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VISION

Vision on technology for a better world

FROM **SMALL-SCALE COOPERATION** TO A **FULLY-FLEDGED EUROPEAN RESEARCH CENTRE** (10 YEARS ENERGYVILLE)

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Dear reader,

The Belgian energy landscape has unmistakably changed in the past decade. The proportion of solar and wind energy in the energy mix was highly increased, which is largely down to the fact that these renewable sources very quickly became cheap and therefore competitive. On the consumer side, we also saw the breakthrough of the electric car. Whereas the 'car with a plug' was a mere curiosity in 2010, there is nothing to stop it now from becoming dominant on the roads.

2010 was also the year in which EnergyVille was officially founded. The first ten years of the energy research institute reflect the evolution that the Belgian and European energy landscape went through. With EnergyVille a coherent vision for energy could arise and develop itself further within the Belgian research landscape. A vision that has arisen from the will of the KU Leuven, VITO, imec and the University of Hasselt – EnergyVille's four 'mother institutes' – to join forces, meaning mutual competition and fragmentation gave way to close collaboration and synergy. 'We realised then that it was better for us to start collaborating,' says Ronnie Belmans in this issue on EnergyVille's anniversary. Belmans passed the baton to Gerrit Jan Schaeffer last summer. In the same article, the brand new General Manager of EnergyVille gives a foretaste of his ambitions for the coming ten years.

As usual, it is our pleasure to keep you up to date on current research at VITO/EnergyVille and on recently concluded projects and initiatives via this magazine. The energy transition continues to claim a major role in this as well. You can read how we are contributing to the decarbonisation of the built environment in Flanders with tools such as the Urban Energy Pathfinder. With a view to the climate objectives, this will be one of the most important challenges in the coming years.

In addition, we would like to present the 'smart' battery cell, an innovation through which VITO/EnergyVille is helping to make the entire value chain for batteries – from production through use and reuse to recycling – more sustainable. A major extra asset is that smart, sustainable batteries will also make Europe less dependent on Asian battery manufacturers.

A large dependency can be problematic, as we have experienced during the coronavirus pandemic. In the past year and a half, it has become increasingly clear that the European Union is highly dependent upon external suppliers for many raw materials as well as finished products – from face masks through rare metals and wood to batteries and computer chips. With the resurgence of the economy in the post-coronavirus era, now is the time to safeguard that security of supply at a European level.

The ambition for a European 'autonomy of raw materials' is consistent with the need for a lower dependency on oil and gas. This shift is being achieved in the chemical industry, among others. Also in this issue, you can read how our researchers are developing 'green' alternatives to petroleum in the manufacture of synthetic resins. It is only a small part of the radical operation for sustainability that the industry stands for – and Flanders is by no means left behind. But it does show that it absolutely pays to focus on sustainability and on circular value chains.

Together, we will evolve into a sustainable society.
Happy reading!

Dirk Fransaer
Managing Director of VITO

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Paper made from recycled material
FSC® C012419

More info: vito@vito.be - www.vito.be/en

Publisher
Dirk Fransaer, Boeretang 200, 2400 Mol

Text
sciencejournalist.be

Lay-out
Phobos & Actor

Printing
Drukkerij Antilope De Bie

STEM AT VITO

Getting young people excited about the possibilities that come with scientific knowledge, while also guiding them through the limitless possibilities and opportunities of a scientific education. As innovation is only possible when we open the door today to the scientists of tomorrow, VITO is committed to promoting the STEM disciplines (Science, Technology, Engineering, Mathematics). We do this by introducing young people to science in all its aspects.

It all started several years ago, with the deep geothermal energy plant at the Balmatt site in Mol. Since 2018, VITO, together with VOKA, the Province of Antwerp and GoodPlanet, has been organising educational tours of its Balmatt site to introduce pupils to the concepts of heat networks and geothermal energy as sustainable alternatives to traditional fossil fuels. Thousands of children and teenagers have found their way to Mol, and the call for a full day's programme has grown in recent years.

The Balmatt site is an ideal visitor centre, with facilities suitable for receiving groups of pupils. It is equipped with everything from big screens to VR goggles. While developing this educational programme, we had to make certain choices. VITO wants to be accessible, yet not superficial. We focus on the over-15s in ASO and TSO but also BSO and KSO, a group that is often forgotten in STEM initiatives. With our activities, we consciously keep up with current events and go deeper into a scientific challenge that lies within VITO's field of expertise. 'The COVID-19 pandemic was the ideal stepping stone towards discussing indoor air quality, ventilation and aeration' explains Marianne Stranger, VITO indoor air quality expert. 'Along with showing students why ventilation is so important, we have been familiarising them with data and examples from research in schools, while we have also been able to directly demonstrate the impact of certain measures.'

'When we talk about the problem posed by the plastic soup, we are not only talking about how plastic is made, the major problem of waste and the potential of recycling, rather we are talking about sustainable alternatives and the scientific barriers we need to overcome,' says Karl Vrancken, who helped design the Plastics module. When we talk about CO_2 and its detrimental effects on our climate, we not only demonstrate how CO_2 is 'captured', but also why it is important that we reuse it in a sustainable way. As such, we dissect each research topic and show students how VITO is working towards finding sustainable solutions.

Recognition is important to us. Therefore, each module is conducted in the same way. With Team Scheire's mad scientist Anthony Liekens, VITO's STEM offering has brought in a familiar face. After he introduces each topic, a VITO specialist then explores the subject during a half-hour video recording. Then, by means of an experiment or a quiz, we check whether the pupils have understood the subject matter. GoodPlanet, who specialise in educating about sustainability issues, provide the guidance and supervision. Teachers are supported as the modules' contents are also oriented towards their curricula and attainment levels. VITO's STEM programme therefore fits in perfectly with the Flemish Government's own STEM action plan.

Because the coronavirus pandemic taught us how important remote learning can be, we have also created an online version of each module. At www.vito.be/stem, teachers and pupils can access detailed information via texts, videos, podcasts, newspaper articles, etc. The online version can also be used by teachers in their classrooms, with or without the assistance of GoodPlanet staff.

The VITO STEM package already includes five modules: geothermal energy, plastics, CO_2, indoor air quality and remote sensing. These topics will soon be added: water, outdoor air quality, circular economy, energy and health.

Besides this rather academic approach, we also have ResourCity, the augmented reality game allowing young people to search for chemical elements across five Flemish cities. In Antwerp, Mechelen, Oud-Turnhout, Herentals, Leuven and the Dutch town of Oss, chemical elements are literally there for the taking. Here too, VITO has provided support for teachers, who can easily incorporate this city game as part of their lessons.

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FROM **SMALL-SCALE COOPERATION** TO A **FULLY-FLEDGED EUROPEAN RESEARCH CENTRE**

EnergyVille celebrated its tenth anniversary at Genk's Thor Park on 1 June 2021. At the same time, Ronnie Belmans passed on the torch as general manager to Gerrit Jan Schaeffer. A good opportunity to look back as well as forward. "We have grown very quickly over the past decade, and our two research buildings are the most visible result of this," says Belmans. "But there is also a close community that achieves impressive things." Meanwhile, successor Gerrit Jan Schaeffer has strong ambitions. "We are far from fully grown."

EnergyVille was founded in 2009. Back then, both the energy researchers from KU Leuven and VITO had come to realise that the energy system was changing significantly and that new technologies and systems were absolutely necessary in the fight against global warming - the Paris Climate Agreement was still five years away. "Our unit was already researching smart grids at that time, looking at topics like balance in electricity networks, their flexibility and possible energy storage," says Bert Gysen of the VITO/EnergyVille Energy Technology unit. The Electa research group in Leuven, headed by Professor Ronnie Belmans, was also working on smart grids. "We realised that we could work better together," recalls Belmans. That is how research into smart grids and the alignment of KU Leuven and VITO - two of the four 'parent institutes', later joined by imec and Hasselt University - led to EnergyVille, which was officially launched in 2010.

The 'Ville' in EnergyVille

Meanwhile, with LINEAR, the first joint research project had already begun. It was researching how households in Flanders can use a smart grid to adjust their electricity consumption to the available solar and wind energy. The project was a prelude to how EnergyVille was set to conduct research on the energy transition. LINEAR involved numerous industrial partners, which, years after the project's conclusion (in 2014), continues to generate new energy products and services. With this project, EnergyVille was also part of the inception of Smart Grids Flanders, from which the Flemish energy cluster Flux50 later emerged. Belmans: "We brought together the scientific research, but also paid attention to Flanders's industrial and social reality."

The LINEAR project focused on Flemish households' green electricity consumption in a broader sense, and not only on the possibilities offered by the electricity network. "From the outset our focus was on smart cities, we wanted to look beyond the energy networks alone," says Gerrit Jan Schaeffer, the brand new general manager of EnergyVille, who was Energy Group Director at VITO for eight years until 2015. "That's why we're called EnergyVille."

The broader focus on smart cities – i.e. urbanised agglomerations, as present in large parts of Flanders – also stems from another VITO unit that conducts research into the energy transition, and in which the built environment is a central focus. "When EnergyVille was founded, VITO/EnergyVille research into energy and the built environment was still in its infancy," says Leen Govaerts of the VITO/EnergyVille unit Smart Energy & Built Environment. "But in recent years, this field is higher on the agenda, mainly because of its major challenges and the fact we can make a significant contribution with knowledge of multidisciplinary systems, for example the trade-off between energy efficiency, renewable energy and flexibility."

Living lab

The energy performance of buildings and neighbourhoods can be made more sustainable through guidance from the authorities, but also directly by better informing and encouraging stakeholders such as owners and social housing companies. This can be done, for example, with 'digital twins' of buildings or of entire city districts to achieve a clear picture of the expected profits, and at the same time of the anticipated costs. Or with other tools such as the Urban Energy Pathfinder, which detects and calculates renovation and renewable energy potential. The link through all of these solutions is that they are based on reliable data and thorough data analysis.

These solutions are also developed and researched at Thor Park in Genk, the home of EnergyVille. Within the framework of a major ERDF-SALK project, the campus has grown over the past five years into a real 'living lab' in which new energy technologies can be tested on a large scale, real world situations can be simulated and new business models can be created. In line with the philosophy of EnergyVille, companies are actively encouraged to make use of this testing ground. At the beginning of 2020, Thor Park was recognised as the very first 'low-regulation zone' for energy applications in Flanders.

The most visible element in the development and growth of EnergyVille over the past ten years has undoubtedly been the construction of the two research buildings in Genk, with offices and state-of-the-art labs for some 400 employees. Ronnie Belmans sees the EnergyVille 1 and 2 buildings as proof of the great strides made by the energy research centre. "But more importantly, I have always had the feeling that our people like coming here, that it is a pleasant place to work. And I am not exaggerating when I say that a close community has developed over recent years. It can accomplish things that we couldn't achieve if we were split up." Belmans also mentions EnergyVille's highly increased visibility in the media, where the debate around the energy transition has been vigorous, especially in recent years.

And politicians, too, are increasingly listening to Genk's energy experts. This is partly due to the projects carried out in the framework of the Energy Transition Fund. In particular, the combination of high-quality modelling with technical insights makes EnergyVille a unique knowledge player in our country in the field of energy.

Finally, EnergyVille is also highly regarded within the energy world itself. "We noticed this, for example, at the beginning of this year during our debate series Energy Encounters, where the level of lectures and discussions was very high. We had no trouble persuading interesting speakers to take part," says Belmans.

And now?

There are worse times to take over as general manager. But Gerrit Jan Schaeffer has strong ambitions for the coming years. EnergyVille has already started a new line of research this year, more specifically into sustainable molecules for processes that are difficult to electrify, for example in the chemical industry. "Industry, too, is a major emitter of greenhouse gases, but electrification alone will not get us where we need to be," says Schaeffer. Ultimately, the goal is to produce as many raw materials as possible in a carbon-neutral way. "We simply must use all means to achieve net zero emissions by 2050."

In the coming years, cooperation with (energy-intensive) industry will be strengthened, including in the power-to-molecules story. Both Schaeffer and predecessor Ronnie Belmans are convinced of this. "The way I see it, EnergyVille will continue to set up new research collaborations," says Belmans. "Especially in the chemical sector, where there is still a lot to do. Ideally, EnergyVille will be able to link up with a number of international companies to pursue research."

"We are now an important European player," says Schaeffer, who does not hide his ambitions. "In recent years, the number of European projects we take part in has grown enormously. I see this as a confirmation for EnergyVille that we are a fully-fledged European research centre in the field of energy transition. Further expanding this position and playing a leading role internationally are the challenges where cooperation remains the leitmotif."

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‘GREEN’ SYNTHETIC RESIN MOVES OUT OF THE LAB

Synthetic resins are very important intermediate raw materials in industry, from the manufacture of coatings and composite materials to insulating foam and hard plastics. Today, resins are still produced mainly from petroleum derivatives. As part of its ambitious research programme on biopolymers, VITO wants to replace the fossil basic components of epoxy and phenolic resins with lignin, a biochemical compound that can be extracted from green by-products and waste streams. This not only reduces the climate and environmental impact of the resins, but also makes them less toxic.

Lignin is one of the most common organic materials on Earth and the most abundant natural source of phenolic compounds. It is mass produced as a by-product of, for example, the manufacture of wood pulp and paper. Most of this lignin is currently burnt, which means that the material is only valorised energetically.

That is a pity since lignin has much more potential as a so-called bio-aromatic. It can replace many aromatics of fossil origin in the chemical industry, such as the basic chemicals phenol and bisphenol A, which are found for example in synthetic resins. The latter are intermediate raw materials that have a wide range of applications in various sectors, from construction to mobility and transport to the plastics industry.

Ambitious biopolymer team

For years, VITO has been active in researching the use of lignin as a basic raw material for chemicals. It focuses, among other things, on the production of bio-based synthetic resins of two types: epoxy resin and phenolic resin. This not only increases the sustainability of these materials, but also makes the resins part of a broader circular value chain. After all, the lignin comes from secondary and waste flows. Finally, introducing recyclability in these resins iis also VITO’s ambition.

The research into lignin is being carried out by an ambitious team of biopolymer researchers within the SPOT research group (Sustainable POlymer Technologies). The VITO team is working closely with industry on this while also studying other bio-based side streams than lignin, such as hemicellulose. Furthermore, VITO is also part of the core of Biorizon, the Belgian-Dutch research consortium that aims to produce relevant bio-aromatics from lignin on an industrial scale - in order to achieve a sustainable and profitable ‘green’ chemical industry. Functional bio-aromatics will be produced from lignin at the LignoValue Pilot, a VITO pilot installation that is currently under construction and that will be running at the beginning of 2022.

In the case of epoxy resin, the issue is replacing bisphenol A, a chemical that has built up a negative reputation in recent years due to its toxic effects on the environment and on human health (for example, it disrupts the hormone balance). Two years ago, VITO developed a new patented method to make epoxy resin completely bio-based from lignin and saturated fatty acids. “Lignin and lignin oil are therefore very good candidates to phase out bisphenol A over time,” says Jaime Gracia Vitoria of VITO.

This year also saw the start of two new European projects on epoxy resin, both involving VITO’s SPOT team. “Some 320,000 tonnes of epoxy resin are produced in Europe every year,” says Gracia Vitoria. “The introduction of bio-based raw materials will thus have a significant impact here, not least due to the wide range of epoxy resin applications.” One of the projects is BBI LigniCoat, which focuses on the use of epoxy resin in metal coatings. This involves cutting the large lignin molecules into smaller pieces first (depolymerisation), after which these smaller aromatics can be used again in the resin synthesis processes. “In order to specifically investigate and improve this depolymerisation, a small reactor will soon be installed in our lab at VITO.” In another project, VITO is working with various companies on the replacement of bisphenol A with lignin oil in epoxy resin for composite materials, in particular for car parts. “With these last two projects we are really moving out of the lab. We are taking an important step towards finding economically viable bio-based alternatives to bisphenol A in epoxy resin.”

Demonstration phase

The other synthetic resin receiving strong attention from VITO is phenolic resin, a material found in a wide range of applications, such as insulation foam, building materials, car parts and adhesives. Here the goal is to partially replace phenol a basic chemical substance of fossil origin, in phenolic resin by lignin. To this end, the VITO biopolymer team is working together with industrial partners like INEOS, SBHPP and KINGSPAN and other knowledge institutions (UGhent – INCAT research group) within the framework of the BIORESAL project, which is supported by VLAIO and under the auspices of Catalisti (the Flemish spearhead cluster for innovations in sustainable chemistry). “We aim to replace at least 20 per cent of fossil phenol with lignin,” says Gracia Vitoria. Again, VITO researchers are focusing mainly on the selection of lignin from by-products and waste streams, and on the chemical modifications required to reconstitute the bio-aromatics into long resin polymers.

The use of these biobased phenolic resins will be tested and evaluated in industrial foam insulation applications and in the production of molding compounds. Gracia Vitoria: “With BIORESAL we are currently aiming to scale up to a one-tonne production trial of lignin-based phenolic resin.”

A third type of resin that VITO is researching - on a smaller scale - is synthetic resin based on acrylic fibres. Here, the researchers are still looking for possible applications, and for possible partners to cooperate with.

New partners are also welcome in the epoxy and phenolic resin research. Moreover, companies and organisations can always contact VITO with questions or suggestions about lignin and specifically about making synthetic resins more sustainable.

In the meantime, when it comes to the broad research landscape around lignin, VITO plays the role of spider in the web. Its researchers have an excellent view of the sources and availability of this bio-organic material. And the properties of this wonderful gift of nature, and how they translate into specific applications, hold few secrets for them. Finally, VITO researchers are also studying how applications can be recycled as much as possible.

Biorizon
The way to aromatics

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SMART MONITORING MAPS **DISTRIBUTION** AND FLOW OF **MARINE PLASTIC WASTE**

Plastic pollution in the seas and oceans is a well-known phenomenon. The cause behind this global environmental problem is also very well known: our excessive consumption of plastic, which is processed into almost everything. However, much less is known about the exact distribution, varieties, quantities and specific sources of all that 'marine' plastic waste. VITO is helping to close this information gap, for example by monitoring waste from the air and from space, but also from bridges and river banks.

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Today, marine plastic waste is still largely monitored by local sampling, for example by casting nets from ships and seeing what comes to the surface. Or by studying plants and animals in the sea (or sea birds) to see how many and which plastics have entered the food chain.

Remote sensing, with images from cameras fitted in satellites, planes or drones but also in vessels or buoys or in devices on land, can take that monitoring to a higher level. Not only to estimate the bulk quantities of marine plastic waste, but also, for example, to recognise the types of plastics. "This is possible thanks to spectral analysis, whereby we examine plastics through different parts of the sunlight spectrum," says Els Knaeps of VITO. "With infrared, for example, different types of plastic show a unique fingerprint that we can detect with our spectrometers." This technology is already used in plastic recycling (on land), where cameras and sensors help sort plastic waste. However, the distance to the plastics is usually small and there isn't usually (sea) water in between or on top of them. "With plastics either floating on the water's surface or just below, it is more difficult to recognise the different types by spectral analysis."

Chosen techniques, with AI

Exactly how difficult this is, and what can be done about it, is what VITO has been researching in the HYPER project. Experiments were carried out to collect spectral data from a whole range of plastics, both new ('virgin') and weathered plastics, in various conditions: dry, wet, immersed, covered with algae, etc. All these data were gathered in a unique database that VITO made publicly available.

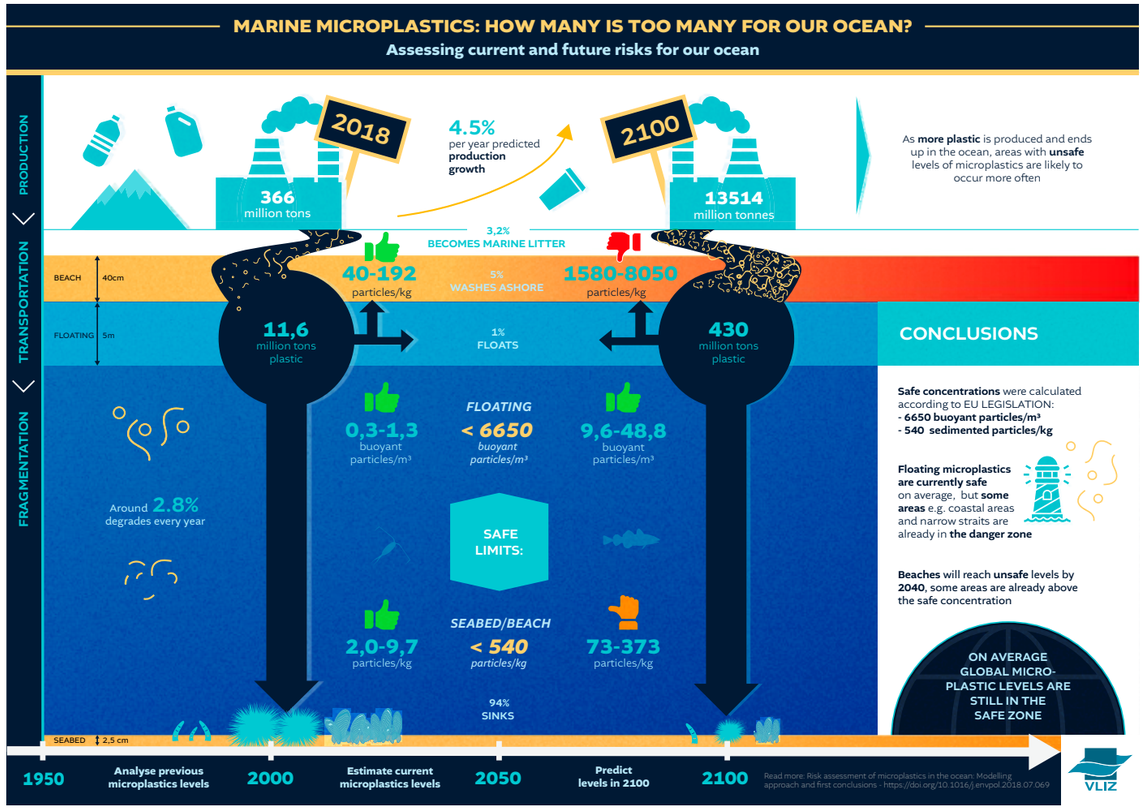
The experiments took place in a large water tank at the Hydraulics Research Laboratory in Antwerp. Cameras and sensors were installed to examine the influence of various parameters (the turbidity of the water, the intensity of light in the tank, the types of plastic waste and the depth at which it floats in the water). The research is part of the European Horizon 2020 programme ATTRACT. Knaeps: "With the results of these experiments in a controlled environment, we aim to select the best camera and sensor technologies for the detection of marine (macro) plastic debris in the near future." The chosen technologies may also contain some artificial intelligence (AI), so that the plastic waste detection and recognition can be done independently and possibly also enable the monitoring of large areas of water in the future.

This monitoring will not only take place on the high seas. "Most plastic waste ends up in the sea via rivers," says Knaeps. "By placing cameras on bridges, for example, we can spot the waste in time to remove it. That is much more difficult once it reaches the sea." For example, the plastic waste can be intercepted by an unmanned river drone that locates and fishes it out based on the data analysis from the camera images. Other remote-sensing technologies such as drones could be used to monitor wide stretches of rivers, for example in Southeast Asia where a lot of plastic waste flows into the ocean via major rivers.

In Vietnam, VITO has been participating in the AIDMAP project since September 2020. It experiments with drones to detect, recognise and quantify marine plastic waste - using AI technologies such as deep learning. The project is supported by the European Space Agency (ESA), as the drone images can also serve as a monitoring tool for high-resolution images taken by satellites.

Democases in the Scheldt

Smart processing of remote sensing data is still in its infancy. Many steps still need to be taken before it can be rolled out in concrete applications. These applications will be developed according to the specific circumstances and problems. In the Scheldt at Antwerp, for example, it may be useful to automatically detect waste larger than, say, 20 centimetres so that it does not obstruct navigation. In addition, more and more companies that are at the source of the plastic waste stream (for example, because they produce packaging materials) want to know whether and to what extent their plastics end up in rivers and the sea.



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But companies are also joining forces to tackle plastic pollution, although much more needs to be known about the flow of plastic waste from rivers into the sea. After all, it is extremely complex: plastic moves differently according to size, shape, composition, state of weathering, whether algae grow on it, water temperature, salinity and depth. Anyone who wants to tackle the problem must therefore take all these factors into account. That is precisely the aim of the PLUXIN project, a collaboration between knowledge institutions such as the Flemish Marine Instituut (Vlaams Instituut voor de Zee - VLIZ), which is leading the project, and 13 companies from the so-called Blue Cluster. The companies include large players such as Colruyt Group, which conducts research into aquaculture in the North Sea, but also small innovative companies such as Xenics from Leuven, which develops and improves infrared cameras to detect plastic waste.

Within PLUXIN, VITO is jointly responsible for the project part on remote sensing, in which technology is tested in several democases, including in the Scheldt basin. Cooperation with companies, often from very different sectors, is important. "We learn from each other what the technology's possibilities are, and how we can support each other in choosing the right techniques and applying them," says Knaeps.

The fact that the VITO Remote Sensing unit has become so involved in recent years in projects to help combat plastic pollution is a result of its rich experience and broad expertise in monitoring water quality, typically combining data from different sources. The data are also processed in various ways, such as in the MAPEO Water platform, which is currently also being used (with fixed cameras and drones) to map plastic pollution in rivers and coastal areas.

Other VITO units are also closely involved in the plastics issue. The Sustainable Materials unit is looking at how more plastics can be better recycled or reused. And the Sustainable Chemistry unit is investigating how microscopic plastic particles (microplastics) in water can be detected more easily. And then, of course, there are the possible harmful effects of macro and (especially) microplastics on human health and the environment. This is what the researchers of the VITO Health unit are looking into.

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TOOL SPEEDS UP SOURCE DETECTION IN **LEGIONELLA OUTBREAK**

In the event of an outbreak of Legionnaires' disease it is important to find the source of the dangerous bacteria quickly. However, this is often far from easy: the incubation period is long and, depending on the source, contaminated aerosols can travel for kilometres. In cooperation with the Flemish Care and Health Agency (Agentschap Zorg and Gezondheid AZG), VITO has developed a tool that reconstructs the spread of legionella retrospectively - and thus delineates the area where the source is most likely located.

Our country experienced another legionella outbreak recently. Two years ago, a 'legionella cloud' was released in the Ghent port area, striking thirty people (employees of port companies but also people living in the vicinity and passers-by) with the feared Legionnaire's disease. Two of them died of the lung disease.

Legionnaire's disease (or Legionellosis) is a notifiable infectious disease. As usual when several legionella infections are reported in the same period and the same area, the Flemish government's Care and Health Agency (AZG) immediately opens an investigation. Experts tried to trace the source of the contamination as quickly as possible. They interviewed the patients to find out as much information as possible about their whereabouts in the days and weeks before the outbreak began. To do so, they had to go back almost three weeks, because the incubation period - the time between infection with the bacteria and the first symptoms - of Legionnaires' disease can be very long sometimes.

Source detection

"It was a stressful period," recalls Liesbeth Lejon from the AZG. "New infections were still being reported several weeks after the first reports. This suggested that the source might still be active." The survey ruled out the possibility that the source was a temporary activity visited by the patients – as had been the case in the previous fatal outbreak in Kapellen in 1999, where the source was located in a trade fair for whirlpools. The source was narrowed down to an industrial plant that had spread a legionella cloud over a larger area.

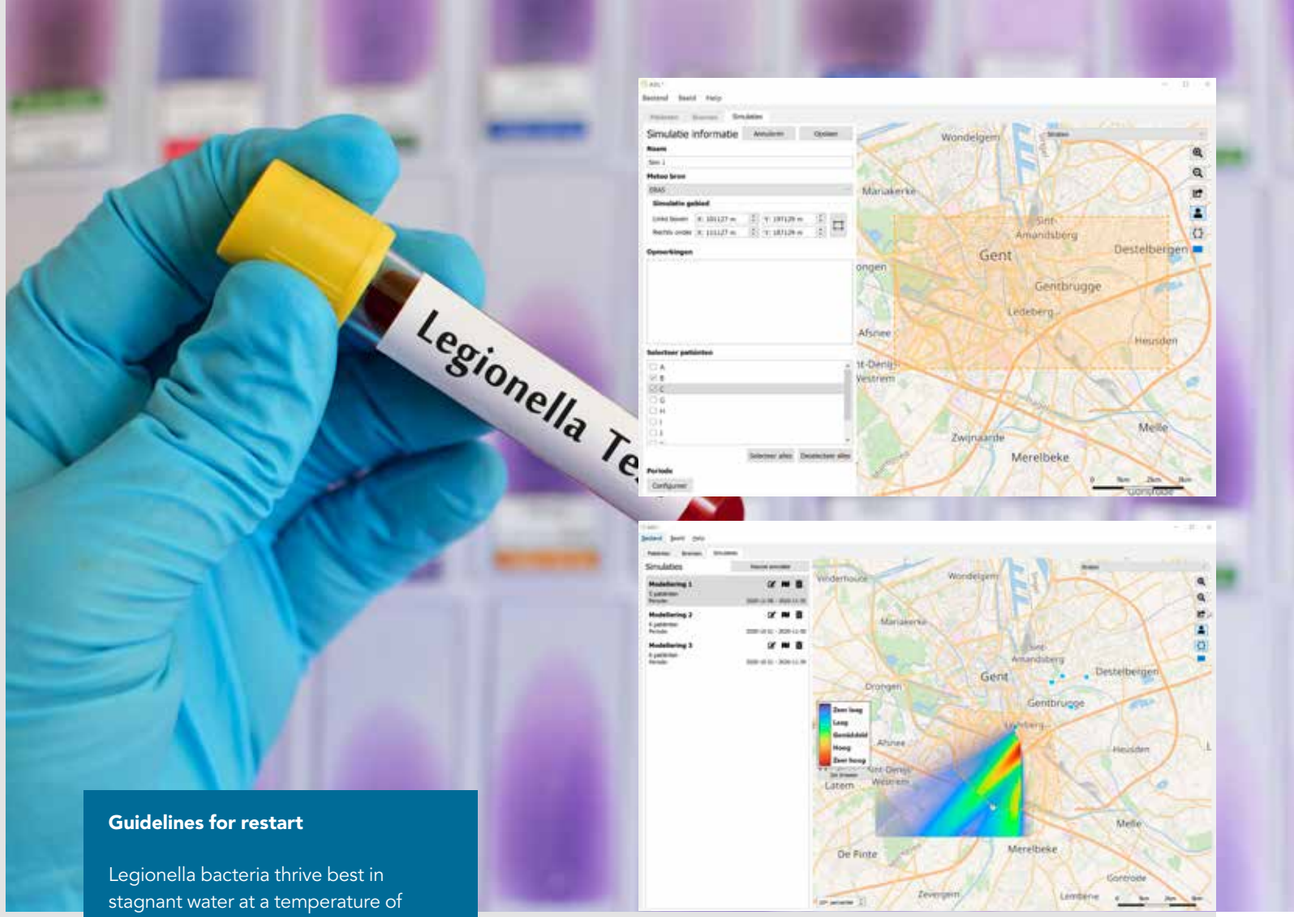
Based on the wind direction during the weeks before the first contamination, the source was located in the Ghent canal zone. "Based on those data, but also on experience, we defined a search zone," says Lejon. "Fortunately, our assessment was correct." It was also fortunate that the factory where the legionella source was found at the end of May 2019 complied with the notification requirement for cooling towers. "This immediately provided us with accurate contact details."

Already during the source detection, the AZG had called in air quality experts from VITO, and more specifically on modelling fine dust, exhaust gases and other pollutants. Their input confirmed that Lejon and her colleagues were on the right track, allowing them to fully concentrate on the defined area. "Legionella spreads via aerosols, small moisture droplets that often behave like the substances in our air quality models," says Wouter Lefebvre of VITO. Using inverse modelling, Lefebvre was able to reconstruct the distribution of the legionella cloud backwards over time. But the way the modelling work had to be done was not ideal. "There was no established protocol for source detection by modelling and the necessary data transformation caused delays."
The experience with the outbreak in the Ghent canal zone proved to be an incentive and at the same time a good test case for the development of a fully-fledged legionella tool. It could then be used as standard in future outbreaks with a potential environmental source. The AZG turned to VITO because of its rich and broad expertise in air quality modelling combined with the necessary IT knowledge to transform complex scientific models into usable tools.

Reverse wind direction

Inverse modelling involves completely inverting air quality models. The patients infected with legionella are then regarded as sources. An infection region is reconstructed based on their physical location, time and the reverse wind direction at the time. "We generate a separate map for each hour for each patient," says Denis Caeyers of VITO. "At the end, we put the maps together, and where the overlap is largest, that is where the source of legionella is most likely to be found." This method is actually not new, except that modelling used to be done with pen and paper and the maps were printed on transparencies. These hand-drawn maps were put on top of one another on a projector to make the overlap visible. Today, of course, that is no longer necessary. Furthermore, the VITO modellers can now combine the maps and models they generate with other data, for example through the mandatory cooling tower reporting or satellite images. Automatic detection based on satellite images by the VITO Remote Sensing unit can also be integrated, allowing unreported cooling towers to be visualised and investigated.

Early and reliable source detection is important, not only to stop a legionella outbreak as quickly as possible, but also to be able to carry out highly targeted sampling at suspected facilities (e.g. cooling towers) during the search, which is very time-consuming and expensive. In the event of a possible outbreak in the future, the AZG can now use this new tool very quickly.



Guidelines for restart

Legionella bacteria thrive best in stagnant water at a temperature of between 20 and 50 °C. The measures to limit the spread of the corona virus required the (partial) closure of sanitary installations in sport facilities, holiday parks and other accommodations and in public buildings. A (temporary) standstill and the restart of these installations is a known risk moment for the growth and spread of Legionella. That is why the AZG (in cooperation with the Scientific and Technical Centre for the construction industry) issued precautionary guidelines for the restart of these public sanitary installations.

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Preventive monitoring of legionella

The PREMOLEG project was selected as a demonstration and dissemination project as part of the Vlakwa Open Call 2020, allowing the innovative technology behind it to be tested with end users for a year. It is financed via Vlakwa by the Province of West Flanders and the Province of Antwerp.

These two technologies can both detect legionella preventively (i.e. long before problems arise) in both drinking water and cooling water systems. Specifically, they consist of an AI monitoring system and a quick offline legionella concentration determination in collected water samples.

The preventive monitoring can lead to more economical use of chemicals for disinfection of the pipes and to lower water consumption (because flushing only takes place when it is really necessary). "This makes it a very promising technology that fits in nicely with the broader sustainability picture," says Veerle Depuydt of Vlakwa. "If results confirm it works well, it deserves to be rolled out more widely among legionella-sensitive companies."

The technologies were developed by the Flemish start-up Liquisens. They will be tested in four organisations between now and the end of the year 2021: a coffee roaster with a small cooling water system, two care institutions with a complex drinking water system and a factory equipped with a cooling tower.

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VLAKWA

MADE IN EUROPE: **THE SMART BATTERY CELL**

Decentralisation is popular, including when it comes to how batteries are monitored and adjusted. At VITO/EnergyVille, we are working on an innovative battery management system based on 'distributed intelligence'. Smart battery cells could soon form the basis of a new disruptive value chain for European-made batteries.

Electric cars are full of electronics. These systems are used not only to assist driving and increase comfort, but also to monitor the condition of the batteries and adjust their operation if necessary. This is done via the battery management system, the BMS. It ensures, for example, that during discharging and recharging, all the individual battery cells remain within the limits that guarantee the highest level of safety but also the longest service life. In fact, the BMS constantly monitors the battery's health and safety status and, based on this, gives instructions to adjust its performance.

The BMS is currently usually located on top of the battery module, as an external brain consisting of a central computer, dense wiring and numerous sensors. This location is partly due to the fact that the BMS is not developed by the battery manufacturer itself, but is only installed on the modules later by the so-called battery integrator. A battery pack is then typically made up of different modules.

From module to cell level

Not only does this mean that the BMS takes up extra space and weight in the electric vehicle, but the wiring is often quite complex and makes battery construction a time and cost-intensive process. This configuration also makes possible battery re-use more difficult as the BMS has to be replaced frequently. "The result is that we lose the information about those cells' characteristics," says Serge Peeters of VITO/EnergyVille. "But we need these data to guarantee safety and to be able to calculate the cells' remaining service life and therefore their residual value."

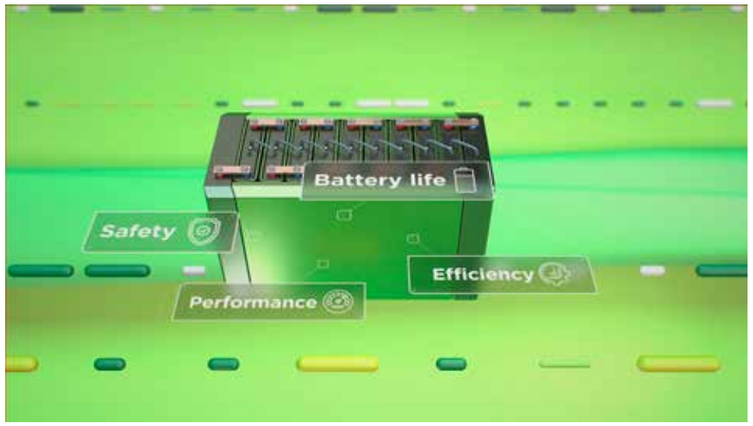
So-called smart battery cells can solve these problems. The BMS's 'intelligence' is spread throughout the module, embedded in the individual cells. "With smart cells, the BMS's hardware is directly linked to the individual cells", says Peeters. "That has several advantages, including a cost reduction from much less complex wiring."

Another advantage is that the cells are already 'smart' when they leave the battery factory. Their condition is therefore monitored from the very beginning and the cells carry this information with them throughout their service life. This allows them to be read out at any time, for example when a battery module is dismantled and the status of the individual cells is checked. Peeters: "This enables us to select the strongest cells or modules more quickly, for example, and use them again for the next application. As a result, they get a second life with an impressive remaining service life."

The smart-cell technology still needs to be developed, fine-tuned and extensively tested and proven - and this against a background of a rapidly developing and expanding range of battery applications. A first step in development is currently taking place in the battery labs of VITO/EnergyVille, partly within the framework of European Horizon 2020 funding via the Current Direct and NAIMA projects. "We are still in the early stages of development. Over the past year, we have determined the specifications of, among other things, the microchips and microsensors with which the smart cells will be equipped. This was done in close consultation with battery manufacturers and integrators to see exactly what they want and what we can offer them," says Peeters.

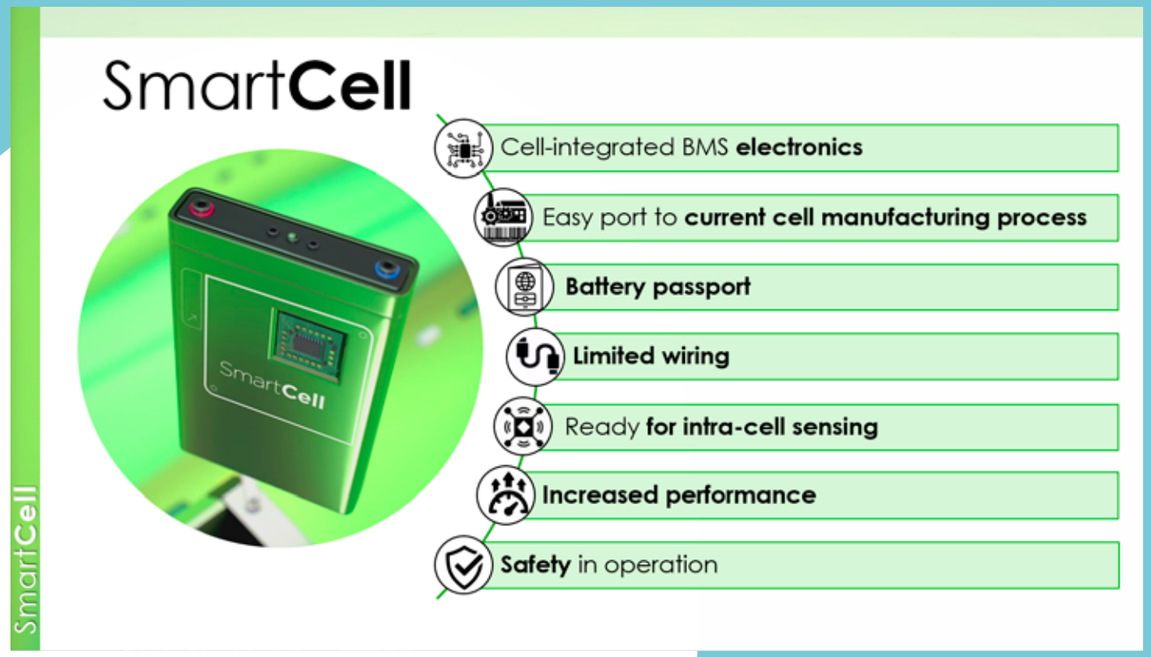
Autonomous European battery production

Much more than today's battery cells, the BMS will be able to keep track of the characteristics and the performance of the smart cells through the various stages of their life cycle - from cell assembly and module building through the operational to the diagnostic phases. This last phase is part of a continuous reuse and recycling of batteries. Ultimately, strict monitoring must become part of the so-called battery passport that each cell will carry, and which learns what materials it is made of, where and when it was produced (this is the 'static' information) but also how it has already been used and what impact this has had on its service life (the 'dynamic' information). Despite the decentralisation of the BMS, there will still be a minimal central, overarching 'mother brain'. It is there that the data from the individual cells are translated into system level information.



The development of smart cells is in line with the European Union's current ambition to take back control of the value chains behind batteries - for all applications, from electric transportation to stationary grid electricity storage and home batteries. "The EU does this by taking a clear position and focusing on a few aspects, such as sustainability, quality (long life, high performance) and safety," says Jeroen Büscher of VITO/EnergyVille. This innovative solution can play an important role in all these aspects and thus form the backbone of an entire value chain. After all, better monitoring at cell level will result in a higher residual value for reuse, better performance and enhanced safety. "Eventually we will move towards a new economic model for batteries in which they last 15 to 20 years and in which recycling of modules or cells plays a much more important role." Today, in electric cars, most batteries are replaced after only nine years, although they often still have 80 per cent of their original capacity at pack level.

As such, smart cells can be a means for European battery production to differentiate itself from Asian producers and become more independent from the current big players. This is strategically very important, but it takes time. We will only be competitive in about four years, partly because of our focus on cost reduction, on longer and more optimal use and on more recycling. Thanks to this kind of smart innovation, eventually we may even become cheaper than Asia," says Büscher.



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GENERAL QUALITY LABEL FOR MORE **ENVIRONMENTALLY FRIENDLY VEHICLE REPAIRS** THROUGHOUT THE EUROPEAN AUTOMOTIVE SECTOR

When it comes to vehicle repairs, damage is traditionally estimated in euros. The environmental impact of the chosen method of repair is not immediately taken into account. That is about to change, because with the Eco Repair Score®, expertise agency Vonck and VITO are launching a quantitative measurement that allows policymakers, repairers, insurers, leasing companies and car experts to accurately define and achieve their environmental targets. The development of this standard is among other things based on the scientific support from VITO which has a lot of expertise in sustainability assessments.

Every year an estimated one million vehicle repairs are carried out in our country, of which about half are reported to insurers. In the case of repairs, the damage and everything that goes into the repair, such as parts and products, are estimated in purely financial terms - in other words, in euros.

Objective figures

However, this purely financial accounting ignores another important cost that is not borne by the party at fault in a claim, but by the environment. "And it shouldn't be underestimated," says Wout Van Den Abbeele of expertise agency Vonck, one of the major players in the Belgian vehicle expertise market. The ultimate environmental impact depends highly on the chosen methods of repair, available materials, products, etc. The logistics behind the repair also play an important role. How and wherefrom are parts delivered, what journeys, and thus transport emissions, does the damaged vehicle make to and from the repair shop?

The main sources of environmental impact are known, but how significant are they and how much weight do they have in the overall picture of a vehicle repair? To gain insight into this, the Eco Repair Score® has called upon VITO, which has a wide expertise in evaluating and monitoring the environmental impact of products and processes, including circular strategies such as repair and recycling, thanks in part to scientifically sound methods including life cycle analysis. VITO's experts have put all relevant aspects of vehicle repairs into a scientific model that provides objective figures through a computation. The output is a quantitative measure that links a concrete score to the environmental impact of a vehicle repair.

The result is a thorough determination of the environmental impact. "We do not only consider the difference between replacement and repair (the latter is usually more environmentally friendly). We also map out the origin of parts," says Van Den Abbeele. "Are they brought in from Germany or from South Korea, and what packaging is used?" But our analysis goes beyond the mere parts. "We also take into account, for example, waste production, energy and water consumption and the replacement vehicle from the repairer."

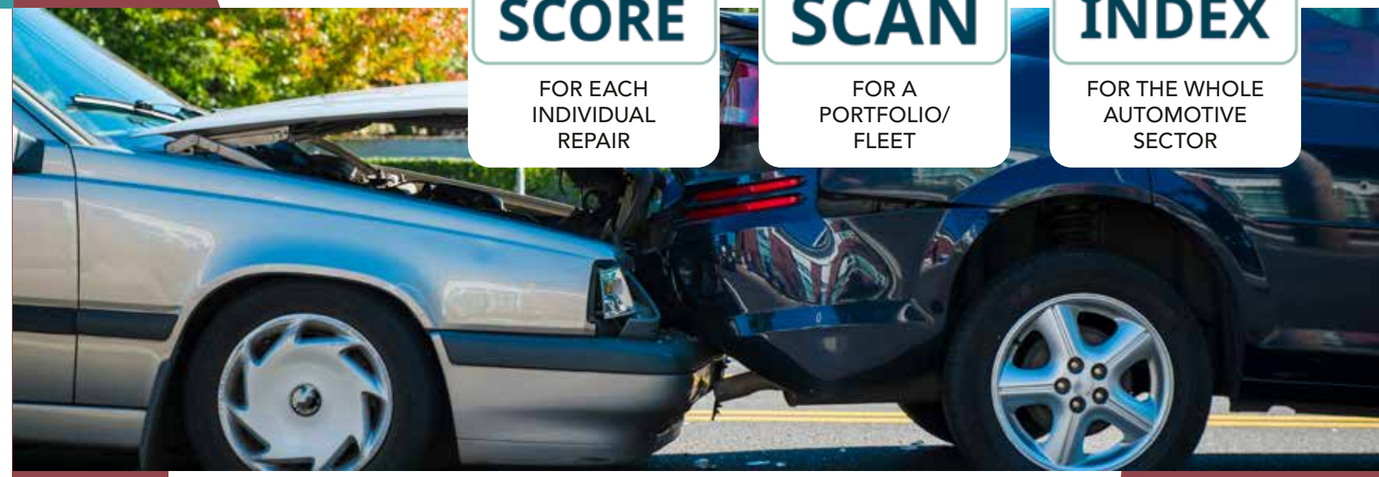
Over the past few months, expertise agency Vonck and VITO have tested a proof of concept of the model based on data from parts in the BMW 3 series. "Based on the data provided, we examined, for example, where the greatest opportunities lie for reducing environmental impact," says Philip Marynissen of VITO. Thus, the Eco Repair Score® not only gives an indication of the environmental impact, but also provides information to start reducing that impact.

This so-called Eco Repair Score® was introduced at the beginning of 2021 in response to the need to reduce the environmental impact of vehicle repairs in a measurable way. Even those who wanted to make efforts to reduce the impact on the environment lacked quantitative benchmarks because they simply did not exist.

In the first phase, the Eco Repair Score® is calculated on the basis of a model which incorporates repair data for the thirty parts most frequently damaged in a collision. "In a next stage we will link the model to databases featuring all the parts used in all vehicles from the last 12 to 15 years," says Marynissen. "That is hundreds of thousands of parts." Thanks to VITO's expertise, the model can use all this information to calculate a reliable environmental impact score.

Great value for the sector

The Eco Repair Score® provides useful information for all players in the vehicle repair market, not least insurers and leasing companies with their own networks of authorised repairers. "When quoting a repair, they can then take into account not only the cost, quality and service but also the environmental score," says Van Den Abbeele. "In this way, they can encourage repairers to start assessing and reducing their environmental impact."
The Eco Repair Score® can thus not only be used for individual repairs, but also for an Eco Repair Scan of entire portfolios and the presentation of an Eco Repair Index for the whole automotive sector.



ECO REPAIR A B C D E **SCORE** — FOR EACH INDIVIDUAL REPAIR

ECO REPAIR A B C D E **SCAN** — FOR A PORTFOLIO/ FLEET

ECO REPAIR A B C D E **INDEX** — FOR THE WHOLE AUTOMOTIVE SECTOR

Great value for policymakers

The repair industry can achieve a lower environmental impact through circular strategies. There is an environmental benefit if a part is repaired rather than immediately replaced with a new one. Marynissen: "Replacing a part with minor damage is usually not a good idea." Nevertheless, in recent decades, the market has shifted towards replacement rather than repair. "That is easier of course because it requires less qualified staff, "says Van Den Abbeele. "Repairs indeed require specific skills," Marynissen agrees. "This project demonstrates once again the need to continue training our quality workforce in order to continue to distinguish ourselves as a region with the knowledge and skills required to work in a more circular manner. We know that employment in the circular economy is growing faster than in the regular economy. Demand for technicians who can carry out high-quality repairs, such as 'spot repairs' on vehicles, is expected to increase."

The Eco Repair Score® will be tested in the coming months as part of a pilot project in cooperation with insurers. It is then important to further scale up the model behind the score and to market it as a true 'environmental label' for vehicle repairs - also with a view to a future roll-out on a European scale.

The Eco Repair Index provides policymakers with the missing tool to assess the environmental impact of vehicle repairs, which they can then use to design policies to reduce this environmental impact.

In the case of VITO, the expertise provided cannot be considered separately from other activities that determine the environmental impact of vehicles, such as choice of materials during design, emissions during use, and dismantling at end of life. That is why VITO was recently involved in the Circular Cars Initiative, a project of the World Economic Forum to make the automotive sector more sustainable and bring it into line with the objectives of the Paris Climate Agreement.

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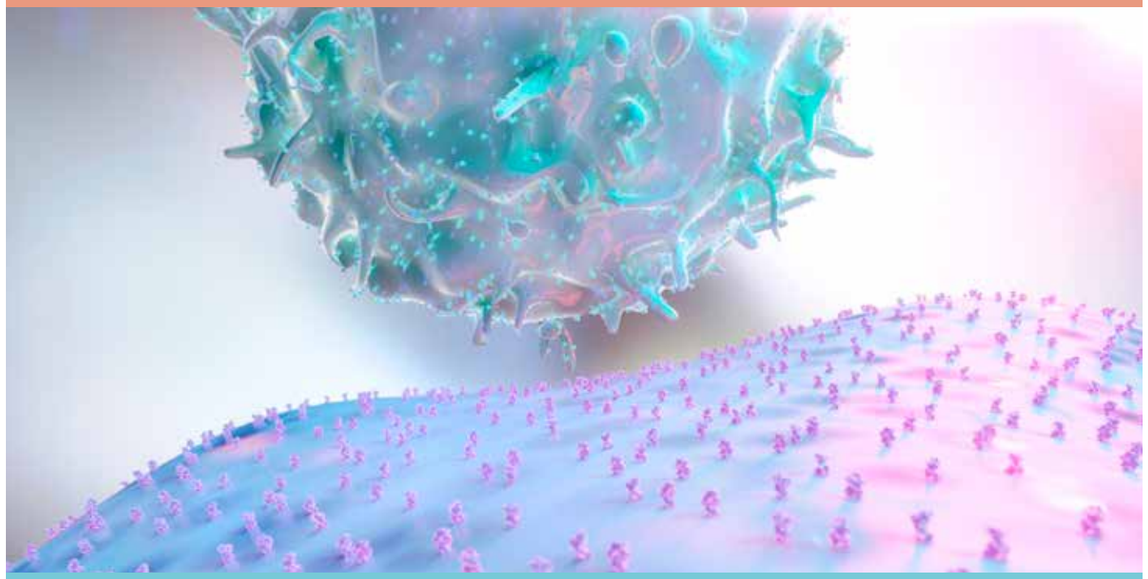
TOWARDS **PERSONALISED IMMUNOTHERAPY**



With its role in the still recent field of 'immunopeptidomics' in which tumours are analysed for cancer-specific antigens in the form of small proteins (peptides), VITO is helping to pave the way for what may soon develop into a form of immunotherapy tailored to the needs of the patient. But first, much more data is needed with regard to the identity of these antigens. VITO aims to obtain these data together with academic and industrial partners via an "identification platform" which allows the immediate identification of antigens in tumour tissue.

In immunotherapy, which has provided good results as an anticancer treatment in recent years, the aim is for the patient's immune system to clear away the tumour cells itself, partly by better recognising them. This recognition is performed by so-called antigens which are produced by all cells, not just cancer cells, and are "presented" to specific immune cells - neoantigens are antigens produced specifically by tumours and which allow the immune system to distinguish cancer cells from normal cells. Immunotherapy aims to strengthen the response of the immune system against these neoantigens (e.g. through vaccination) so that a strong(er) immune response can be generated.

Identifying antigens

In order to properly tune immunotherapy, it is important to know exactly which antigens are presented by the cancer cells.

At present, this identification is not optimal. And that's because prediction of tumour cell neoantigens is based upon computer models which are often still far too little based upon real-life biological data. Using the immunopeptidomics platform, the antigens themselves are measured and their structure determined, rather than based upon predictions. This will allow us to improve prediction models and discover new antigens (not previously predicted).

With this prediction in hand, immunologists can develop immunotherapies, for example by imitating the neoantigens in the form of small proteins (so-called peptides) which then evoke the same immune response, however a much more powerful one. This can be done in several ways, via T-cell therapy, mRNA vaccines or by offering the peptides themselves. All these therapies aim to activate and strengthen the body's own immune system and clear away the cancer cells. This is a form of vaccination against cancer, except that in this case the pathogen is the body's own cells - and so the immune system's "natural" response is enhanced for that particular patient with that particular tumour.

But in order to apply this type of immunotherapy, it is important to properly characterise the tumour-specific antigens. Moreover, they differ not only from one type of tumour to another, but may also vary from one person to another. As such, this strategy forms the basis of a form of personalised immunotherapy.

To this end, researchers are currently developing a platform which can identify and characterise useful neoantigens, initially in colon cancer tumours - but with the potential subsequently to expand the platform to all types of cancer. The research is part of the ImmunoPepX project supported by VLAIO, in which not only VITO but also the KU Leuven, the VUB, the Janssen pharmaceutical company and the Ghent start-up, myNEO, are collaborating.

The platform will be built following a complementary strategy of identifying the neoantigens of tumour cells, by combining a strong bioinformatics approach with enhanced immunopeptidomics (the analysis of immune-related peptides), whereby this should lead to the determination of both the specificity of neoantigens and the reactivity of immune cells to them.

The tip of the iceberg

Like proteomics, the more common brother of peptidomics in which all the proteins of a cell or an organism are mapped, peptidomics also aims to identify and characterise all peptides. The difference is that in both fields only the tip of the iceberg is analysed, but in proteomics researchers at least know how much is still underwater because proteins can be predicted from the known genes. "We can't do this to the same extent with peptidomics because we don't have a complete reference such as a genome, and we are interested in what deviates from what we expect," says Geert Baggerman of VITO and UAntwerp, who wrote a PhD on peptidomics twenty years ago and can therefore be seen as a pioneer in this field. "Moreover, this is where it comes down to identifying what deviates from the norm (healthy cells), so we're actually looking for a needle in a haystack. In addition, tumour cells often create very few neoantigens, which means that you have to use very high resolution and sensitivity in order to be able to see them".

Identification and characterisation are performed with high-tech equipment in specialised proteomics labs at UAntwerp, including mass spectrometers which can distinguish molecules on the basis of their molecular mass. This equipment is unique in our country, although this also applies to the specific field of immunopeptidomics. The first scientific papers on this subject appeared a while ago but only recently technologies have matured sufficiently to do it with adequate sensitivity," says Baggerman. ImmunoPepX can be seen as a first important collaboration in this field, between both academic and industrial partners. The project brings together complementary expertises, whereby that of VITO can be summarised as high-resolution peptidomics.

At first, the project will compile a unique dataset based upon clinical data from 15 colon cancer patients. Baggerman: "This will include a full screening of the DNA, the RNA, the proteome, the immunopeptidome (the identified antigens) and this combined with analyses related to the immune response. Once we have the dataset, we will be able to predict and also validate the neoantigens of these patients with very high reliability." The fundamental research can also serve to prepare algorithms for identification and characterisation for future use. "ImmunoPepX will thus become the best platform available for the analysis of neoantigens, which will furthermore integrate all the necessary elements."

Neoantigens play a role not only in cancer, but also in other conditions such as infectious diseases. These are of course also fought by (the same) immune system. It is not proliferating tumour cells which produce and supply neoantigens, but cells infected by viral particles, for example. As such, immunopeptidomics research offers a broader perspective on immunotherapy, based upon a personalised approach whereby the treatment is tailored to the patient - allowing the most optimal immune response to be evoked.

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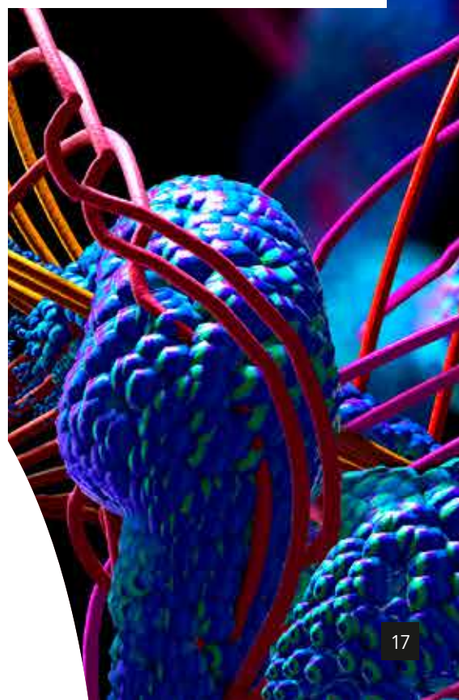

URBAN ENERGY PATHFINDER SHOWS THE WAY IN THE ENERGY TRANSITION

With the Urban Energy Pathfinder, VITO/EnergyVille has a handy, versatile tool with which renovation and energy strategies can be simulated at various levels. The tool's strength lies in its combination of bottom-up operation with a holistic approach, which is very useful in the decarbonisation of urban environments.

The Urban Energy Pathfinder (UEP) was developed three years ago at VITO/EnergyVille, as the result of a collaboration between various units. The planning tool, which helps local and regional authorities to realise the energy transition, is therefore fundamentally multidisciplinary in nature. The UEP works at the level of individual buildings as well as districts, whole towns and cities. And as a simulation tool for the built environment, the UEP not only helps to draw up renovation plans but also provides insight into the potential of renewable heat. Hence, the tool can give a boost to the renovation market and is also useful for companies active in that market, such as engineering and planning firms.

The renovation market could certainly use a boost. Every year, only 1 % of Flanders's building stock is renovated. For Flanders to achieve its climate goals, a renovation rate of at least 3 % is needed. The factors that are blocking a thorough renovation are well known: high investment costs, lack of financial incentives due to the low price of fossil fuels and the drastic nature of thorough renovations.

Digital twin for renovations

With the DITUR project (Digital Twins for Upscaled Retrofit), VITO/EnergyVille wants to do something about this. Until mid-2022, this Flux50-ICON project will investigate how data analysis can be a catalyst for neighbourhood renovation projects in order to increase the renovation rate in the short term. This is done by combining innovative data into a digital twin of the building stock for two types of pilot cases: city districts (in Aalst and in Roeselare) and a social housing estate (in Roeselare). To this end, VITO/EnergyVille works together with the city councils involved and with the social housing company De Mandel. Other partners involved are AGC, June, Zero Emissions Solutions, Avineon, imec and Ghent University.

One of the key elements of DITUR is the integration and combination of data on buildings from very different sources: general and freely available 'open' data but also detailed private data. "The open data mainly come from a kind of 3D scan of the built environment in Flanders," says Glenn Reynders of VITO/EnergyVille. "These data include the built volume, the wall and roof area, but also information such as the number of windows. In this pilot project, we link these data to electricity or gas consumption data, obtained for example from residents with a digital meter. This gives us a concrete and very detailed idea of the renovation potential of buildings and neighbourhoods."

Ultimately, as many buildings as possible in Flanders will have to be upgraded energetically to the highest EPC level (the A label). Reynders: "This requires extensive work for many buildings, which at first glance seems expensive. Therefore, in this project, we optimise the possible renovation on the basis of each individual building's boundary conditions. We have already seen that this pays off: in a social housing estate comprising some two hundred homes, we arrive at a cost that is only half as high as renovating using a uniform approach."

Data play a crucial role in DITUR. Therefore, the willingness of private individuals to share privacy-sensitive data (such as energy consumption) is also being investigated. To what extent are people prepared to do this, knowing that they will receive concrete renovation advice? And what data solutions are there to handle privacy in the simulations? These are the sort of questions we are seeking to answer. "We are studying, for example, how people react to general or very personal questions where this data request is linked to a concrete renovation simulation. If enough people are convinced of the usefulness of such simulations, it will be easier to convince local residents and to win them over," according to Reynders. Thus, the project provides a great opportunity to study user involvement in renovation and energy solutions.

Roadmap to a carbon neutral Genk

GEENkool is another project developed by the UEP over the past year. With this project, the city of Genk - home to EnergyVille - wants to develop a roadmap towards carbon neutrality by 2050. Here too, the greatest gains will have to come from building renovations, although the integration of low-carbon energy sources also plays an important role. The project path follows both a bottom-up and a holistic approach, and does so by following two 'tracks': a planning track and an action track. "Governments are often not lacking in ambition when it comes to climate objectives," says Rutger Baeten of VITO/EnergyVille. "But just announcing their ambitions or organising a signing ceremony does not make them a reality. In the planning track, we examine what these ambitions mean for the city of Genk in concrete terms for the local built environment, but also for sectors such as industry and mobility. By linking the energy needs to the goals, we are working towards each other's targets." It is also important for a local government to know where and how it can have a meaningful impact. This, too, requires a planning approach.

In the short term (the next few years), the action track will examine what new projects can still be launched and what current initiatives can be accelerated or expanded. "We want to set up energy yards quickly and very concretely," says Baeten. "They can then possibly be supported by the Flemish post-corona recovery plan, called 'Vlaamse Veerkracht'."

The GEENkool project intensifies the cooperation between VITO/EnergyVille and the city of Genk. "As a former mining town, energy is in Genk's DNA," says alderman Toon Vandeurzen. "That is why we are now resolutely opting for a sustainable energy future. We are pleased to be able to join forces with VITO/EnergyVille as a stepping stone to a genuine Genk energy coalition."

For VITO/EnergyVille, the project, which is financed from the city budget, offers new opportunities to research, simulate and experiment with even more aspects of energy in an urban context.

A dynamic 'heat zoning map'

Cities and municipalities wanting to know how big the heat demand is in a given part of their territory, can use the Flemish Heat Map (Warmtekaart Vlaanderen). However, it is based on buildings' current heat and energy demand, making the map somewhat static over time.

At the request of the Association of Cities and Municipalities (Vlaamse Vereniging voor Steden en Gemeenten - VVSG), a consortium including VITO/EnergyVille will therefore develop a more dynamic version of this map, which will be called the 'inspiration map of heat zoning'. This will be based on simulations of heat demand looking towards 2030 and 2050.

Policymakers will be able to consult the 'heat zoning map' to know the heat density in a given area, and thus to assess whether it is (or will be) high enough for a heat network, or whether it would be better to opt for an individual energy solution. Thus, the map will help cities and towns pave the way towards fossil-free heating and cooling of buildings by 2050.

The new project once again demonstrates the huge potential of the Urban Energy Pathfinder, which will be used to make heat demand simulations.

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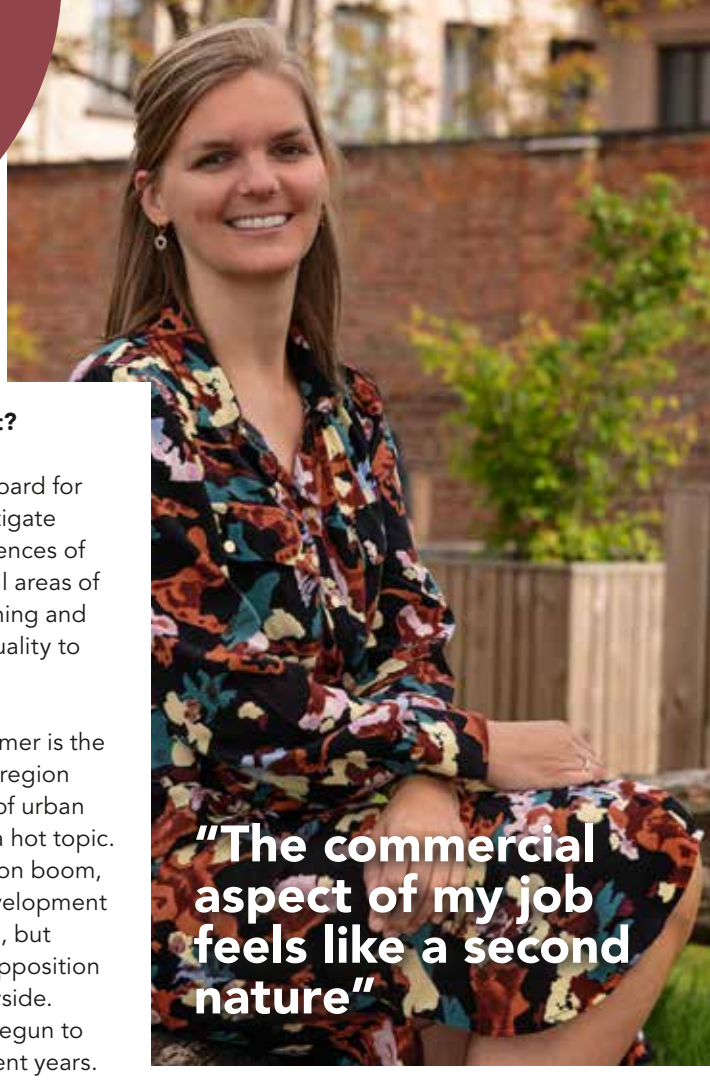
VITO EMPLOYEE **IN THE SPOTLIGHT**



What if ...? And what would happen if we do a little more of this, and a little less of that? These are the kind of questions Business Development Manager Karolien Vermeiren deals with. As a member of the VITO team on Spatial-Dynamic Modelling, she investigates how well-defined policy choices can change the world we live in - in terms of living, working and mobility as well as nature and climate. Vermeiren and her team do this mainly by means of spatial simulations and models, so that policymakers get a reliable estimate of what the consequences of their decisions might be. This field of research is highly multidisciplinary and one that is growing in importance lately - especially since we can no longer ignore the detrimental effects of spatial (dis)order. "That is a big difference with my PhD, in which I simulated the growth of African cities," says Vermeiren. "At the time, that work was not picked up by those who could do something about it."

You joined VITO fairly quickly after completing your PhD at the end of 2014. How was the transition from the academic world?
"In essence, I continued to do the same as at KU Leuven, i.e. develop spatial models based on existing data and use them to simulate how all kinds of geographical, but also social and economic aspects are very likely to change. During my PhD research, I did this for some cities in Africa. I simulated their growth (and more specifically their 'urban sprawl') using data such as population growth and economic indicators. It was very interesting but I didn't feel that anyone was taking it further."

And this is now different?
"Definitely. We provide an indispensable sounding board for policymakers, as we investigate and simulate the consequences of their decisions in almost all areas of society. From spatial planning and energy, mobility and air quality to climate."

Our most important customer is the Flemish government. Our region is known for its own form of urban sprawl, which is currently a hot topic. Just look at the construction boom, the costs of dispersed development and parcelling, traffic jams, but also, for example, at the opposition to windmills in the countryside. Policymakers have really begun to look at these issues in recent years. We also notice that environmental thinking, which is typical for spatial modellers like us, is becoming more and more popular with governments and companies."

What change have you seen in your domain in recent years?
"The role of ICT solutions has increased even further. More and more overview maps are created automatically, whereas a few years ago we still did them manually, i.e. sitting at a computer screen. As a result, these maps are now more user-friendly for the users, our customers. They like the fact that the maps are interactive, for example, and that during the presentation of a map you can change a few things, such as the weight of certain parameters."

To what extent do you still feel like a researcher, which is what you were trained to be after all?
"You're right that I have a strong scientific basis, but my VITO business card has read 'business developer' for about four years now. At the same time, I am also involved in research, fundamental simulation and modelling work. This combination is not easy - sometimes it is difficult to maintain a balance - but I like it. The commercial aspect of my job - screening tenders, guiding offer processes towards projects, but also maintaining a network - now feels like a second nature. I already had this need for human contact at university, where I really enjoyed my job as a practice assistant, for example."

More info
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