote sensing, and we're aiming to do this in close collaboration with VITO.' Ultimately, it is this collaboration that should deliver a true long-term competitive advantage for the world's second-largest producer of sugar beet seeds, with a market share of 30 percent.

Alongside this, SESVanderHave will also begin building up its own expertise in the analysis and interpretation of the data generated by the drones – so this can be combined with genetic or climate data too, for example. As regards to the climate, SESVanderHave also has several decent advantages in helping to make European agriculture more sustainable. Sugar beets are more resistant to

drought than sugar cane, for example. 'We have to respond to many external factors in our market,' says Vanderstukken. 'These could be European restrictions in terms of plant protection agents, or a rising demand for climate-proof varieties. These factors mean we need to put even greater effort into innovation.' On that score, things are already going well at SESVanderHave: the company is investing no less than a fifth of its turnover into R&D, and one in four of its over 650 staff works at the R&D department.

The strategic collaboration has also come about because the development and implementation of drone and sensor technology is still fully developing. 'We can stay ahead of the curve in this respect through VITO, while being assured that remote sensing is being used efficiently here,' says Vanderstukken. In turn, VITO can benefit from the data supplied by SESVanderHave for optimising its automatic phenotyping. Decloedt: 'This way, we can develop methodologies together that we can then start applying in MAPEO.'



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These Flemish companies are also using MAPEO:

Globachem specialises in the development, registration and marketing of high-quality crop protection products for agriculture and gardening. The family business, based in Sint-Truiden and internationally active, began as a manufacturer of generics, but has been putting intensive efforts into its own innovative products in the past few years. Since early 2020, VITO has been processing the data from drone flights above 25 of the company's trial fields spread across the whole of Europe.

Aphea.Bio is a R&D company that develops natural, microbial products to raise crop yields and better protect them against disease. Products are used as coatings around seeds or as sprayable solutions. The coatings ensure that the seeds germinate better and the young plants grow more quickly. Spray solutions on leaves or spikes can better protect grain crops against fungous diseases. VITO processes the drone data from trial fields in Belgium, Germany and France.

Arvesta (formerly Aveve) tests and validates new breeds based on specific criteria. The Belgian company mainly does this for grain crops. VITO processes the data from drone flights above an Arvesta trial field in Tienen, looking at the crop height, the sensitivity to flattening (where the grain falls over) and the number of spikes per square metre, among other things.

TOWARDS CITIZEN-ORIENTED DATA MANAGEMENT

Health, innovation and privacy often do not seem easy to combine. Worse still: in the current system, they are often in conflict, although this is rather because of how that system handles data. VITO's Data Science Hub is helping to build a society and economy in which data-driven research and innovation are encouraged – alongside respect for citizens' privacy.

The corona crisis really made this clear: without the active involvement or 'empowerment' of citizens, measures or solutions proposed or put forward by authorities serve little purpose. Take, for example, the discussions around the apps for containing the spread of the virus through contact tracing. It soon became clear that citizens are not unreservedly prepared to have their privacy restricted in exchange for digital aid. It exposed a wider and more fundamental problem that also occurs with the use of personal data beyond the corona context, namely that innovation and privacy are often difficult to reconcile within our present system.

Data monopoly versus open data

The cause of this problem lies in the manner in which data is collected, used and managed: now the online data economy has been almost monopolised by a few large tech giants, transparency is often lacking. Moreover, the data collectors are often – despite existing legislation – also the owners and managers of it at the same time. On top of this, different types of data streams are still running alongside each other far too often and are insufficiently linked, which then slows down innovation.

These flaws in data management not only impede crisis management in the health sector in corona times, but also block effective breakthroughs in other social fields such as the environment, economy, mobility and food security. It is these sore points that VITO is consciously attempting to remedy, given its major dedication to data-driven research in recent years.

This is the focus of the Data Science Hub, a structure that strengthens data-driven research horizontally – read: across the various VITO themes. 'Data-driven research could be considered the fourth paradigm of scientific research, alongside theory, experiment and computer simulation,' says Jef Hooyberghs, research leader at the VITO Data Science Hub. 'It's a new driver of the scientific process, using data collected or generated by people or computers.' To VITO, one characteristic of data-driven research is that it is also socially engaged. 'The collaboration with colleagues from the VITO Transition Platform means we're also working on embedding our activities within society right from the start.'

From smart islands to a smart region

VITO is also dedicating itself to data-driven projects as far as possible. One example is the Flemish Open City Architecture, or VLOCA. The goal to which this initiative aspires, which VITO is carrying out along with imec in close contact with a multitude of stakeholders, as commissioned by the Flemish Agency for Domestic Management, is developing a blueprint for making cities and municipalities in Flanders 'smarter' through digitalisation and better use of data. 'Countless local authorities are already taking initiatives for this,' says Hooyberghs, 'and that brings the usual growing pains with it. There isn't yet a uniform way of working and, for smaller authorities, the resources to do this self-sufficiently are often lacking.'

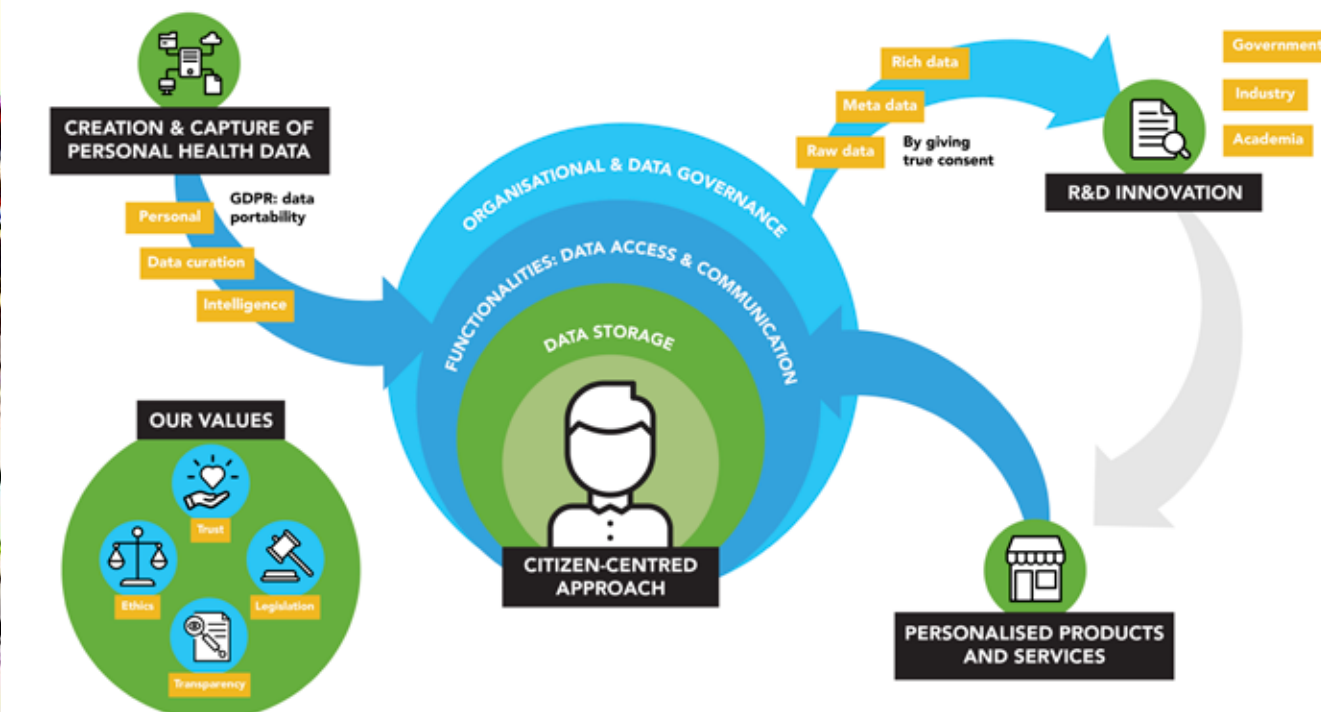
Ultimately, VLOCA, which started early

2020, is intended to help Flanders evolve from a collection of smart islands to a sustainable, smart region. One of the project's strong aspects is that it is not tying itself to a particular discipline. 'At VITO, we're working across the themes and the great thing is that the authorities are also combining policy fields that are often very important to local authorities, such as the environment, quality of life, governance and mobility,' explains Hooyberghs. 'All too often, the data that local authorities gather or generate through various separately developed applications is still to be found in separate silos, making it difficult to bring this together. We're aiming to merge them together through our vision of an open digital architecture.'

Innovation and health go hand in hand

While VLOCA mainly revolves around public data, the health world largely concerns personal data. The corona crisis offers an enlightening reflection here too. Hooyberghs: 'Many agencies have been collecting data in the past few months: universities as part of online surveys, authorities to get the epidemic under control and keep it that way, companies for testing and development, etc. This was generally done with the best of intentions, but although the citizen is at the heart of this, they're nonetheless often left out in the cold. They don't know who is managing their data, where this is stored, what happens with it, who has access to this data, etc.'

In recent years, the idea of 'giving the data back to the citizen' has



been steadily gaining ground'. The aim of this is not only to 'empower' the citizens. It also has economic advantages, as smaller companies have barely any access to data at present – meaning there is no room for competition. 'By putting the citizen at the heart of this, we're creating a level playing field in which everyone does have economic opportunities', assures Hooyberghs.

As regards to health data, the thinking in Flanders is largely moving in the right direction already. In May 2020, the first and second-line care with the GPs' syndicate Domus Medica and the care organisation Zorgnet-Icuro, the Flemish Patients Platform, the King Baudouin Foundation and VITO all joined around the concept of citizen-oriented data management. 'The intention is to crystallise the principles that we've collectively agreed upon into practical policy over the coming years,' says Hooyberghs. This process has already begun to translate into practical projects. At the European Smart Specialisation Platform, in which Flanders is focusing on personalised healthcare, VITO plays a leading role in designing the data management. In this context, VITO has been working with two other European regions on an innovative data concept since March 2020, in which the citizen plays

a central role in the management of their own health data, and whereby innovation and health are not in conflict with one another, but in fact go hand in hand. 'We're aiming to develop this concept into something that private companies will shortly see some investment potential in.'

As a practical application, VITO is digitalising a health guide, whereby the citizen makes their own decisions as to who they share their data with and what they use that data for themselves. This is taking place in collaboration with Domus Medica and the care innovation testing ground LiCalab, and with support from Empowercare, a European Interreg 2 Seas project. The advantage of the guide is not only that the citizen can monitor and enhance their health in an evidence-based manner via a personalised action plan, but that the data can also be used to improve policy or to help develop new health services for the citizen. That closes the circle.



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POST-CORONAVIRUS: TOWARDS A SUSTAINABLE AND RESILIENT ECONOMY

At the end of 2019, the European Commission set out its new sustainable growth strategy with the 'Green Deal'. Then came the coronavirus crisis, which forced European policymakers to design an ambitious economic recovery policy called 'Next Generation EU'. Broadly speaking, this programme is based on the same principles as the Green Deal, which makes it clear that the European member states are facing a 'green recovery'. Europe's ambition is to move forward to a sustainable future instead of a setback to the status quo from before the coronavirus crisis. To VITO, this all sounds very familiar. 'Creating economic impact out of sustainability: it's in our DNA.'

Although the coronavirus crisis is far from over, it is already clear that the economic devastation is unprecedented. No less than 98 percent of regular Flemish companies have experienced (or are still experiencing) serious problems, according to a recent survey by Circular Flanders and VITO. But the results of this survey also show a ray of hope: two thirds of the circular companies indicated that they had no shortage of raw materials during the crisis, thanks precisely to their local supply lines. In short: a circular business model offers certain advantages during a crisis.

New growth agenda

Let the transition to a (more) circular economy be just one of the core elements of the 'Green Deal', the green policy strategy that European Commission President Ursula von der Leyen proudly presented at the end of 2019. The Green Deal goes far beyond the ambition to make Europe climate neutral by 2050 – to which it is often reduced. In fact, this is an entirely new economic growth agenda, amounting to EUR 1,074 billion to be spent over the period from 2021 to 2027. 'The special thing about the Green Deal is that the green, sustainable economy is

really seen as an opportunity,' says Arnoud Lust, Manager International Business Development at VITO. 'Unlike in the past, "green" is no longer considered something that automatically costs money. On the contrary, the benefits outweigh the investments.' At VITO, of course, this has been known for a long time. 'Creating economic impact out of sustainability: it's in our DNA. It is nice to see this is now also reflected in the long-term strategic vision of the European Union.'

However, the coronavirus crisis forced Europe to set up another strategic investment programme. That became 'Next Generation EU'. For example, in early summer 2020, European leaders decided to release no less than €750 billion for a post-coronavirus recovery policy. Remarkable: this economic recovery package draws from largely the same spirit as the Green Deal – it also relies heavily on digitalisation. Renewable energy, circular economy, resource efficiency, massive renovation of buildings, etc. By investing in these, Europe is aiming to pull itself out of the economic swamp. Each one of these is a theme on which VITO has been focusing for years. 'Both the Green Deal and Next Generation EU are based on principles that are perfectly in line with our mission,' says Bruno Reyntjens, Commercial Director of VITO. 'Just add our task of stimulating the Flemish economy, and the picture is complete.' Flemish companies can therefore expect a whole array of new initiatives in the coming years to help them become more sustainable and resilient. And they can count on VITO, which is a logical partner to work with in this area. Reyntjens: 'Companies can come to us more than ever for collaboration on research projects and joint technology developments and, of course, for advice on strategies to be followed, in order to familiarise them with the wide range of subsidy instruments and investment opportunities. VITO mainly aims for a connecting role in

this, for example within consortia of companies working together on one specific theme,' says Reyntjens.

Round-table discussions

The green recovery will not only bear fruit in the long term. In the short term, it can also provide a considerable stimulus for the Flemish economy and employment, according to a thinking exercise that VITO carried out this summer – this took place as part of a round-table discussion on the role of the construction sector in an economic recovery policy. 'Through green investments, for example, in the improvement of the built-up (urban) environment of Flanders, we can create a double effect,' says Lust. 'Upgrading the energy status of buildings or neighbourhoods has a positive climate impact, but also leads to economic gains in the form of increased employment and added value through the implementation of state-of-the-art new technologies.' A good example of how economic profit can go hand in hand with environmental and climate benefits. It is no coincidence that the Green Deal aims to upgrade 3 % of the buildings in Europe each year, compared to just 1 % today.

The other round-table discussions organised by VITO on sustainable energy and the circular economy led to similar conclusions. The further development of a sustainable energy system, for example, will not only (help to) make Europe climate neutral by 2050, but will also make it much less dependent on fossil fuels from outside Europe. During the round-table discussion, it emerged that the energy world expects a stable framework in which clear, sustainable policy choices can be made. Here too, the clarity of the Green Deal serves as an example. As far as the circular economy is concerned, the benefits are clear: companies with circular operations do not only operate more sustainably, but are also more resilient – this crisis has proven that.

Focus on applications

In addition to the thematic content of the European growth and recovery plans, there are also strong similarities with VITO's business operations in terms of the destination of the financial support. 'We notice that the Commission is focusing much more than before on pilot and demonstration projects,' says Lust. 'The research phase being closer to application and commercial valorisation. This is also the case at VITO: we mainly help companies with projects beyond the basic research phase.' In addition, many funds from the Horizon Europe R&D programme and the European Regional Development Funds (ERDF) will be targeted at SMEs and start-ups – including through the well-funded Accelerator programme from the European Innovation Council (EIC). 'Through the new support, start-ups and SMEs can develop new cleantech applications in collaboration with VITO. We will also inject existing VITO technologies into the economic landscape via spin-offs and licences,' says Bart Swaelens, Head of Tech Transfer at VITO. 'This is how we help generate new and sustainable economic activity.'

Moreover, the focus on start-ups and small businesses in the European investment plans is ideal for Flanders, which has long relied on its strong SMEs. 'And these companies are among our most important partners,' says Lust. 'The European strategy therefore corresponds to VITO's strategy in many areas.'



Central commercial team at VITO



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ONE BIO-REFINERY FOR ORGANIC SIDE STREAMS

Green waste and other organic side streams can be valorised as energy, compost, fertiliser, cattle feed and ingredients for high-quality chemicals. Owing to their highly divergent properties, however, the by-product streams require a custom approach. With insect larvae as an interim step, this problem disappears, which enables a refinement process with a single inflow. VITO is investigating the fractionation of the various larvae components within this process.

Insects are gaining more and more attention as an alternative source of biomass, nutrients (mainly proteins) and other useful substances. The major advantage is that insects generally see strong and easy growth, without taking up much space. Moreover, most species are not too discerning about what they eat. This presents the prospect of valorising highly divergent organic by-product streams such as grass, fruit and vegetable waste, whose direct processing would normally depend very much upon intrinsic properties, and which is also seasonal.

Fractionation

The use of insects can bring together a range of side streams, processing them together in a single bio-refinery – which obviously makes the economic valorisation much more interesting. This approach formed the basis of the European Horizon 2020 project InDIRECT, which ran from late 2016 to late 2019 and examined the potential of (larvae of) the black soldier fly and the mealworm fed on various by-product streams. VITO brought together a consortium of nine partners for this.

Insect larvae consist of fats, proteins and chitin: three (from a human perspective) useful substances which, before they can be used, first need to be separated and cleaned up – or 'fractionated'. VITO was responsible for this within the InDIRECT project. 'We have a lot of experience in terms of separating components and cleaning them up, partly through our research

into micro-algae,' says Leen Bastiaens from VITO. For the fractionation of the larvae biomass, VITO built its own installation on its site, known as the fractionation pilot plant (which is part of the Insect Pilot Plant). Within InDIRECT, the larvae were supplied by two industrial insect farms: Protifarm and Circular Organics. VITO carried out the applied research into the components it was fractionating in collaboration with the companies Nutrition Sciences, Chemstream and the Innovation Support Point.

Unique process

The fractionation at VITO takes place in several steps. First, a mechanical process – compression – is used to separate the hard skeletal structures of the larvae. These largely consist of chitin, which is the most common biopolymer on Earth after cellulose. The chitin can then be broken down into short sugar chains, which presents the prospect of a wide range of applications. The VITO process that separates and processes the chitin is practically unique. 'Chitin is seldom fractionated and characterised on this scale,' says Bastiaens. 'Over the three years that the project ran, we processed more than a ton of larvae. That means we have definitely taken the step from lab to pilot scale.'

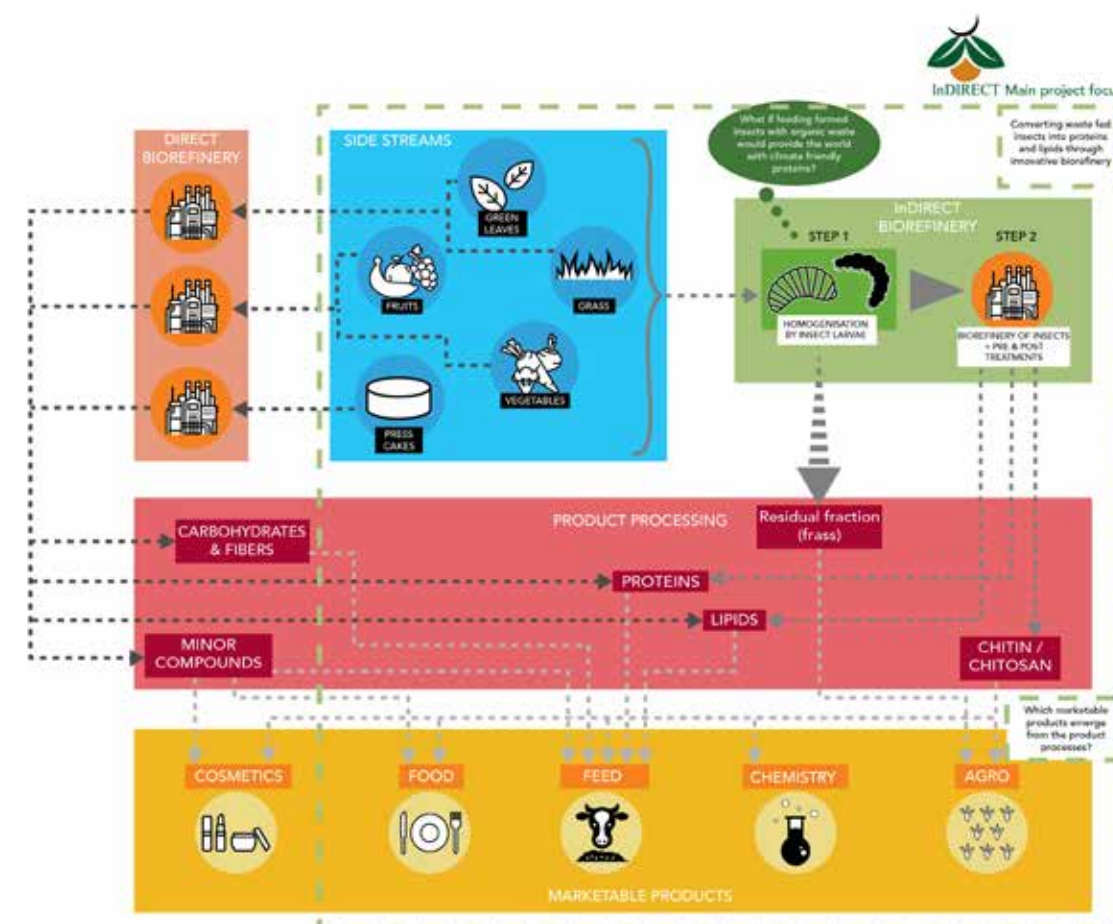
The scale-up is important, even though the technology remains in a largely exploratory research phase. 'Countless kilos of a particular ingredient can sometimes be needed for the current applied research,' continues Bastiaens.

'That means it helps if you're already able to work with reasonable volumes. Furthermore, it brings us closer to realistic circumstances.' Besides scaling up, custom fractionation (tailoring) is also important. 'If we're looking to make feed for young chicks, for example, there should not be too many salts or specific tastes in the end product. Some things we can do to avoid this are to modify the larvae's food – i.e. the by-product streams – or to make alterations to the bio-refinery. The precise influence of the composition of the streams on the larval growth and on their own composition was researched in detail.' According to Bastiaens, further research into the metabolic properties of the larvae may lead to an exhaustive optimisation of the growth and the tailoring.

Alterations to legislation

Could the interim step via the larval growth – hence the project name InDIRECT – make the valorisation of organic by-product streams economically profitable? In order to create a sustainable alternative to e.g. imported soya from Brazil or basic fossil chemicals? 'At present, not yet', admits Bastiaens. 'There are too many steps that still need automation.'

But the legislator may be able to lend a hand, for example by permitting the use of larvae in cattle feed. For the time being, this is not always allowed, because insects currently still fall under the strict animal laws – and there have been very strict rules on the use of animal products in the agriculture and food sector since mad cow disease in the 90s. Bastiaens does expect this to change at a European level soon, though. 'Insects as a raw material for cattle feed will first be permitted for broiler chickens and pigs – for egg-laying chickens and aquaculture it's already allowed. It might well be a bit too sensitive for cattle yet.'



A wider view of the applications could also help. It was possible to demonstrate for various components of larval biomass, for example, that they have an antimicrobial and prebiotic effect. This is interesting for the production of high-quality cattle feed. Additionally, countless components are usable for pharmaceutical products and cosmetics.

In the meantime, VITO is ready to support companies that are interested in the valorisation of by-product streams through larval growth via contract research. 'We're noticing that interest from the industry is increasing. That's obviously the intention of our VITO activities. By investing in this research infrastructure, such as the fractionation pilot plant, we're aiming to raise companies' interest in starting to do their own work around this in turn,' says Bastiaens.

VITO biomass fractionation and conversion pilot plant



Hosting: Insect pilot plant - Mol



Insect Pilot Plant

Insect pilot plant – Mol
Insect biorefinery part

vito

Insect pilot plant – Geel
Insect growth, harvest & stabilization part



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As regards the roll-out of an insect-based value chain from by-product streams, InDIRECT's findings were set out as 19 recommendations. These are available via this QR code:



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THOR PARK IS A 'LOW-REGULATION ZONE'

As part of the current energy transition, VITO/EnergyVille is developing and testing innovative technologies in Genk, which are set to shape the energy system of the future. Thor Park was made a 'low-regulation' zone to enable this to happen as smoothly as possible. This makes the site a 'living lab' for sustainable energy solutions.

Four years after the idea was launched, it has finally happened: in early 2020, Flemish Minister for Energy Zuhal Demir recognised Thor Park in Genk as the very first so-called low-regulation zone in Flanders. That means new technologies or applications in terms of energy can be tested at Thor Park without certain current regulations getting in the way of this. This 'exception regime' only applies to legislation in terms of energy, and will last for the coming five years – with the possibility of an extension by another five years.

Not possible within current regulations

'The intention of a low-regulation zone is to give more freedom, in a safe and controlled environment, for research into technologies, services, market and business models and other aspects of a sustainable energy system,' says Daan Six from VITO/EnergyVille. 'It allows us to carry out experiments that otherwise wouldn't be possible within current regulations.'

Ultimately, the results of those experiments will provide a view of future regulations, and to support policy. Six: 'The energy transition is currently proceeding, whereby a range of innovations are being developed and tried out. Which of these are set to be implemented, and how exactly that will happen, the future will tell. But what is certain is that we're evolving from a

centralised, top-down energy system directed by large power stations to a far more distributed system, where end users are also producers and play a far more active role. It's pretty clear that this system will also need to be embedded in new regulations.'

'Living lab'

Typical for a fruitful experimental environment is that only the broader themes around which work is taking place are fixed – such as the local exchange of renewal energy, smart control of energy networks and the development of new market models. Some of the experiments have already begun, such as the smart charging of electric vehicles. There are also other experiments that still need to be fully conceived and developed, but this is characteristic for a low-regulation zone. 'Along with the other partners on the site, we're forming a 'living lab' for energy technologies where collaboration is very important,' says Six. 'That means companies are very welcome to come and experiment here in a low-regulation framework.' VITO/EnergyVille, which is responsible for the scientific implementation of the low-regulation zone, will be proposing several new practical experiments in the coming months. 'The further development and implementation of the low-regulation zone will take place in consultation with many stakeholders, including The Provincial Development Agency (POM) Limburg, so that companies can make optimum use of the lab.'



Smart heating grid

The recognition of the low-regulation zone explicitly mentions the regulations from which Thor Park is exempt. But what if concrete legislation does not yet exist for some applications? For example, this is the case for a number of aspects linked to VITO/EnergyVille's research into an innovative thermal network for the optimum integration of various renewable energy sources. 'We've been doing research into smart(er) thermal networks for some time now,' explains Six. 'That's where there is smart control of both the production and consumption. Over time, we'll demonstrate that at Thor Park too, by aligning the consumption from heat pumps on the site to production peaks in the locally produced solar and wind energy, for example.' The research into this smart thermal (low-

temperature) network is still quite fundamental, making it risky, but the technology has a lot of potential, particularly when it is combined with the challenges on the electricity grid.

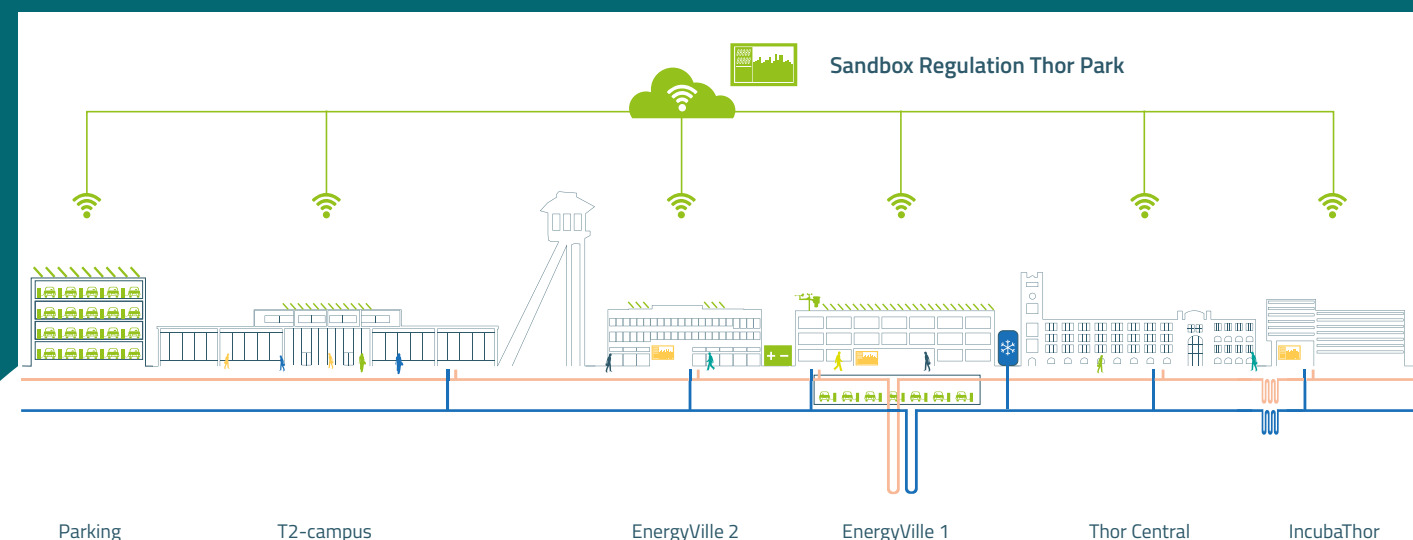
From a content point of view, the low-regulation zone fits in closely with the concept of the local energy community or 'LEC', which generates, consumes or stores energy within a cluster of buildings (see also page 14 and 15 in this issue). At Thor Park, this LEC is formed by clusters of buildings and companies with locally coordinated and optimised energy management.

Six: 'That allows us, at a very small scale, to do research into future energy markets and how they might be organised and/or regulated.'

Aside from the authorities, knowledge institutions and businesses, energy grid managers are also interested in this exploration of the future energy system. This is why a collaboration agreement has been concluded with Fluvius to streamline the knowledge exchange for the low-regulation zone. 'This is obviously very important for enabling the experiments to proceed in complete safety', confirms Six.



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BUILDING TOWARDS A COOPERATIVE ENERGY LANDSCAPE

At ten locations spread all across Flanders, the basic building blocks of the energy system of tomorrow are emerging. One of these is Thor Park in Genk, a local energy community where VITO/EnergyVille is already experimenting with an innovative energy environment itself. In the ROLECS project, the roll-out of these 'LECs' (Local Energy Communities) is being thoroughly examined and tested.

Based on the European regulations around sustainable energy, the energy transition is not only being steered in the direction of more active individual end users who are also producers, but also towards so-called energy communities. These 'Local Energy Communities' or 'LECs' generate local sustainable energy and align their consumption to this, assisted in some cases by storage systems such as batteries. They may form an important component of the affordable and sustainable energy system of the future. For example, LECs can promote the local integration and exchange of renewable energy, help to bear the economic and social costs of the energy infrastructure and create new business opportunities.

New energy applications

But before fully-fledged LECs can be rolled out, all the facets – after all, this involves a brand new concept – must be well-studied and documented. Yes, at a technical level – by searching for the optimum link between local power production and delivery to the grid, for example – but the economic, legal, social and social domains are just as important. This is all part of the Flemish ROLECS project, which is supported by VLAIO via Flux50, the Flemish spearhead cluster for energy

innovation. The Flemish SME Think-e is responsible for coordinating the project. ROLECS stands for Roll-Out of Local Energy Communities and will run until summer 2021.

Although the project has largely arisen at the request of Flemish industry, ROLECS still has much ground to cover before a potential market introduction. 'Many companies see potential in the current energy transition,' says Georg Jung from VITO/EnergyVille. 'Some examples of these could be developers and manufacturers of smart home technology, smart energy modules and remote control applications. They're looking for new areas of application with innovative hardware, software and engineering. That could be better interaction between local power production (through solar panels, for example) and day-to-day energy consumption. Or another example could be a technology that allows a company to use the residual heat from a neighbouring business as process heat.' The ROLECS project aims to rapidly accelerate these kinds of innovations.

The optimum scale for a LEC is a residential district or a business cluster. Within this, energy would no longer be bought and sold as a commodity, but rather as a service. 'Households don't purchase gas or electricity, but instead a comfortable temperature or hot water. This form of "taking care of things" is typical of the philosophy behind the LEC,' says Jung.

Ten demo projects

But how would it be best to roll out such a LEC? This is the central question of the ROLECS project. In fact, the project is building upon a series of feasibility studies that

have been developed in recent years for the various types of energy communities that could emerge here. This ultimately led to the establishment of ten demonstration projects spread all across Flanders – ten complementary 'living labs' where all the aspects of LECs are being investigated.

There are thirty companies working on ROLECS, along with five knowledge institutions including VITO/EnergyVille. The project has been sub-divided into six work packages, each of which addresses a different aspect of a LEC. 'Based on our broad expertise, we have an advisory role in most of the packages,' says Pieter Van Den Steen from VITO/EnergyVille. For the second work package, however, VITO/EnergyVille was appointed as coordinating partner. This one is investigating at a fundamental level how new LEC tools can be developed, what the potential of new LEC services could be and what obstacles (legal or privacy-related, for example) might be encountered here. 'Ultimately, it's down to the industry to do it. As a knowledge institution, we're helping to answer relevant questions and fill gaps, so that companies can conceive of solutions and start developing products.'

Thanks to the division of work packages and the various demo sites, LECs are being looked at from some very different perspectives. What are the appropriate business models? What is the best way to roll out a LEC? What are the regulatory and legal possibilities? How will the financing work? Will it be easy to scale up? And what are the advantages for the stakeholders – both the companies and organisations directly involved and society as a whole? The latter could initiate some far-reaching discussions that may even have tax implications. 'For example, if you allow discounts for direct stakeholders of a LEC, then you might be passing on the costs to other people or companies via the invoice or tax return,' says Van Den Steen. 'Then you have to wonder whether they've had the ability to join a LEC too. These are the kinds



of questions that are also being investigated, which mainly means looking at new tariff structures for energy invoices.'

Innovative data management

A different and possibly very important advantage of a LEC is flattening out peak consumption on the grid, precisely because of the smart local energy consumption. 'The expectation is that we'll be moving to an electrification of energy consumption, and thanks to smart control of charging stations and heat pumps, grid managers may find they don't need to invest as much in strengthening the grid, with less need for peak plants' says Wim Cardinaels from VITO/EnergyVille. 'So this could be some major added value of a LEC. We're looking at how that would play out in the Flemish energy landscape.'

Exactly how this flattening out works is being shown at the Thor Park

demo site in Genk, where EnergyVille is also based. VITO/EnergyVille is already making skilful use of its electric vehicle fleet and solar panels to limit its peak consumption from the power grid there, and to align the total energy consumption to the production from solar panels at cheap hourly rates. 'For example, we're trying to use smart software to avoid – where possible for the users – the electric cars all being charged at once in the morning,' says Van Den Steen. 'After all, that's when electricity consumption is high anyway.' VITO/EnergyVille is using innovative data management for this, whereby the expectations of users, building data, weather predictions and hourly rates for electricity are combined to take decisions in real-time. This is just one of the larger challenges in rolling out a LEC.

In any event, the local aspect of a LEC does not take away the bigger picture. Ultimately, LECs could contribute towards producers and

end users of energy becoming far more active than they are now. 'We need to maintain our overall thinking, even at a local level,' says Georg Jung. 'In that respect, the LECs form the real basic building blocks of a co-operative energy landscape.'



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WATER-CLIMATE NEXUS

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Flanders: from a water-scarce region to a model region for efficient use of water

Flanders has been plagued by drought for the fourth year in a row. What has been known for some time is now reaching a wider audience: Flanders is struggling with a serious water shortage. A thorough rethink of our water system with the aid of technological innovation and a new approach will be necessary. If not, there is a threat of disruptive damage to our economy. The Flemish government is responding to this and recently announced the 'Blue Deal'. VITO can make an important contribution to this with its water-related tools and innovation projects, and its specific knowledge around water.

"Water and climate are inextricably linked," explains Inge Genné, programme manager for Water at VITO. "Climate change is leading to greater drought for us, and in the long term, rising sea levels will also be a concern. On the other hand, water plays a major role in resolving the consequences of climate change, such as the need for cooling and extra water buffers to combat long-term drought. Climate and water form a cohesive system, known as the 'water-climate nexus'."

Flexible and resilient

Flanders had already indicated its ambition to achieve a (climate-) robust water system. "Robust does mean strong and shock-resistant here, but it certainly mustn't be rigid. Rather, resilience and flexibility will be crucial," emphasises Inge Genné. "In the future, our water system will need to be able to handle changing circumstances such as extreme drought, or an intensive period of rain. Every company using water in its processes will need to be able to adapt, and our cities and regions also need to remain liveable in the new reality. We're in need of a flexible water system that makes maximum use of the available water for all possible applications and uses."

Data to information

"Intelligent management systems for mapping out both the quality and quantity of water in detail and in real time will offer the ability to handle our water supplies better and more flexibly," says Piet Seuntjens, innovation manager at VITO. In terms of technology, this is why VITO is focusing on data-to-information. This is where water knowledge is

linked to data management and we are developing software tools for authorities and businesses to enable smart control.

"We aim to use artificial intelligence and machine learning to produce very precise and practical information, including about water drainage. One of the problems we're struggling with in Flanders is the fact that our area is largely designed to drain water quickly. Both in times of drought and water scarcity and in times of flooding, we need to be able to make targeted decisions about actions (such as pumping up water from waterways, filling and emptying buffers, or reusing water) based on fast and accurate data on the quality and quantity of the water.

"With Internet of Water Flanders, we're already focusing on machine learning and artificial intelligence today, in order to process information on water quality parameters in real time. This information can be used to address the issues of surface water discharges and the salinization (a consequence of drought) at our polders and harbour areas."

Collaboration

Collaboration will be crucial to our future water system, in the water world and in all parts of our society. "Good collaboration between Flemish water operators will lay the foundations for the necessary transition. VITO is collaborating with the Flanders Environment Agency (VMM), The Water Group, Aquafin and The Flemish Waterways and is bringing in its transition team to develop a systematic approach along with VLAKWA.

"Water has many users, each with their own social and economic interests. But that doesn't have to turn it into a competitive battle," argues Inge Genné. "The same drop of water can be reused many times. But for that, we'll need to make our water usage smarter and encourage reuse. And that can only happen if users get to know one another better and discover each other's water needs. That's how we can set up collaborations and even bring about some win-win situations."

Giving companies autonomy

"If you study the water challenges in our industry, it's clear that circular water usage needs maximum development. That's how you can separate the limited availability of water from economic growth," Inge Genné points out. "But a good overview of a company's water usage demands a thorough water audit to map out everything that requires and consumes water." VITO is taking this 'the more you show, the more you know' concept a step further by designing water dashboards, which give companies a high degree of autonomy in the management of their own water. Known as 'Water Management 4.0', we are reviewing how smart process control can respond to the changing availability of water sources. Future scenarios and the accompanying cost-benefit analyses need to take account of climate change and the associated impact on water availability, as well as the consequences for other users of the water system. VITO is working on a Water Barometer Tool to give companies an insight into the risks of drought.



Liveable cities

Steps must also be taken for the liveability of our cities, she emphasises. "Both grey, 'engineered' solutions and nature-based measures can arm us against climate change. When developing new sites or for renovation projects, it is crucial to be actively focusing on optimal, partly decentral water management right from the design phase. In order to meet the demands from the drinking water sector and the project developers, VITO has developed the Water Architect Tool. This tool allows to design or calculate scenarios with buffering solutions and the use of alternative water sources such as rain or grey water. The prototype for the tool is currently being demonstrated on the Hertogensite in Leuven.

The old contrast between "nature or economy" is outdated. Returning reclaimed marshland to nature can provide a natural water buffer, for example. At the same time, this creates more space for recreation, which then provides a new economic stimulus. These natural ecosystem services, as they are known, have a wide reach. For example, depaving and planting trees in the cities causes more rainwater to seep into the soil, reduces the formation of heat islands, improves the air quality and causes the breakdown of CO₂. This makes life in the cities more pleasant. VITO's Nature Value Explorer tool (www.natuurwaardeverkenner.be) offers town planners, architects and policy officers a quick and handy overview of the potential of interventions."

Water and agriculture

It goes without saying that our agriculture is also suffering from the dry-outs caused by climate change. Inge Genné: "VITO is using satellite imagery to monitor how much water every crop needs and when would be the best time for irrigation. VITO is launching the Irrigation 2.0 tool, which also maps out alternative sources of water close to agricultural firms. This allows purified wastewater from wastewater treatment plants or from industrial water users (with controlled quality parameters) – water that would normally be discharged – to be reused for certain crops."

Model region

"You can see that there are many solutions to the major water challenges. Flanders needs to combine its know-how to take on the challenge. By focusing on cross-sectoral water-climate solutions, we can take this global too. That's how we can evolve from a water-scarce region into a model region for efficient use of water," concludes Inge Genné.



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INNOVATIVE DIAGNOSTICS FOR CARDIOVASCULAR RISKS

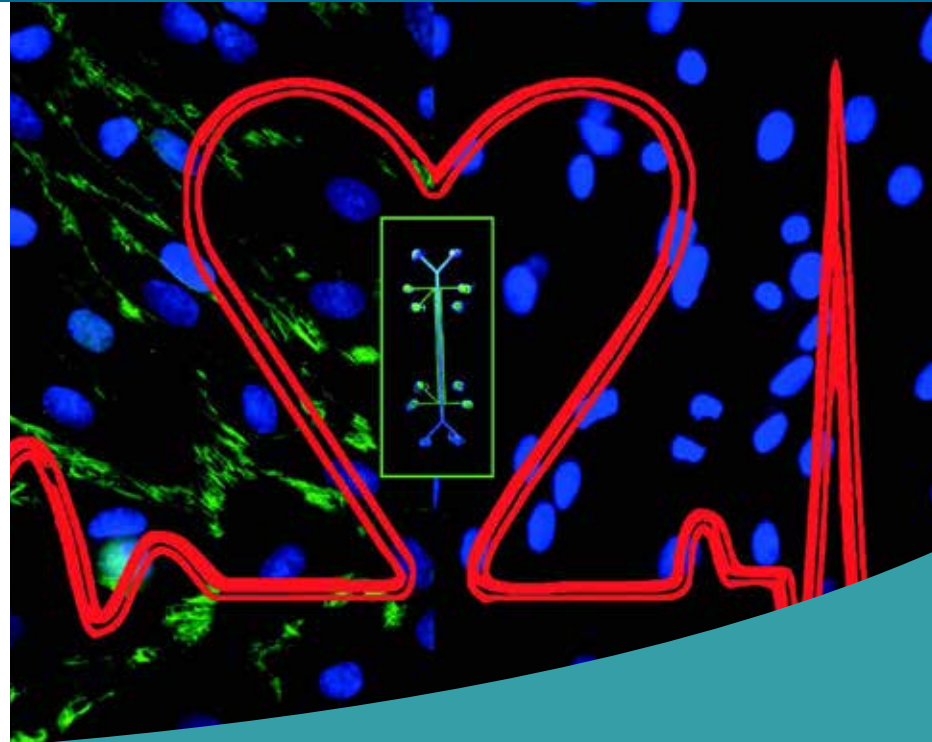
Based on cell vesicles and the molecular profiles that researchers encounter in them, the risk of specific cardiovascular diseases can be determined. This is before symptoms even occur. VITO perfected the analysis of these bio-markers in the Interreg TTD project.

More than a hundred Belgians die every day from a cardiovascular (CV) disorder. This means cardiovascular disorders remain one of the most major causes of death in our country. And due to the rising life expectancy, the number of patients with a CV disorder is only expected to rise in the coming decades. That will mean more and more people needing to undergo heart and blood vessel examinations too. However, these examinations take time (and money) and can impact the patient.

Innovative technological platform

The risk of cardiovascular disease cannot be driven down through better prevention and a healthier lifestyle alone, but requires earlier diagnosis – ideally, before the first symptoms appear. The latter lay at the heart of Trans Tech Diagnostics (TTD), a (completed) European Interreg project that centred around the development of an innovative technological platform for efficient and accurate cardiovascular diagnostics, with little impact upon the patient. The project ran from early 2016 to early 2020.

TTD focused upon the early recognition of an elevated risk of CV disorders using new kinds of bio-markers, namely extra-cellular vesicles. These are minuscule bubbles of up to 150 nanometres in size (a nanometre is eighty thousand times smaller than the thickness of a human hair) that are expelled by the cells in our body, whose composition reflects the health of those cells. This composition can be determined by examining blood samples. The major



advantage of these bio-markers is that they provide an accurate prediction and can shed light on CV disorders even before symptoms appear.

Stressed cells

But which vesicles should we zoom in on in a patient's sample exactly, so that a personalised risk of cardiovascular disease can be determined? This was VITO's task in the TTD project. Along with the project partners, there has been a search for new and more refined detection methods for vesicles in recent years. "In fact, we were looking for signals in the vesicles that point to symptoms of inflammation in the cells they come from," says Inge Nelissen from VITO. "In order to pick up those signals, we not only need to be able to detect different kinds of biomolecules, but to "refurbish" the vesicles in vitro so these signals become clearly measurable too."

In TTD, which came about through a collaboration between the Universities of Hasselt and Maastricht (hence the cross-border nature of this Interreg project), a so-called

'bio-assay' was developed, which is a biological testing environment in miniature that allows the potential and concentration of inflammation-related vesicles to be determined from the effect on living cells and tissues. Because cardiovascular diseases are often the result of an early or dormant infection in the blood vessels, this bio-assay was equipped with cells from both human blood vessels and the immune system. The assay was then integrated into a suitable medium for this, a lab-on-a-chip.

VITO (in collaboration with the Universities of Hasselt and Maastricht) used this bio-assay to be able to select the right biomolecules and the molecular profiles that are an indicator of an elevated risk of certain CV disorders. The focus here was on arteriosclerosis (hardening of the arteries) and angina pectoris (pain in the chest resulting from a poorly functioning heart muscle). The VITO researchers were looking at endothelial cells that form the basis of the blood vessels, and at monocytes and macrophages – the immune system's first line of defence, let's say.

Unique analytical capacity

The measurement of the vesicles took place using hyper-sensitive flow cytometry, a technique that allows individual particles (such as vesicles) to be detected and identified down to a resolution of 50 nanometres. VITO purchased specialist equipment for this, meaning it now has technology and expertise in-house in terms of flow cytometry that is unique in Flanders. "This equipment gives us an analytical capacity that we don't see in any other technology," says Nelissen.

Although the flow cytometry technique is not new, standardisation and calibration were still somewhat lacking before TTD commenced – at least for the analysis of vesicles. VITO has perfected this in recent years, also writing protocols to guarantee high-quality analyses. That means that diagnostics based on extra-cellular vesicles are in principle

ready to be evaluated in clinical practice. Nelissen: "We can now analyse vesicles, both qualitatively and quantitatively, once we've refurbished them from blood or urine samples. Hospital labs will now have to decide whether they want to make the move and develop the diagnostics further in-house."

VITO would like to continue its research into flow cytometry on vesicles in-house too. "For example, we'd like to start working with more comprehensive bio-assays to be able to read several bio-markers from the vesicles at the same time. Alongside this, we'd like to shift in a practical direction, by helping to translate this into clinical applications," says Nelissen. VITO will submit an application for a fellowship via the European Marie Curie programme in order to staff this further research. "We'd like to set up a full-time post-doc here."

The portfolio of the public partners in the consortium behind TTD has since been classified into a separate structure: the TTD Open Technology Platform. This serves as the basis for further collaboration with external partners or users. The short-term aim is to enter into accessible collaborations through a number of demo projects. There will be communication from the project partners on this in the run-up to TTD's closing event (which was postponed owing to the corona crisis).



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VITO EMPLOYEE IN THE SPOTLIGHT

When our country was struck by the corona pandemic in mid-March 2020 and VITO switched to home working en masse, this started a unique period for the VITO support service Environment, Safety & Quality. Jan Deckx experienced it all from the first line as a prevention adviser. 'We're at the service of all the VITO employees, so they can do their job in a safe and healthy manner.'

You've been a prevention adviser since 2015. How does that role connect to your education as a chemistry graduate?

I've worked as a chemical lab assistant for various companies where there were strict guidelines in place around safety and prevention too, such as Umicore and Janssen Pharmaceutica. My education covered many safety aspects as well. What's more, I've always had a strong interest in safety. I got the diploma I needed to be a prevention adviser through extra training.

We can't get around corona. How was the lockdown for VITO?

VITO had a maximum focus on working from home. While most of the staff were advised to do this, our lab assistants stayed at their posts. For them, maximum efforts were made around maintaining a distance by physically spreading people and providing sufficient supply of disinfectants, so they could clean their own working environments. On top of that, extra rotation was adopted in the planning, so the lab assistants could work separately as far as possible and various tests weren't to take place at the same time, for example. That also meant there was no need to make it mandatory to wear face masks during that time.



What was the most thrilling moment for you?

The third phase of the exit strategy, whereby many staff would return physically to VITO, was prepared from early May. This was a thrilling moment, because as a prevention adviser I was among those brought in for the practical developments to make the site 'coronaproof' by 8 June. The rules for this had been established by the government, but it was our job to implement them in a pragmatic manner. In the run-up to 8 June, I was helping to make offices, meeting rooms and laboratories coronaproof by creating distances, providing enough disinfectant gel and designing and putting up posters and stickers. For us, this also came down to being able to react quickly, as the measures from the government were changing regularly.

What are your typical characteristics as a prevention adviser?

I have a very pragmatic mindset, but if I notice something could be done better or more efficiently, I go for it. Being able to convert theoretical rules into practice smoothly comes in handy in my job, and we're always trying to do that better in terms of safety and prevention too. We do this by running training courses, for example, providing prevention toolboxes and coaching colleagues. That's how we raise the level of the staff's safety culture.

That culture has seen strong growth in the past few years, up to a very high level. VITO meets various ISO standards, which demands far more effort from us than the legislation does. These standards require you to continually set new goals and achieve demonstrable improvements, so we're doing things a little better tomorrow than we are today. I like that style.

You are consulted by all the different VITO departments and units. That gives you a helicopter view of everything VITO's doing.

That variety of topics attracts me. We are in contact with every VITO unit: from research into sustainable energy, to health, to remote sensing. We're at the service of all the VITO employees, so everyone can do their job in a safe and healthy manner. We always follow the same prevention route in this, from the identification of small and large risks to the implementation of specific measures. During that exercise, we blend our prevention knowledge with often highly technical expertise from colleagues. That gives me a lot of satisfaction too, as I have a strong interest in technology.

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