

# VISION

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## SPIN-OFF MONA SPEEDS UP SCREENING FOR EYE DISEASES

**CLEAN VISION  
SUMMIT 2022**

**PFAS POLLUTION** DEMONSTRATES  
IMPORTANCE OF **THOROUGH**  
AND **CONTINUOUS MONITORING**

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Dear reader,

The past year has been marked by various crises worldwide, including in our country. The PFOS pollution in Zwijndrecht became a topic of discussion in the spring. In the soaking-wet month of July, we were infested by floods – after the heatwaves of the years before, yet another manifestation of our planet’s warming. And as though that were not enough, coronavirus returned in a fourth wave too, with the virus filling our hospitals once more – the very high vaccination rate in our region did thankfully prevent us from having to take further strict lockdown measures.

All these crises also hit VITO, in the sense that policy-makers as well as companies look at us and ask for insights into the causes, for aid in mapping out all the problems and of course for solutions, in both the short and the long term. This means VITO occupies a unique and crucial position in the Flemish and Belgian society and economy, pointing the way out of the various crises and showing which path can best be chosen. In our country and region, VITO keeps its finger on the pulse of the living environment, the climate, public health and so many more aspects that determine our daily life.

This issue contains a broad discussion of two of the three mentioned crises – the PFOS pollution and climate change. You can read how we are helping to map out the seriousness and scope of the pollution in and around Zwijndrecht. We were only able to proceed immediately to analysis of soil, water and blood samples last spring thanks to the years of knowledge and expertise we have built up in PFAS monitoring – a gigantic family of chemical substances, of which PFOS is only one. The fact that we were able to begin aerial measurements very quickly last year too is a further example of our proactive attitude.

In terms of the climate, VITO has grown into an internationally renowned and esteemed partner for climate-related projects and service provision. This was further highlighted at both the G-STIC sustainability event that we organised at the World Expo in Dubai and at the climate summit COP26 in Glasgow. In this issue, you can read how we are offering integrated climate services and solutions to less developed countries. One great example of this is the support in drawing up the NDCs which countries can use to report on their progress in terms of climate mitigation and adaptation. We can be rightly proud of the launch of the NDC Support Center last year, which supports African countries in their climate reporting.

We are also operating more and more internationally in environmental terms. Last year, we celebrated the tenth anniversary of LIBOVITO, our research department in China that supports authorities as well as companies there in their ambitions to improve air quality. As we look back on the past ten years, the results that LIBOVITO has achieved have been impressive. This is in large part thanks to the modelling work by our colleagues here and in the Far East. That is yet another feather in our cap.

Happy reading!

**Dirk Fransaer**  
Managing Director of VITO



COLOPHON

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- linkedin.com/company/vito

More info: [vito@vito.be](mailto:vito@vito.be) - [www.vito.be/en](http://www.vito.be/en)

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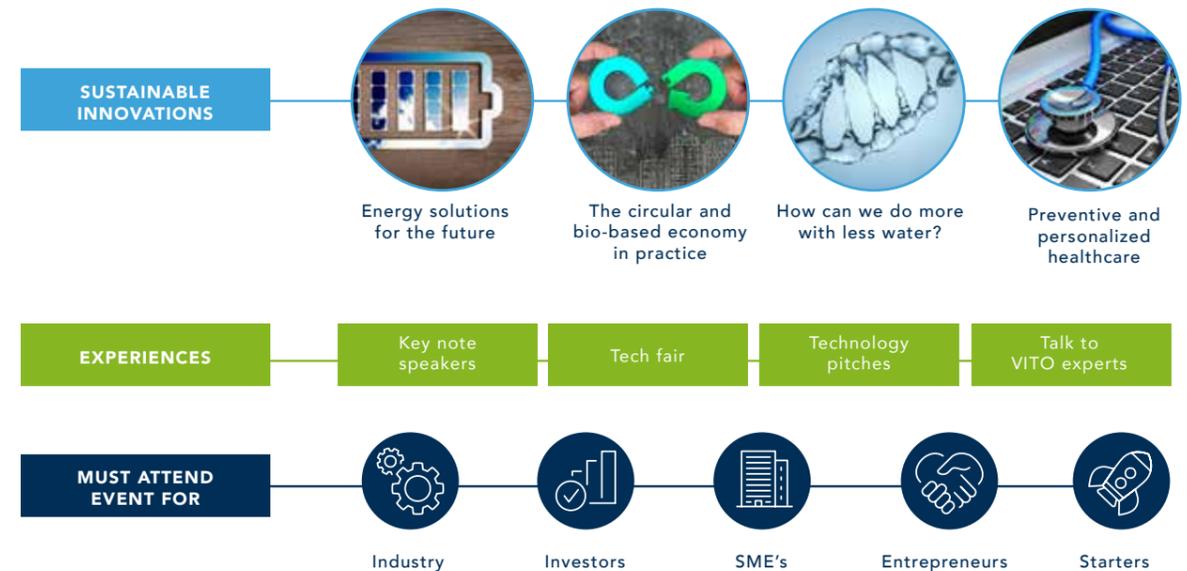
CLEAN VISION SUMMIT



TURN SUSTAINABILITY INTO BUSINESS

14 JUNE  
BIJLOKE GHEENT

WOULD YOU LIKE TO USE MORE SUSTAINABLE INNOVATIONS IN YOUR COMPANY TO STAY AHEAD OF COMPETITION?



On Tuesday 14th June 2022 VITO organises the third edition of the Clean Vision Summit at the Bijloke in Ghent. During this business event, as a visitor, you will get an overview in one single day of the sustainable VITO innovations for the following themes: energy solutions for the future, the circular and bio-based economy in practice, how can we do more with less water and preventive and personalised healthcare.

Expect insights and demonstrations from VITO experts and market specialists, sharp debates on actual topics and networking opportunities with our experts and potential partners

to grow your business in a sustainable way.

During technology pitches VITO experts will present their challenging (growth) projects and we look at possible collaborations and/or technological developments, together with your company.

How can you use all these upcoming innovations as an advantage in your company?

Don't miss this chance to discover the latest opportunities in sustainable technology for your business in Ghent.

MORE INFO

**Where**  
Bijloke Ghent

**When**  
Tuesday 14th June 2022 (starting 10 am)

**More information about this business event**  
[summit.vito.be](http://summit.vito.be)

*This event is organised with the Covid Safe Ticket (CST) and the actual corona safety measures will be applied.*

# SPIN-OFF MONA SPEEDS UP SCREENING FOR EYE DISEASES

**Artificial intelligence can make screening for serious eye conditions considerably faster and easier, and can help reducing the long waiting lists for people at elevated risk. This is what MONA is demonstrating with its new eye screening method, which was introduced in this country late last year. The VITO-KUL spin-off combines medical research from the KU Leuven with state-of-the-art AI techniques developed at VITO. The result: an eye test that is very reliable, produces immediate results and gives no discomfort at all.**

There are half a million people in Belgium with diabetes. What few patients realise is that they run a far higher risk of diabetic retinopathy, or damage to the retina, as a result of their chronic condition. If treated inadequately or too late, this eye disease can lead to reduced vision and even blindness. Indeed, diabetic retinopathy is the main cause of blindness among the professional population of working age in this country.

Despite this, far too few diabetics see an ophthalmologist, even though a timely screening for retinal damage can lead to the immediate start of treatment – and as with so many diseases: the earlier it is diagnosed, the better the prognosis is. Over one fifth of people with diabetes never even go to an ophthalmologist at all, and just 50 percent are seen at least once per year. We should acknowledge that this is not always their fault, as Belgium (just like most other countries) is struggling with a pressing shortage of ophthalmologists, meaning it can sometimes take six months before you can finally be seen. On top of this, diabetics are also discouraged by the inconveniences of a traditional eye screening: the pupils are dilated so they can be examined, which can cause irritation and dizziness afterwards – this means you are not

even allowed to drive a car in the first five hours after a screening.

## AI analyses retinal scans

Diabetic retinopathy is not the only disease that can be screened for through retinal examination. Glaucoma, which involves damage to an optic nerve, can also be diagnosed this way. And non-eye diseases, such as cardiovascular conditions, dementia and Alzheimer's disease, might also be detected very early in this way too. At least, that was what researchers from the KU Leuven and VITO were dreaming of. Their way of achieving that dream? Screening for biological changes in the retina with artificial intelligence (AI) and relating these to the development of a particular disease.

Today, the AI models have been trained with hundreds of thousands of retinal scans that had previously been analysed by ophthalmologists. The technology is now ready for use, but only for eye diseases such as diabetic retinopathy and glaucoma. 'Initially, those who first conceived the new eye screening method hoped they would be able to start screening for a very wide range of diseases,' recalls Bart Swaelens, Head of Tech Transfer at VITO. 'But to create a spin-off, you need to focus. Ultimately, the detection of diabetic retinopathy and glaucoma proved to be the most interesting trail to follow.'

Over two years ago, the research into the new eye screening method, led by Bart Elen from VITO and in collaboration with Professor of Ophthalmology Ingeborg Stalmans from the KU Leuven, was ripe for preparing the ground for commercial valorisation. Swaelens: 'Back then, we started looking for an external entrepreneur with valuable experience in the medical world to lead this spin-off and prepare for the launch of the new eye screening method. That is how we found Olivier Ménage.'

## The patient is central

The Frenchman Olivier Ménage, who had over 25 years experience in the sector and had lived in Belgium for many years, joined the MONA team on 1 April 2020, just after the coronavirus pandemic had broken out. 'We gave ourselves a year to translate the medical research results into an innovative commercial product. We also developed our business model and determined our strategy over that year.' So all that had to be done over the phone and in video meetings; Swaelens and Ménage had met just once in March 2020 and only digitally since then. 'You could say it was a very unusual way to start,' says Ménage. 'We really had to do everything remotely.'

One crucial element in MONA's strategy is that the patient is central. After all, they need to be encouraged to have regular screenings. That means the screening needs to be easily accessible, take a short time, be available in many places and, of course, be comfortable – i.e. without the inconvenience of pupil dilation from eye drops. It is much to MONA's credit that it was able to translate and integrate all those requirements into its eye screening method. This is based on a camera that scans the patient's eye. The scan is complete in less than four minutes and they can go home again, while the ophthalmologist – who always oversees the screening – gets the results immediately. They only need to take a brief look at it, as the analysis by the AI software (with a sensitivity of 90 % and specificity of 95 %) is just as reliable as a human one. That allows the ophthalmologist to refer a patient for treatment immediately, if this is necessary.

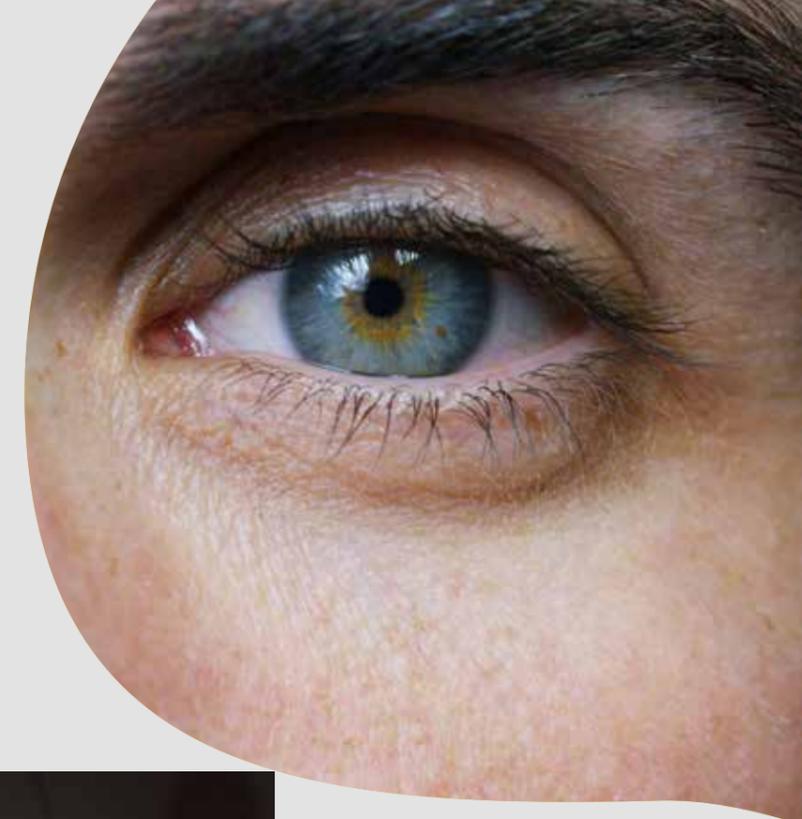
The VITO spin-off MONA then came about in May 2021. It was founded by Olivier Ménage, along with Prof. Stalmans and Stef Rommes, one of the software engineers at VITO, who is now leading the R&D at MONA.

The new eye screening method was a quick hit with Belgian investors. In the summer of 2021, they collectively managed to collect 1.5 million euros. A solid amount, but this will be needed for further software development, recruiting extra staff and completing the first pilot projects on diabetic retinopathy and glaucoma screening.

Finally it is time for the big moment; MONA introduces its screening kiosk. Cameras with software have been installed at various hospitals in Belgium. These enable them to optimise the workflow in their ophthalmology departments, meaning far more people can have a screening done more quickly and easily.

Belgium may seem a small country for an ambitious medical company, but with half a million diabetics, there is a great need for eye tests. Nonetheless, MONA is already ambitious to offer its services to hospitals elsewhere in Europe too, as well as in Africa and the Middle East. 'We are in contact with hospitals in Congo and Rwanda, for example. The cost-efficiency of our screening method is an asset there,' says Ménage.

'Belgium is what is known as a beachhead market in that respect,' says Swaelens. 'This is an initial market to conquer, from which you can grow into other markets.' VITO is also profiting from this growth, as it happens, as a co-shareholder in MONA.



**More info**  
bart.swaelens@vito.be



**More info**  
olivier.menage@mona.health

# PFAS POLLUTION DEMONSTRATES IMPORTANCE OF THOROUGH AND CONTINUOUS MONITORING

VITO plays an important role in the monitoring of PFAS pollution in and around Zwijndrecht. It is thanks to its many years of experience in monitoring the wider PFAS family that VITO was able to proceed immediately to soil, water and blood analyses last spring.

When it became known in the spring of 2021 that there were unusually high PFOS values in the soil around the 3M factory in Zwijndrecht, few people had heard of this chemical substance. Hardly anyone knew they were part of a very large family known as PFAS, which – since last year – have also been described as forever chemicals. The name shows why many substances in this family are so problematic once they end up in the environment: they are barely degradable, so they remain in the environment for a very long time, where they can build up and lead to negative effects after prolonged exposure.

## Need for a range of measurement and analysis methods

VITO has been aware of PFOS and PFAS for a long time. 'The first assignments leading to the development of a specific methodology for measuring PFAS date from the early 2000s,' says Griet Jacobs of VITO. 'That meant we already had many methods for monitoring PFAS in soil, water, blood and plenty of other matrices when the pollution was announced last year. It was a great advantage that many methods were ready to use. Moreover, some of them had already been comprehensively validated and accredited by the national accreditation body, BELAC (ISO17025).'

The development and validation of the new measurement and analysis methods is dependent upon Flemish environmental legislation. 'Momentum gained rapidly around PFAS methods in 2015,' says Jacobs. 'Back then,

there was an initiative to constrain the substances as far as possible, thereby keeping them away from the environment as much as we could, at both a worldwide and European level. Some of the methods we now have were developed then.'

The problem with PFAS is that the family is so large; at present, it comprises around six thousand different substances and these cannot all be measured using one single method. Such a method also depends on the medium in which the substance is being traced. VITO also began aerial measurements in the autumn of 2021. 'We couldn't even wait until the methodology for aerial measurements had been fully validated,' says Jacobs. 'The urgency demanded faster data. Our approach was able to guarantee the necessary quality of the measurement data, but further validation remains necessary.'

PFAS are most well-known for their applications in coatings for making products resistant to water, grease and dirt, for example. In addition, they are used in innumerable industrial as well as consumer products. In chemical terms, PFAS are practically inert, so they hardly react with other substances. This is partly why they are so persistent in the environment. However, inert does not mean harmless.

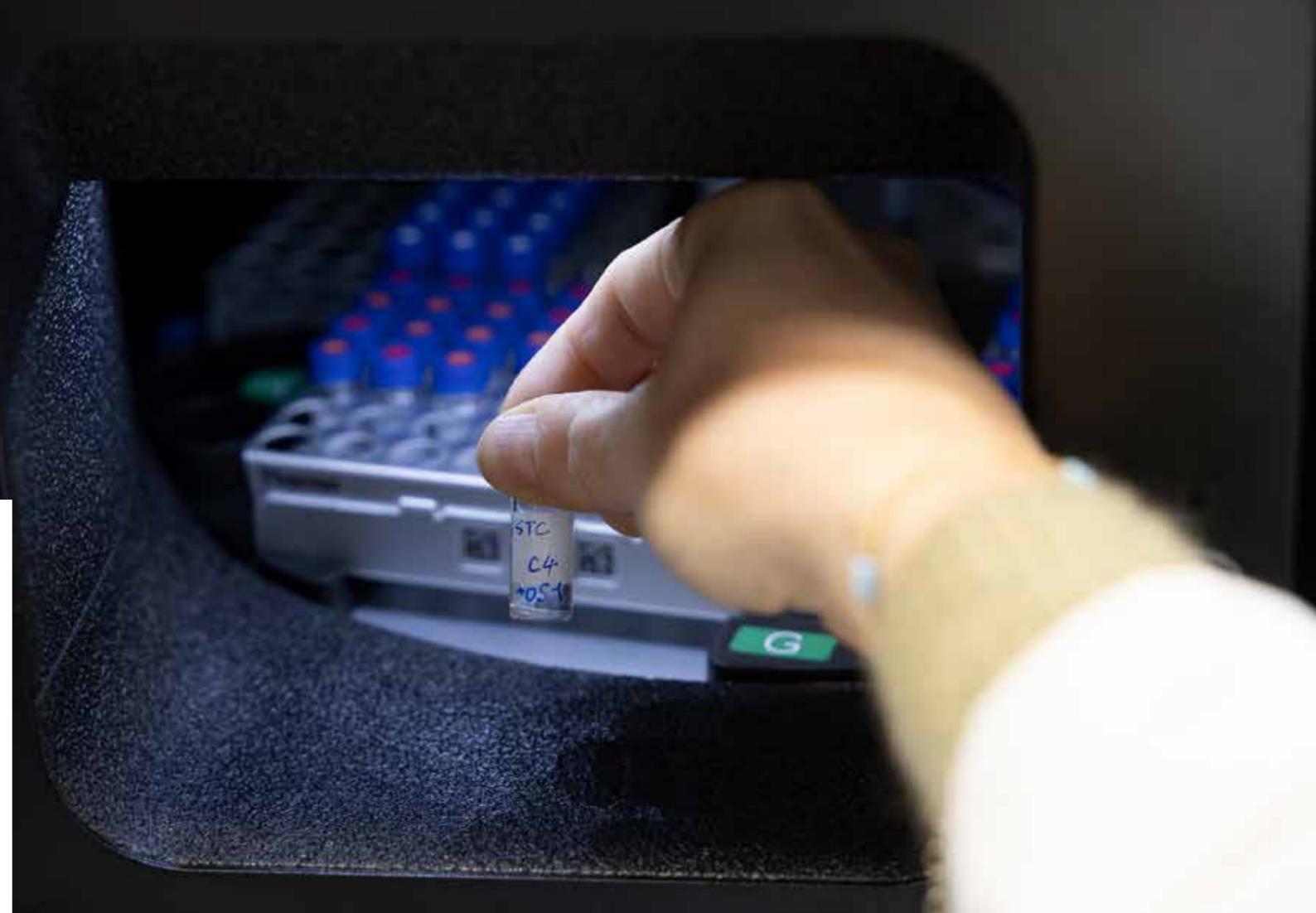
## Need for more general screening

Exactly what the health effects of PFAS for humans are is not yet entirely clear, but various studies have linked them to harmful effects such as a disrupted

hormone balance or an increased risk of cancer. 'The problem is that many PFAS act upon receptors in our bodies that are linked to vital functions,' says Stefan Voorspoels of VITO. 'That can lead to mutually reinforcing effects, so we can't just downplay low concentrations of a particular PFAS component in the environment. So that means we need to be able to trace them all separately. A huge job given the current state of the technology.'

This is why VITO is conducting research into new methods that can identify various PFAS at the same time, both in soil, water and air and in humans. 'We want to evolve towards a general screening that provides a meaningful total picture,' says Voorspoels. 'To do so, we need to try and detect as many of the six thousand PFAS as we can at the same time. This is possible with methods that map out the total load of PFAS on the one hand, and can also provide detailed information on particular PFAS components that demand special attention on the other. The technology, expertise and ideas for how we can manage this scientifically are ready.'

The more you measure, the more you know, but measurements also costs money. Voorspoels: 'If we want to know the extent to which certain substances are present in our environment, and how they are distributed, we can't just base that on literature studies from abroad that we then extrapolate onto Flanders, for example. We need to be doing our own continuous and thorough monitoring too, particularly if the pollution is not in the news. This is what the PFAS pollution crisis has



now demonstrated.' But the green evolution is definitely still going on. 'Industry bears a lot of responsibility too. We are already collaborating with many companies that have developed and rolled out technology to reduce the discharge of harmful substances. We are helping them to monitor the efficiency and performance of their system on the one hand, while tracking down problematic components that they have no knowledge of yet on the other. Sadly, this is not yet standard practice, but we are nonetheless seeing that some companies want to prevent any future problems this way.'

'VITO develops methods, transfers them to the routine laboratories and monitors the quality of their implementation through the accreditation system. The environmental controlling measurements are not actually carried out by VITO,' says Voorspoels. 'It's ultimately policy that determines everything to be investigated and monitored,' adds Jacobs.

VITO takes on a proactive role. 'We do more than just hand over the measurement results. If we notice something unusual, we report this and ask the client whether we can investigate it further. That's our scientific attitude.' This attitude distinguishes VITO from other labs that routinely enter the market. Voorspoels: 'We are not bound by a single method and can implement changes quickly if the samples require it. This is far less evident at routine laboratories. It makes us more capable of detecting something unexpected, for example. In addition, we always enter into discussions with the client first and get a sense of their expectations. This proactive attitude can also be useful in our work for the government.'

## Network of experts

VITO has also been an advisory member of international organisations and networks of experts such as CEN and the Norman Network for many years. 'That gives us a good view of what's

going on on the front lines. We hear very quickly which alarming substances we urgently need to pay more attention to, for example,' says Jacobs. This allows VITO to act decisively in monitoring the Flemish environment and as a partner to companies with green ambitions that want to resolve environmental problems before they arise.



More info  
stefan.voorspoels@vito.be

# ARTIFICIAL INTELLIGENCE LENDS DEMOLITION FIRMS A HELPING HAND

Spurred on in part by the European Green Deal, Flanders is facing a radical renovation operation for its (often outdated) building stock in the coming years. This means that materials being transported away from built-up areas – which are already responsible for the largest waste streams – will need to be collected, sorted, recycled and reused on a large scale. In order for this to take place in as circular a manner as possible, however, the local material stocks need to be known. VITO's Demolition Guide is the first to offer a more refined assessment of this, based on automatic material recognition.

What materials, and in what quantities, weights and shapes, are going into and out of a defined area such as a district, city or region? Based on existing data and a few statistics, a rough assessment can be made of the stock of subsequent inflow and outflow streams. Unfortunately, the resolution for this is quite low, so it is accompanied by rather large margins of error. That means the picture of material stocks remains obscure.

But concrete information on those material stocks (or material inventories) is precisely what is needed for sectors like waste processing and recycling, as well as construction and the transport sector, to start doing business in a more circular manner. 'In the transition to a circular economy, businesses will need to start reusing and recycling more and more materials,' says Yoko Dams of VITO.

'To do so, however, they will need to know what they can expect, so they can focus their activities on that.'

## Semi-automatic tool

There is already a method for detecting and inventorying asbestos in Flanders. This was partly developed by VITO's Remote Sensing unit and recognises asbestos roofs and other asbestos construction elements from aerial imagery. A comparable tool for façades and more specifically window profiles is currently under construction. The Demolition Guide was developed with the support of among others Flanders Circular, the Flemish public-private partnership that acts as an interchange for the circular economy. This tool works on the basis of imagery of house and building façades taken from the street, for example by Google Street View®. Artificial intelligence is

applied on that imagery to recognise specific construction elements such as windows and window profiles, as well as specific materials.

The tool, developed in collaboration with Immoterrae as part of a pilot project that finished late last year, was applied to the city of Leuven and works semi-automatically. Some human intervention is required for selecting the imagery in the tool software, but everything runs automatically after that. The tool's ultimate output indicates how much of a particular construction element or material is present in a building. In order to arrive at an aggregated result for a 'scanned' area and to know how the exact quantities of construction elements and materials are distributed across the local building stock, however, further development is needed. That information may be of interest not only to the mentioned businesses, but most likely also to policy-makers. 'For example, they can then base market economy studies for renovations on that,' says Tanja Van Achteren of VITO.

## Eighty percent reliable

The tool's pilot nature means that the Demolition Guide is not quite finished yet – indeed, this is a new development from scratch. There is, therefore, certainly some room for improvement. 'The technical challenge is quite considerable. The façade of a house or building needs to be clearly visible, for example, and this is often not the case due to parked cars or trees,' says Van



Achteren. 'In addition, the algorithm being trained on thousands of images of construction elements and materials through deep learning is not perfect. At present, the reliability is around eighty to ninety percent. That means an average of ten to twenty percent of detections are still errors. This problem does not have to be insurmountable, but as a user, you do need to know that.'

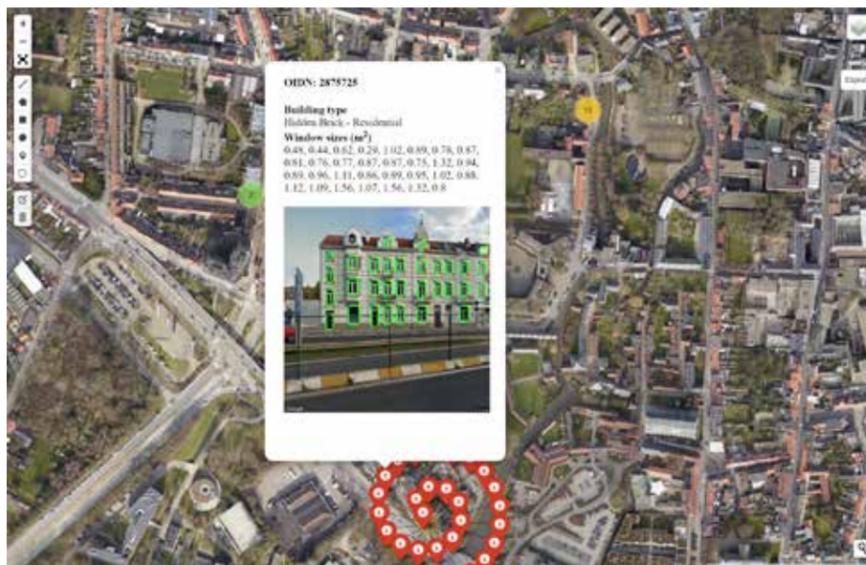
The use of street imagery is an asset for the Demolition Guide. After all, besides Google Street View®, cameras can be used on vehicles that are frequently passing through streets anyway, such as refuse lorries, carrier bicycles and cars, and public transport.

In the short term, VITO is aiming to scale up the Demolition Guide to the city level. The evaluation of the completed pilot project will contribute to this. 'We can now identify the obstacles to further upscaling,' says Dams. 'At the same time, we're aiming to improve the statistical processing and interpretation of the output data at a district and city level.'

The Demolition Guide was developed by VITO in close collaboration with partner Immoterrae and stakeholders VCB, Tracimat, FLOOW2 (supplier of Werflink), BOPRO and the City of Leuven.



More info  
yoko.dams@vito.be



# CEVALUATOR GIVES A FREE INSIGHT INTO FUNDING VIABILITY FOR 'CIRCULAR'

VITO has developed a web-based tool that can offer businesses and investors a more solid foundation for the funding of circular projects, initiatives and business models. 'We were seeking a balance between an easily accessible instrument and a nuanced, data-rich tool.'

A sustainable economy is also largely a circular economy. But the transition to get there is easier said than done. Not least because such a transition cannot succeed without adequate funding. This is where it often stalls today. 'We notice that investors and financiers sometimes get cold feet,' says Anse Smeets of VITO. 'Practically all financiers work and decide on the basis of risk models. Particular to this is that what is unknown is often deemed to be "high risk". And there are plenty of uncertainties when it comes to circularity.' It was no coincidence that Flanders Circular, the public-private partnership that acts as an interchange for the circular economy in Flanders, identified funding as an important lever in the transition several years ago.

In 2019, Flanders Circular organised a third open call for new projects to give the circular economy some more oxygen. The Foundation for Future Generations, Econocom and VITO signed up and saw their Circular Impact Investing project approved. This project ran from December 2019 to September 2021 and led to the development of a new evaluation tool for both financiers and companies with circular plans. The CEvaluator tool is a checklist that maps out the circularity performance for an initiative, project or business model in an objective yet easily accessible manner. In doing so, it not only takes account of typical circular aspects such as product and material flows, but also broader aspects of ecological sustainability and economic facets, such as assessing risks and opportunities.

## Standalone, web-based version

'Our initial idea was just to help point the way for investors in the existing range of tools for mapping out circularity, but there soon turned

out to be a need for an exploratory, easily accessible screening,' says Smeets. 'To make one, we based it on a categorisation system developed by the Support to Circular Economy Financing Expert Group, which reports to the European Commission and of which Flanders Circular is part.' The categorisation system developed by this European expert group is currently used as the basis for the 'Circular economy' section within the Commission's taxonomy for sustainable investments, as it is known. The development of the idea to make this categorisation system interactive led to a complex result in the form of an Excel spreadsheet that users could download from the VITO website. A spreadsheet that was sadly not very user-friendly. 'Moreover, we could only guess at the tool's effective use (we could only see the number of downloads) and we got little feedback.' This was why VITO choose to change tactics and develop a standalone, web-based version of CEvaluator.

The CEvaluator tool's content consists of two major sections. First and foremost, the circularity performance for a particular project, initiative or business model is mapped out – more qualitatively than quantitatively, so without immediately assigning it a score. Smeets: 'Based on the input data from the user, the tool checks for the extent to which a case is circular, and what aspects of circularity it covers. This could range from circular design and use to value and product recovery. It also looks at sustainability aspects such as transport. This evaluation is based on the existing European categorisation system.'

## Tool asks the right questions

Opportunities are linked to every business case (otherwise companies

would not be interested in them), as well as risks (which may scare off potential investors). The second section of the CEvaluator tool zooms in on those specific opportunities and risks of doing circular business. 'These are often closely related,' explains Smeets. 'Better customer relations are typically something that comes about through doing circular business. But that could also mean income is more distributed over time and prefinancing is needed, which a business as well as an investor will certainly need to take account of. Our tool asks the right questions about that.'

The tool is initially intended for circular entrepreneurs (such as start-ups) and for evaluators, as they are known. The latter may be private investors or authorities issuing subsidies, as well as professional supervisors who support entrepreneurs in the transition to more circularity. For example, these could be the funding experts from FINMIX, a VLAIO (Flanders Innovation & Entrepreneurship) initiative that innovative businesses can call upon for funding advice coming from a panel of various types of public and private financiers.

A VLAIO business advisor (or a consultant) can assist in the effective use of the tool. 'It takes around an hour to enter all the data and answer all the questions,' says Anse Smeets. 'We were seeking a balance between an easily accessible instrument and a nuanced, data-rich tool. How useful it is naturally depends on the specific user, and the extent to which they are familiar with and involved in circularity. But from the reactions we have received up to now, we can already conclude that the tool certainly has its value.'

Now the development and pilot phases are over, Flanders Circular is taking over the web hosting and further co-ordination of CEvaluator from VITO.



More info  
anse.smeets@vito.be  
cevaluator.be



We contacted two organisations that have already used the CEvaluator tool: a company with circular ambitions and a bank in great support of circularity.

### 'The tool helped map out our potential circular scale in full'

Veldeman Bedding is a family business that has been producing high-quality 'sleeping systems' (mattresses, divans, slats and toppers) for the Belgian and European market since 1954. 'Sustainability is in our genes, but since 2017, we have also been doing some very practical work around circularity in the form of circular sleeping systems,' says Valerie Veldeman, Sustainability Co-ordinator for the company in Oudsbergen.

A truly circular business model, however, demands a very structured, clear approach. This was why Veldeman Bedding recently called upon the CEvaluator tool, which the company completed along with Philip Marynissen. 'The tool is specific enough to be able to learn from, while at the same time broad enough not to lose sight of the bigger picture,' reports Veldeman. 'We were already quite comfortable with circularity to a degree, but I can imagine that companies that aren't will be surprised when they use the tool for their specific business model.'

The problem with sleeping systems is that the residual value is generally low. The tool highlighted this further. It also revealed several cases for which additional funding is needed, although this had not been obvious at first. 'The tool helped map out our potential circular scale in full,' says Veldeman.

Veldeman will incorporate the results of CEvaluator's calculation, which can be downloaded in the form of a PDF file, into future credit files to persuade financial institutions to invest in the company.

### 'The tool gives users an actual picture of their circular project in the long term'

Sustainability is also in vdk bank's genes. And the bank actively conveys this. 'As a niche player, we focus on funding sustainable, ethical business models, and the transition towards these,' says Sven Verstraeten, Companies & Organisations Manager at vdk bank. 'This also includes funding for green (and thus circular) assets, for which we maintain strict criteria.'

These criteria are partly based on the categorisation system and taxonomy from the European Commission (that is still in draft). Verstraeten: 'That's a complex job, particularly if you want to see it translated into clear language and avoid confusion of ideas. The CEvaluator helps with this, ensuring that users get an actual picture of their circular project in the long term.'

Just like vdk bank, CEvaluator maintains a rather more holistic perspective. 'We are used to viewing business models in their totality, and not in silos as still happens too often today,' says Verstraeten. 'That means we don't just focus on circularity. A shortage of process water could be life-threatening for a company, for example, not just for the circular strategy. So being circular is part of being future-proof.'

# LIBOVITO IS BIG IN CHINA AFTER 10 YEARS

**What began for VITO as a project just here and there, every now and then, has grown into a strong, permanent presence in China. The air there has cleared up massively in the past decade, which is due in part to the air quality models implemented in China via LIBOVITO.**

VITO has been active in China since the start of this century, mainly working on monitoring air quality and remote sensing on a project basis. But the Summer Olympics in 2008 switched everything up a gear. As the organiser, Peking was particularly worried about the poor air quality in the city, which was known for its almost permanent smog. Largely also because the eyes of the world would be focused on the Games.

Back then, VITO was a partner in the AMFIC project, a European-Chinese project that was being co-ordinated by the Dutch KNMI (Royal Dutch Meteorological Institute) at the time. 'In that project, VITO, in collaboration with the other EU partners, provided a daily forecast for the air quality in the city and specifically in and around the Olympic stadium (the famous Bird's Nest)', says Mao Debin, Business Development Manager for VITO Asia, from where VITO's activities in China are run. A special website was set up for those forecasts on which (mainly the athletes) could consult the anticipated ozone and particulate matter concentrations during the Olympic Games.

## Valorising air quality models

This assignment also took place on a project basis, namely as part of a broader European project, so it did not involve any more sustainable activities. But VITO's air quality experts felt they could do far more, not as part of separate projects paid for by Flemish and European money, but more through

a permanent presence in China. 'We decided to change tactics and take our business model more along commercial lines,' continues Debin. And so it was that LIBOVITO was launched in September 2011, with its original goal being to valorise VITO's environmental and air quality models – developed in Flanders – in China. LIBOVITO began as a joint venture, with VITO and its Chinese partner Antipollution each holding half of the shares.

LIBOVITO's commercial approach meant that Chinese clients would call upon its products and services for payment. There were plenty of ups and downs in the first few years, involving trial & error. It was evident that the Flemish and European models could not simply be extrapolated onto China, with its enormous cities on the coast and immense hinterland. Debin: 'We were confronted with a steep learning curve. For example, we quickly found out that we needed regional models for monitoring and forecasting the particulate matter concentrations, for example. The particulate matter was present across practically the entire country, for example.'

## Back to the drawing board

The VITO experts therefore adapted their AURORA model (Air quality modelling in Urban Regions using an Optimal Resolution Approach) to the Chinese reality. This mathematically-driven model can forecast the air quality based on weather and emissions data, comparable to the way a weather forecasting model does so. However, this was not a resounding success, largely because the model was too complex and there was not yet enough input data available, such as from local emissions of particulate matter and other pollutants. 'We offered AURORA up to 2014, but only two projects arose from that, which was far too few,' admits Debin. 'So we went back to the drawing board.'

As it happened, not only the LIBOVITO experts did so, but also those from VITO's Spatial Environmental Aspects unit in Mol. 'The unit's activities were still very much in the research phase at that point,' says Lisa Blyth of VITO. 'Step by step, we got to know the market and learned how to turn our models into solutions in the form of products, for example.' This learning curve did both VITO and LIBOVITO a world of good. They had done their homework when the Chinese government rolled out its major multi-year plan to drastically improve the air quality in 2014.

This plan involved a gigantic investment, and local and regional authorities and businesses were given specific obligations through binding legislation. Finally, there was a clear policy. Debin: 'Without the government's ambition, it would have remained difficult for us to sell our products or models. If no-one is obliged to achieve certain objectives, then nothing will change.'

## Bullseye

In the meantime, the LIBOVITO experts had learned what made the Chinese stakeholders needed. That meant they had a better idea of what they were lacking, which turned out to be not just technology, but trained staff and know-how to be able to work with it in particular, and of exactly what they needed. Thanks to the experience with AURORA, they now did know what approach would be successful too. This is why OPAQ was introduced, an affordable and reliable forecasting model for air quality that provides information in real-time and also sends out notifications in the event of peaks in pollution, for example. Equipped with this system, local and regional policy-makers could take immediate action to improve the air quality in their city or region. This was not just for particulate matter, but also for nitrogen and sulphur oxides.



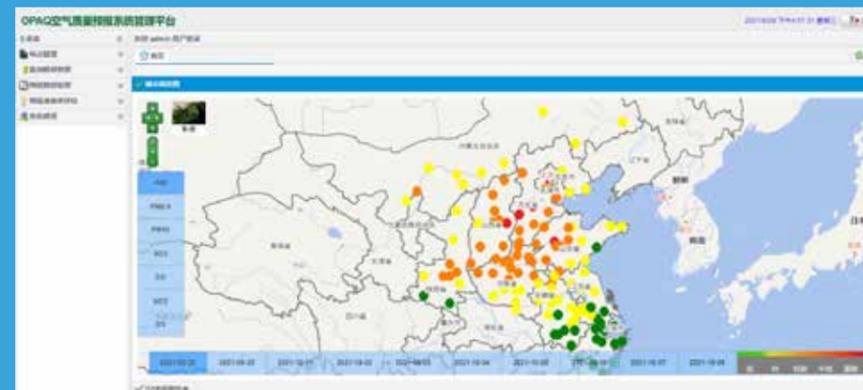
It was a bullseye. In the past few years, more than sixty OPAQ projects have been implemented by LIBOVITO in China, with one even at a national level. This has made OPAQ one of the most popular air quality models there today - and by far the most used out of the models of foreign origin. With the model, mainly regional authorities could tackle some of the most polluting areas, such as in the Hebei province, where more than twenty OPAQ projects have been rolled out. The effect on the air quality did not take long to show, and indeed across the country. For example, Peking recorded a drop in the average concentration of particulate matter (PM2.5) of no less than 45 percent between 2015 and 2020. The sulphur dioxide content, largely originating from burning coal, even fell down by 61 percent.

Since then, LIBOVITO has also been working closely with the China National Environmental Monitoring Centre (CNEMC), the government body responsible for monitoring the air quality throughout China and all the forecasts for this. 'We are currently running a demonstration project with them based on our OPAQ model,' adds Blyth. 'Partly so we can forecast the ozone concentrations better, which is currently a priority.'

VITO's presence in China has also been strengthened. Since 2017, it has been the only shareholder in LIBOVITO, which has an office in Peking and currently employs ten people. LIBOVITO's Chinese employees regularly come to VITO in Mol for training – or rather, they did before the coronavirus pandemic broke out.



What does the future look like for LIBOVITO, now the Chinese multi-year plan for air quality is coming to an end? 'In environmental terms, the quality of the air is only the beginning. Afterwards comes the quality of water and of the soil,' says Debin. So the coming years will also see LIBOVITO helping to improve the water quality in China and everything that goes with it, such as forecasting floods, for example. On top of this, it will be expanding its activities. 'We are not only focusing on monitoring and forecasting, as the market for products based on water quality is far larger than the one for air quality,' says Blyth. With that said, LIBOVITO will continue to supply modelling and forecasts for the latter too.



Screenshot of the OPAQ forecasting dashboard established for CNEMC showing the Air Quality Index for 70 cities over China. Users can explore the Air Quality Index and individual pollutant (NO2, SO2, PM10, PM2.5, CO and O3) values for the next 9 days by selecting the pollutants and dates. (CNEMC: Chinese National Environment Monitoring Center)



More info  
debin.mao@vito.be

# VITO JOINS FORCES AS A PROVIDER OF INTEGRATED CLIMATE SERVICES



Countries, regions and cities are in need of integrated solutions to achieve their climate objectives and keep up their efforts, while also facing up to the consequences of global warming. VITO has particular knowledge and expertise in fields spanning the whole climate issue. As a provider in this international market, it is even better to align and integrate these climate services. VITO has put its climate services in the spotlight this past autumn, during G-STIC Dubai (at the World Expo) and during COP26 in Glasgow.

In recent years, VITO has developed a range of tools for mapping out the impact of climate change on e.g. agriculture, biodiversity or built-up areas. Policy-makers can use these to help equip those systems against the predicted consequences of global warming, thereby making them more robust. Climtag (for agriculture) and UrbClim (for built-up areas) are two examples of this. VITO has also developed a solution for national long-term strategies for reducing greenhouse gas emissions.

## Momentum for collaboration

The fact that VITO has already developed a range of tools for climate adaptation from so many different lines of approach is further proof of its broad knowledge and expertise in climate issues. However, in the past year in particular, VITO's experts have noticed that policy-makers - both in Belgium and abroad - are mainly expecting integrated solutions. 'For example, if a government is interested in an energy-related service, they tend to be asking for climate adaption solutions too - better protection for built-up areas against the heat island

effect, for instance, to give just one example of adaptation,' says Maarten Lenaerts of VITO/EnergyVille. 'Until recently, we responded to those questions on an ad hoc basis; now, we are presenting ourselves far more consciously as a provider of integrated climate services and solutions.'

This does demand closer collaboration between the various VITO units working on climate-related themes. 'But that works for us,' says Raf Theunissen of VITO. 'Everyone is now looking in the same direction and there is a clear momentum for making this a lasting collaboration. We have all understood that VITO has particular knowledge and expertise in a very wide range of fields, while the international market is asking for aligned solutions. Key is to integrate that knowledge and experience.'

This integrated approach was clearly shown during the most recent edition of G-STIC, at the Dubai World Expo this autumn (October 2021). For example, during one session on the role of data in climate policy, collectively organised by

the VITO units SEB and RMA, VITO employee Filip Lefebvre was talking about how regions and cities in particular can equip themselves against the consequences of climate change by making use of local data of many different types. VITO has (through its Remote Sensing unit, among others) more than twenty years of experience in the production, processing and analysis of satellite imagery and this kind of climate data. Given that potential solutions in terms of climate adaptation are often related to a wide range of themes, such as energy and land use, that therefore means various VITO units could be involved in this.

## Projects in Africa and in Colombia

The provisional tailpiece of VITO's integrated climate services and solutions are the NDCs, as they are known, or national determined contributions. These are the core of the 2015 Paris Climate Agreement and show countries' progress in terms of climate mitigation and adaptation (the reduction in greenhouse gas emissions and adjustment to consequences of

climate change, respectively). 'The focus on the NDCs helps us shape our commercial ambitions in the field of climate services at an international level,' says Lenaerts. 'COP26 even concluded that countries need to drive up their compliance with NDCs, which could mean they have a great deal of backlog to catch up on.' VITO has launched the NDC Support Center over the past year. This is in collaboration with two partners: the African Regional Energy Commission (AFREC), an African Union body, and CO<sub>2</sub>logic, which was originally a Flemish climate consultancy company. Through this initiative, VITO is helping countries with their ambition to achieve the climate objectives.

The NDC Support Center includes the foundation of a new knowledge center to support countries in Africa in their future climate reporting, particularly in terms of energy. The knowledge center began as a pilot project focusing on Morocco, Uganda and Malawi, three countries with very different economies, geography and thereby also climate impact. In addition, VITO has extensive experience with NDC projects in Colombia. VITO's work is clearly appreciated by clients: there was a strong focus on the various projects at the climate summit in Glasgow. Flemish Minister for Energy and the Environment Zuhal Demir introduced the session on the NDC Support Center at the Benelux Pavilion. Delegates from Malawi and Morocco, as well as the NDC Partnership (of which VITO has been a member since July 2021), were also present. Another project was presented at the Colombian Pavilion, one on which VITO is collaborating with the World Bank.

## Role of match-maker

VITO has now been collaborating with the World Bank for some years. This collaboration is proceeding in a very co-creative manner, whereby VITO always calls upon local partners to shape the project into a co-operative model. This approach works, given the fact that the World Bank is now structurally calling upon VITO for climate-related projects. 'We see this as a strong recognition for us,' says Theunissen. 'In part



because the World Bank is, of course, a highly valued player in less developed countries, which will be hit hardest by the consequences of climate change.'

VITO's connections with stakeholders in less developed countries have been producing some positive results, including for Flanders. During G-STIC in Dubai, the NDC Support Center played the role of match-maker between Flemish Prime Minister Jan Jambon and the President of Malawi, Lazarus

Chakwera. Many more prominent people were also present at the sustainability event organised by VITO, such as Rashid Ali Abdallah, Director of the Energy Commission for the African Union, and Youssef Nassef, Director of the Climate Adaption Department for the United Nations. Moreover, they were not merely there to observe - quite the reverse. 'Those prominent people gladly wanted to help present the projects we had been working on together,' says Lenaerts.



More info  
maarten.lenaerts@energyville.be  
vito.be/en/climate-services



# HEMS EQUIPS HOMES AND BUILDINGS FOR THE ENERGY TRANSITION

**Due to the transition to a renewable energy system, we will need to be a lot more flexible in our energy consumption. The storage of electricity remains expensive, so green energy should ideally be consumed as soon as it is produced. However, this demands a smart and integrated energy management system at the level of individual homes or buildings. VITO/EnergyVille has a prototype ready for this, intended for energy technology vendors and energy service providers. The aim is for maximum coincidence of energy consumption with the production of (own) renewable energy.'**

There are already many smart devices or components of the energy system that are demand-driven, including residentially – these include a smart boiler, a smart heat pump or a smart thermostat. They use own energy production through solar panels on the roof as far as possible, for example. This provides a cheap and low-carbon way of heating and cooling homes, and providing them with hot water, while the electric car can be charged up. The aim is to inject a minimum of excess solar power into the electricity grid.

Those smart technologies have worked rather more alongside each other than with each other. And soon, as the energy transition progresses, this will cause more

and more problems. 'In the event of excess self-production or low prices, they might all turn on at once, for example,' says Thomas Polfliet of VITO/EnergyVille. 'This can create peaks that push power consumption above the capacity limit.' In the near future, a consumer might be financially punished for this, as capacity tariffs (among other things) are soon intended to avoid the combination of consumers and prosumers (who respectively will begin to consume and produce more) overloading the electricity grid.

## Tailored energy consumption plan

So all those energy technologies in homes or buildings need to be well-aligned. 'They need to be aware of each other, not just their presence but the priority they have too, at any time of day,' says Polfliet. These priorities are not static: they are being continually (re)calculated and entered into an 'energy consumption plan', which is being constantly optimised. This plan has been tailored to the home or building and takes account of the needs and comfort desired by the residents or users. Ultimately, the plan is executed by a kind of central brain that sends instructions to all the smart energy devices and components. This brain is the core of the smart and integrated energy management system that VITO/EnergyVille has developed in the

past few years and is now ready to be tested by customers, for example in the form of a pilot project. These could be energy technology vendors (such as smart thermostats), as well as energy service providers – which will evolve over time into 'comfort providers'. Since last year, the system has seen comprehensive testing at the VITO/EnergyVille site in Genk: charging stations, storage batteries, heat pumps and boilers: it controls everything.

The Home Energy Management System (HEMS), as VITO/EnergyVille's system is provisionally known, is both 'multi-asset' and 'multi-purpose'. It brings a wide range of technologies together and carries out the consumption plan in line with several objectives. This could be a more flexible answer to close-knit energy tariffs that can vary widely by the time of consumption, the type of source (renewable or otherwise), any capacity thresholds or emission allowances. Businesses can already benefit from such flexible energy contracts; for individuals, this is the future. Polfliet: 'It is a powerful tool for making maximum use of renewable energy and avoiding peaks.' Based on information such as weather forecasts and anticipated consumption by residents and users, VITO/EnergyVille's HEMS makes an accurate assessment of the energy housekeeping in a home or building. This involves some complex mathematical optimisations, software that was also developed at VITO/EnergyVille. The HEMS runs on Microsoft Azure's open, flexible platform.

## Avoiding extra costs in the future

Will a system like the HEMS be able to help keep the energy transition affordable for people and businesses? 'You won't be able to



reduce your energy bills with it right away,' Polfliet concedes. 'But you will be able to protect yourself against future rises of many energy-related costs, as plenty of price incentives are set to be introduced to safeguard the electricity grid soon. So yes, you'll save money in the end, although we should concede that the business case remains challenging right now, if we look at it from our vendor perspective.'

But with the HEMS, energy system vendors or tomorrow's comfort providers can already start updating and expanding their products and services. 'End customers can then soon use those to fully organize their own energy housekeeping,' says Chris Caerts of VITO/EnergyVille. 'That way, they can be assured that their energy consumption will level

out, with as much green energy as possible and a high degree of flexibility. Ultimately, that's where we want to get to with the energy transition.' In the next phase, this optimum energy housekeeping could then be 'valorised', for example by starting to sell a surplus in flexibility to a grid manager. For this phase, however, it will be necessary to wait until the government rolls out dynamic energy prices and capacity tariffs for individuals.

Today VITO/EnergyVille's smart energy management system is already of interest to, for example, providers of electrical charging infrastructure. 'More and more office buildings, as well as public car parks, have charging stations,' says Caerts. 'But the historical connection of this infrastructure to the electricity grid

has generally not been provided at that much capacity. For example, the collective peak capacity is often far higher than the solar panels on the roof can supply.' With a variant of the system specially designed for buildings (BEMS), charging infrastructure providers can start managing their consumption far better over time, again based on reliable and detailed forecasts and models contained in the system. 'That way, they can actually optimise their energy housekeeping very easily,' says Caerts.



More info  
thomas.polfliet@energyville.be





# CLEANTECH HEROES: 3 LAUREATES 2021

To increase awareness about cleantech solutions, Cleantech Flanders introduced the first 'Cleantech Heroes' in 2021. Flemish companies within the network of Cleantech Flanders who develop and market innovative cleantech solutions can register to be selected as Cleantech Hero within their domain. The positive impact (in Flanders and beyond) of these cleantech companies must be clearly verifiable. The TRL level of their cleantech solution, the link to the SDGs and the company's potential to be an 'ambassador' of the Flemish cleantech in Belgium and abroad are a few of the selection criteria to obtain the prestigious Cleantech Hero label. Companies that win the award, gain momentum during a whole year. The Cleantech Heroes can wear the label for a full year, they may also present their innovation at G-STIC 2022 (Dubai) and receive promotional support through Cleantech Flanders channels. Permanent jury members of this election are Dirk Fransaer (CEO VITO), Frans Snijkers (Director Cleantech Flanders) and Claire Tillekaerts (CEO Flanders Investment & Trade). For each category of the Cleantech Hero the permanent jury will be assisted by a number of guest jury members with expertise in the specific domain.



## Cleantech Hero Water technology

In March 2021 BOSAQ, a company that develops innovative technology for decentralised drinking water purification solutions, was selected as the first Cleantech Hero Water technology. After an initial selection, three finalists were chosen: BOSAQ, Hydrovolta and InOpSys. In the end, the jury decided that BOSAQ was the perfect ambassador. In its report, the jury praised the company not only for its strong commitment to circular water use, but also for its attention to socially responsible entrepreneurship. BOSAQ donates at least 10 % of its profits to the non-profit organisation Water Heroes, which helps vulnerable local communities gain access to better sanitary facilities and clear drinking water. BOSAQ also takes care of technology transfer to the local population. It manages to combine sustainable objectives and corporate social responsibility (CSR). Its international approach and ambition and the fact that the company aligns its business goals with the SDGs strengthened its position.

### ABOUT BOSAQ

BOSAQ develops innovative technology for decentralised drinking water treatment solutions. BOSAQ's systems transform any ambient water into drinking water in the most energy and operationally efficient manner. The projects are clearly linked to the SDGs of the United Nations. SDG 6 (clean water and sanitation) is central to this, but through the approach other SDGs such as quality education, health, innovation, sustainable energy, gender equality, etc. are also addressed. BOSAQ provides areas with decentralised drinking water with the highest quality guarantee with technology transfer to the local population and the establishment of a local economy to give the projects a long-term chance of success. A sustainable approach along the entire line of project/concept implementation.

[www.bosaq.com](http://www.bosaq.com)



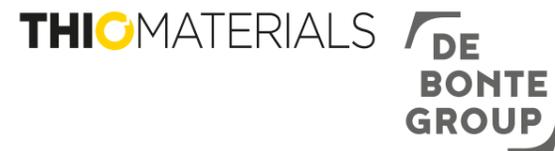
## Cleantech Hero Circular economy

In this category 5 finalists were appointed: Circular Matters, Nuresys, Orineo, Resus and THIOMATERIALS. "We had to conclude that our five finalists scored very highly on many points", the jury stated. After deliberation, the jury elected THIOMATERIALS of De Bonte group as second Cleantech Hero laureate in June 2021. THIOMATERIALS specialises in the development of railway sleepers and sewage pipes from 100 % circular sulphur concrete.

### ABOUT THIOMATERIALS

THIOMATERIALS pioneered with railway sleepers and sewage pipes from 100 % circular sulphurous concrete. In sulphur concrete, cement and water as binding agents are replaced by sulphur that is completely circular. This eliminates the traditional heavy CO<sub>2</sub> emissions from cement and also avoids the use of precious water. The production is based on the physical process of melting and solidifying sulphur. Because this process can be repeated endlessly, the sulphur concrete can be reused endlessly as a primary raw material. This allows network operators to fully embrace circularity. When using sulphurous concrete, CO<sub>2</sub> emissions are reduced by approximately 40 % to 80 % compared to similar products made from traditional concrete, synthetic materials or ceramics. Thanks to the circular properties of sulphuric concrete, there are no secondary waste flows and both pipes and sleepers can be completely reworked into identical products without any loss of quality. Trial projects at Aquafin, Infrabel, De Lijn, SNCF and NS were successful and resulted in accreditations and quality marks. By using this sulphur concrete, Infrabel, for example, will reduce its CO<sub>2</sub> emissions by 6,000 tonnes through the already planned replacement of 200,000 railway sleepers with THIoTTRACK sleepers made from sulphur concrete.

[www.thiomaterials.com](http://www.thiomaterials.com)



## Cleantech Hero Energy

During this first year when Cleantech Heroes were selected, all the honour was given to Turbulent Hydro as the first Cleantech Hero Energy. The jury selected three finalists: Smappee, the Sniffers and Turbulent Hydro. Once again the jury was very impressed by the level of the candidates. However the choice of the jury experts went almost unanimously to Turbulent Hydro. "Turbulent has carefully chosen to develop a technology that is mainly suitable for countries in emerging economies and with a clear link to a number of SDGs. It highlights everything that a sustainable innovation project should be."

### ABOUT TURBULENT HYDRO

Turbulent Hydro changes the way new hydropower is developed. A Turbulent micro-hydropower plant requires no dams, no river impediments and no large infrastructure. The system needs only 1.5 metres of water height difference to generate energy. Therefore this technology results in a fish-friendly, low-maintenance hydropower plant that efficiently produces clean electricity 24h/7d/365d. Turbulent Hydro has large international potential and is already running projects in Chile, Taiwan, the Philippines, Indonesia, Congo, Thailand, Portugal, Estonia, Slovenia, France, the United Kingdom and, of course, Belgium. By installing distributed clusters of turbines, entire regions can be supplied with 100 % green, clean, stable and reliable electricity. Turbulent works together with nature, not against it. Turbulent Hydro also contributes to the SDG goal of affordable and clean energy (SDG 7), as well as to other SDGs, including those for water (SDG 6), resilient infrastructure (SDG 9) and climate change (SDG 13).

[www.turbulent.be](http://www.turbulent.be)



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# VITO EMPLOYEE IN THE SPOTLIGHT

**Griet Jacobs (42) is very familiar with VITO's analytical labs. She has been conducting and co-ordinating chemical analyses in terms of health and the environment, for government and industry, for twenty years there. Nonetheless, this never feels like routine work. 'Clients come to us with challenging assignments, not with standard questions. That feels very satisfying.' Last summer, Jacobs was in the middle of the PFAS storm. 'We had to be constantly alert. I didn't get to take much leave.'**

**The crisis around PFOS pollution in Zwijndrecht began in early summer. VITO was called upon for analyses of this harmful substance in the PFAS family, in soil, air and water as well as in the blood of local residents. What was that period like?**

'It was an extremely busy time. Although we did have a lot of expertise on PFAS monitoring in-house, we still had to develop a whole range of new measurement and analysis methods and get them

ready, including for detecting these substances in the air. The method for (blood) serum analysis also needed to be accredited, which meant extra administrative requirements.'

'But we withstood the storm, even though the external pressure was very high. This is understandable, of course; people were worried and wanted to get the measurement results as soon as possible. We sometimes had to disappoint them – some analyses are complex and do take time. I normally take a few weeks leave in the summer. There was no chance of that then, even though we were taking turns to be on-call.'

**You have been in the lab yourself less often than you used to be in recent years. Today, you are more likely to be managing lab assistants. Do you not miss the lab work?**

'I now have more contact with clients coming to us with a particular question than I used to, and that suits me. I draw up quotations and map out a potential solution for them, which we then translate into practical lab work along with our

team (twenty lab assistants). My own lab experience does help me in those discussions with clients.'

'This close follow-up along with the client is what makes us unique compared to routine labs. Quality is our core focus. If there is a delay to an analysis, we communicate this clearly too. We've noticed that clients appreciate this. They trust us.'

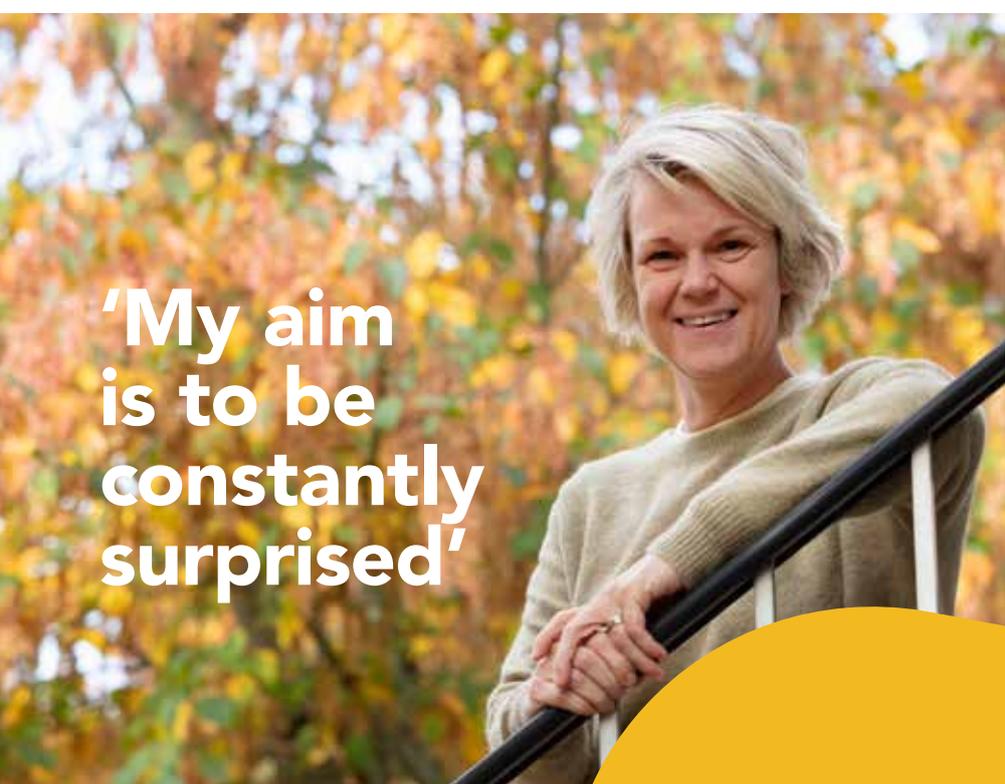
**You started at the Health unit in 2001. In 2014, you moved to the analytical lab in the Separation and Conversion Technology (SCT) unit. Do you feel you still have enough challenge?**

'The advantage of working for VITO is that our clients never come to us with standard questions, but with challenging assignments. If something doesn't work right away, that can be frustrating, but of course it feels very satisfying afterwards.'

**VITO is also an important reference lab. That means you are in the vanguard of chemical analysis technology.**

'We develop new measurement and analysis methods and ensure the existing ones are improved and ready for use. We help the accredited labs apply them correctly. The fact that we're doing this in some many different fields (from water to soil, waste and compost) shows that our knowledge and expertise is very broad. That know-how is distributed among our team, which holds continual discussions. This team spirit also ensures that we can often come up with something surprising and creative.'

**More info**  
[griet.jacobs@vito.be](mailto:griet.jacobs@vito.be)



**'My aim is to be constantly surprised'**