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Dear Reader,

Nanotechnology has the potential to change the world. VITO is acquiring the expertise to develop, produce and use these tiny particles. This edition of VITO VISION shows you how our researchers are examining the possibilities, but also the risks of nanotechnology, throughout the value chain and across our units. Thus VITO, as a leading and international research and advisory centre, provides knowledge and technological innovations that facilitate the transition to a more sustainable society.

In this edition you will also learn all about the energy transition in Belgium and the role of insects as a sustainable raw material or waste processor, about green energy for developing countries, and the possibilities of satellites and drones for charting changes to our living environment. VITO offers knowledge and innovative processes and business models. but we never do this alone. We link the research world with government and the market, and knowledge with policy and business. This allows us to collaborate on the realisation of changes that impact the

I hope you enjoy reading this edition of VITO VISION,

Dirk Fransaer Managing Director VITO



## VITO MODEL FOR LOCAL AIR QUALITY IN INTERNATIONAL CONTEXT

#### **COVER STORY**

Particulate matter and nitrogen dioxide in the air have a major impact on our health. In recent months, VITO experts updated one of the statistical models behind the Dutch air monitoring network. The RIO model calculates background concentrations of air pollution on the basis of measurements, and for many years it has also been the basis for public information on current air quality in Belgium.

VITO developed the RIO model 13 years ago. RIO enables the creation of areawide maps with so-called large-scale concentrations. Bino Maiheu: "The model uses an interpolation scheme. Concentrations measured at specific locations are linked to land use, which allows RIO to take into account the local character of air pollution. Trend functions are developed from the correlation between land use and concentration levels, thus also enabling information on air quality in areas where monitoring stations are not present to be provided."

#### Particulate matter and nitrogen dioxide

"The Belgian Interregional Environment Agency (IRCEL) has been using the RIO method for years to display on its website the air quality throughout Belgium every hour of the day. It specifically concerns large-scale concentrations of particulate matter and nitrogen dioxide, presented on maps with a resolution of 4x4 kilometres. In a wide-ranging comparative study of air quality models, the RIO model emerged as the most accurate for Flanders. Which is why the official projections for air quality in Flanders are checked against the RIO model."

#### Monitoring network in the **Netherlands**

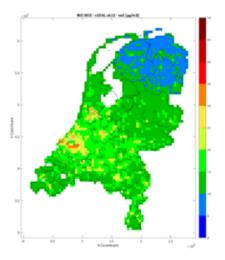
The Dutch National Institute for Public Health and the Environment (RIVM) has been using RIO since 2009. Dennis Mooibroek: "VITO had the original model expanded and adapted to make it usable in the Netherlands. But a lot of changes have taken place since then in the National Air Quality Monitoring Network: some measurement stations have closed or moved, new ones have opened, and the concentrations of most substances have decreased in recent years. In addition, data from partner monitoring networks in Amsterdam and Rotterdam had not yet been integrated. In the meantime, improvements to the model itself have also been made. Which is why we requested an update based on the current concentrations and measurement stations. This will soon be operational."

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> In addition to the Netherlands. other countries are also enthusiastic about the RIO model. It will soon be deployed in Poland, and VITO is looking at opportunities in China.



Dennis Mooibroek (RIVM) and Bino Maiheu



Urban background NO, concentrations expressed



# INFINITE NUMBER OF USES AND RISKS OF NANOPARTICLES

#### VITO IS EXPLORING THE POSSIBILITIES OF NANOTECHNOLOGY IN DIFFERENT AREAS

From consumer goods to medicines: you encounter nanoparticles more often than you think. It is said that nanotechnology will change the world. VITO is developing nanotechnology expertise from various angles in order to fully exploit the value of this technology while taking the potential risks into account.

Nanotechnology covers the development, production and use of very small particles, roughly less than 100 nanometres in size (one ten-thousandth of a millimetre). At that scale, particles have different electrical, optical, thermal and mechanical properties. This allows products or materials with new or improved properties to be made. Nanomaterials are also used in many applications such as coatings, inks and paints, food, packaging, cosmetics, sensors, and even medication. VITO is investigating the opportunities, benefits and risks of nanotechnology throughout the value chain

## Sustainable alternatives to existing production processes

Working at nanoscale is not new for VITO. Jan Meneve: "Making manipulations at nanoscale was a logical step in our activities related to materials technology. For decades we at VITO have been accumulating experience in coatings and plasmas. These technologies have now reached the market. Today we are again looking several steps down the road. Thus we have numerous technologies and the infrastructure to characterise the impact of nanoparticles. We are also looking into sustainable alternatives to existing manufacturing processes."

VITO has patented technology for the synthesis of our own nanomaterials. Karolien Vanbroekhoven: "We have already applied a technology based on 'electrocapacitive crystallisation' in a number of projects. The big advantage over existing technologies on the market is the gentle production method with which we can change the shape and size distribution of nanocrystals. This involves an electrochemical process that occurs in an aqueous environment. The mild conditions – no solvents or high temperatures are used – make the process much more environmentally friendly than conventional techniques. At present, we are able to produce 2 grams of nanocrystals per hour in the lab. Numerous industries, including the cosmetic and pharmaceutical sectors as well as the high-tech industry, will be able to benefit in the future from this breakthrough."

#### Safety by design

Nanomaterials have special characteristics, but exposure to them can adversely affect humans and the environment. Since nanoparticles are so small, they can penetrate deep into the lungs, brains, and cells. They can also be flammable and explosive. Sven Vercauteren: "It is important to identify these risks in time by applying the safe-by-design concept. This means that reflection on the dangers of human exposure to nanoparticles starts already in the development phase. Early screening allows us to know whether it is useful to invest further in the development and whether it is necessary to adapt the functionality of particles to make them safer. VITO guides companies in this area and advises them how to best protect their employees from potential exposure during the production or processing of nanomaterials."

Toxicity?

Ecotoxicity?

Emission

Composition?

Composition?

LCA (Life Cycle Assessment)

Emission

Cocupational exposure

Safe

Sustainable

**BAT** (Best Available Technologies)

Cycle safe by design

Fate & Behaviour?

Inge Nelissen: "Determining the risks of nanoparticles is not evident. The challenge consists in measuring the exact level of exposure, and combining this with particle-specific properties in order to arrive at a particle's toxicity. Sensitive instruments and methods are needed for this assessment. And we have these at VITO."

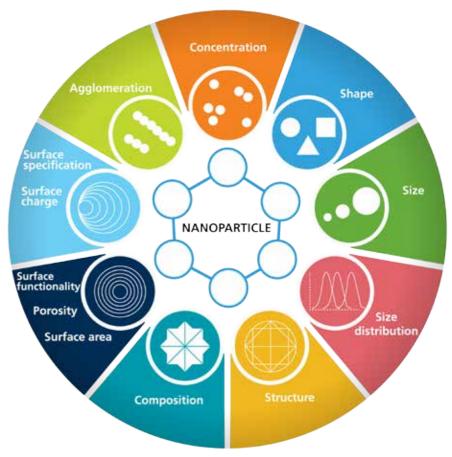
#### **Eliminating negative impacts**

You can eliminate negative impacts by giving nanoparticles a different shape. VITO founded the Nanosafety Test Centre in 2010. Here specific steps in the production phase are simulated, as are the processing and use of products containing nanomaterials. Sven Vercauteren: "Including safety from the start of development is the ideal scenario. But we are also focusing on the testing of industrial and consumer products containing nanomaterials. This is usually done on behalf of companies. The products are subjected to standard operations such as drilling, cutting or grinding to see if nanomaterials are released."

"In Europe it is recommended to give an indication if a product contains nanoparticles, and such an indication is even required in the case of cosmetics. But these guidelines are not systematically applied. Which is why we monitor the exposure caused by certain consumer goods. We perform these tests for both businesses and the government."

#### Detecting cancer and cardiovascular disease early

If we manage to avoid the risks of nanoparticles, nanotechnology could even contribute to better health. A new range of innovative products and technological solutions that improve health exists thanks to nanomaterials. Inge Nelissen: "We are also putting our experience in measuring and characterising nanoparticles to use in the development of cost effective and more personalised healthcare. Thus we are investigating the interaction between nanoparticles and living cells. How are the particles absorbed? How



Main characteristics of nanoparticles

do they interact within the cell? This knowledge can result in new treatments. In addition, nanoparticles play an important role in research on diagnosing disease. Recent studies have focused on isolating and characterising extracellular vesicles. These are nanoscale blisters that are secreted by cells – healthy and sick – in our bodily fluids. Once the vesicles are isolated, researchers can perform protein or DNA analyses to identify biomarkers for disease. This allows for example the early detection of cancer and cardiovascular diseases."

### Valorising knowledge in all areas

Karolien Vanbroekhoven: "Our nanocharacterisation platform covers a broad range of applications, including medical. That is the strength of VITO: we are able to valorise our knowledge and experience simultaneously in different fields. Companies that today use or produce nanocrystals can come to us to have their safety checked. However, we do not only test, but also review the production processes. Together with companies, we evaluate whether the nanocomponents they use can be produced in an alternative or more sustainable way. We also offer our services to governments and we are initiating our own medical developments. Thus we are committed to fully exploring the infinite possibilities of nanotechnology."

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# DREAMVILLE IS LIVING LAB FOR STUDYING WATER USE

#### WATERVILLE EXPERIMENTS WITH SMART WATER METERS AND INFLUENCING BEHAVIOUR



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- > Project Engineer at Seghers Water from 1998 to 2002
- Since 2003, active at VITO in research and demonstration projects on industrial water management and sustainable cities

Water is precious, and we must use it carefully. VITO launched the research project WaterVille to gain more insight into our use of water. At DreamVille, home to 38 000 Tomorrowland festival visitors each year, smart sensors register the detailed consumption pattern, and researchers test which communications convince people, for example, to take shorter showers. In addition to local water savings of at least 20 %, the project aims to be an inspiring example for the tens of thousands of visitors, and for the events industry and the public water sector in general.

Since January 2016, VITO's Water Management & Technology team (WMT) has been bringing together the expertise of water economists, environmental engineers and software specialists. In addition to ongoing water projects for industry and government, this new team emphasises the importance of water for all of society. The WaterVille project is a good example of this.

#### **Optimal water management**

"DreamVille can be seen as a temporary city, with water infrastructure that is rebuilt each year in the weeks before the festival. 38 000 people live at the site during the five festival days, all of whom take a shower, use the toilet ... There's even a laundromat! With Water-Ville, our aim is to gather as much data as possible from the festival visitors on water use," says Wim Schiettecatte. "We use smart water meters to closely monitor the consumption pattern. This gives us greater insight into the behaviour of a large group of people, some-

thing that is not yet possible in a typical urban environment since water meters are read only once a year. The new data will allow us among other things to more accurately dimension a water network and better match supply with demand."

Via an SME study in 2015, VITO researchers already started the daily reading of a number of local flowmeters at DreamVille. At the start of WaterVille, in the summer of 2016, water use was already being measured in many more places, and new measurements were available every 10 minutes via the Sigfox data network. Wim Schiettecatte: "In July 2017, it will be possible to read live data and link it to the number of visitors of a shower area. They are already being registered using wristbands. This allows a more personalised approach to water use and thus opens up a new world for optimal water management."

#### **Nudging collective behaviour**

Hence, a second part of WaterVille includes a study of the behaviour of DreamVille visitors. WMT, supported by the VITO Transition Platform, wishes to use these results in a comprehensive study of transition thinking and waterwise societies. "The crucial question is: how to make water conservation a natural choice for people?" says sociologist Yves De Weerdt. "Combining technology with knowledge about behaviour creates new possibilities. Behaviour depends on many factors: age, gender, individual needs, the example of friends, the collective feeling of a festival, the weather ... Your communication also needs to be adapted to these: should you communicate concisely about water consumption or for example make use of a simulation game?"

For WaterVille, VITO is working closely with the team of Love Tomorrow, Tomorrowland's sustainability platform. They know their audience and are able to properly assess the feasibility of outof-the-box ideas. Yves De Weerdt: "The challenge lies in choosing sustainability while ensuring the comfort of visitors. Currently the WaterVille partners are developing a sanitary unit that is able to communicate creatively with the user about his or her use of water. Using informative displays and mood lighting, we examine what happens when visitors can compare their personal water use to that of the entire group. But the aim remains making saving water the logical and obvious option, not a mandatory process. We need to abandon the idea that sustainability always means a loss of comfort."

#### Smart cities

The WaterVille project covers multiple editions of Tomorrowland. 2016 is the baseline against which the water consumption of the following editions will be compared. Wim Schiettecatte: "In 2017, based on the initial data, we will

be trying out various behavioural measures and technological innovations for the sanitary units. We are aiming for maximum water savings in 2018. The multidisciplinary approach at Water-Ville is resulting in new insights that we want to apply within the broader research into smart cities. We are also striving to maximise valorisation of the project's results among all the participating project partners, each with their specific target audience and product range. And to ensure the optimum exchange of ideas and knowledge, we are planning an annual transition workshop with the events sector, water companies and the government. The translation of results from a multicultural festival environment to an urban context must take place critically and in dialogue with all stakeholders."

WaterVille is co-financed by the Environmental and Energy Technology Innovation Platform (MIP). VITO is working on the project together with Love Tomorrow (Tomorrowland's sustainability platform), Hydroko (smart meters), Forwrd (data communication and processing), Pidpa (water company), MTD (water infrastructure) and Van Overbeek (sanitary units).



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- > Coordinator of the VITO
  Transition Platform: facilitates
  the development and
  integration of transition
  thinking in research and
  technology development
- > Coaches and guides
  VITO employees who use
  transition thinking in research
  and other projects in order to
  have a have greater impact
  on sustainability

## LOVE TOMORROW: "WE WANT TO GIVE A POSITIVE MESSAGE TO OUR PEOPLE OF TOMORROW!"

At Love Tomorrow, sustainability is high on the agenda. In recent years the emphasis was on energy saving and sorting waste. Now the team wants to reduce water consumption at DreamVille. Smart water meters provide interesting information. VITO's initial measurements in 2015 indicated that a large portion of the water consumption at DreamVille was due to intensive flushing of the pipes. After the water supplier began using different cleaning methods, consumption was more than 10 % lower in 2016. By participating in WaterVille, Love Tomorrow is not only aiming to reduce water consumption at the festival, but also to send visitors, the People of Tomorrow, home with a positive message.



### **EMISSIONS TESTING AS** A BASIS FOR PRODUCT LABELLING





## **ENERGY TRANSITION IN BELGIUM: COSTS & CHOICES**





#### VITO/ENERGYVILLE PUBLISHES OBJECTIVE STUDY ON FUTURE ELECTRICITY SYSTEM

Where will our electricity come from in 2020 and 2030? What role will different technologies play? And what is the cost of our electricity system's transition? EnergyVille studied the Belgian energy supply of the future.

Our nuclear power plants will close by 2025. Yet today they are still responsible for more than half of our electricity supply. Reason enough for Febeliec, the federation of industrial consumers of electricity and natural gas in Belgium, to consider how our electricity system might look like in 2020 and 2030. At their request, EnergyVille supplied an objective study.

#### More wind and solar energy

Pieter Lodewijks of EnergyVille: "Febeliec was interested in scenarios with the lowest cost to society. To calculate these, we used the TIMES model. We developed four scenarios. The central scenario shows the impact of the closure of nuclear power plants and realising the goals for renewable energy by 2020, as envisaged in the current policy. In two other scenarios, we calculated the impact of a restriction on electricity imports and variations in the future prices of fossil fuels. Finally, we developed a scenario in which the life of two nuclear power plants, accounting for 2 gigawatts of capacity, is extended."

The results of the objective study are clear. Frank Meinke-Hubeny of EnergyVille: "In each scenario, we see that renewable production triples between 2016 and 2030. The central scenario (current

policy) yields as cost-optimal result an increase of 11 to 36 terawatts by 2030. In order to achieve this, investments in land-based wind turbines in particular need to increase. Onshore wind power needs to grow by 470 megawatts (MW) each year, which is equivalent to the installation of more than 150 wind turbines of 3 MW. Today this is happening at a slower rate, with a maximum of 200 MW in Belgium in 2010. For solar panels, each year 330 MW of new capacity would need to be installed. This is feasible given current developments in price and profitability."

#### Investments unavoidable

"All scenarios require significant investments in our electricity production," says Frank Meinke-Hubeny. "Investments are inevitable as nuclear plants close. Whichever scenario we choose, annual investment costs are between 1.8 and 1.95 billion euros. The final annual cost, including expenditure for the import of

electricity and fossil fuels, could rise from 4.8 to 6.3 billion euros, depending on the scenario."

Peter Claes of Febeliec: "The report shows that it will be a very costly transition and that making the right choices will be crucial for the future of Belgian industry. The study shows that in addition to the current policy choices, other scenarios are possible that could significantly reduce the cost of electricity compared with a continuation of current policy. Therefore we are asking the government to enter into a constructive dialogue on alternative options." Febeliec too is appealing to policy-makers. The federation is asking for a clear choice for more free market processes and a coherent policy that allows reliable and competitive electricity production.

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#### TIMES MODEL PROVIDES INSIGHT INTO ENERGY SYSTEM OF THE FUTURE

EnergyVille used the internationally applied TIMES model for this study. This model links technological and ecocost-efficient future scenarios for the ment of the model.

entire energy system. VITO/EnergyVille has been the Belgian representative for TIMES for more than 20 years and nomic parameters in order to calculate actively contributes to the develop-



VITO supports companies and encourages the transition to a sustainable society.

#### **TECH TRANSFER**

"I have an idea"

**SUCCESS STORIES** 









SUCCESS STORIES



VITOFOAM CUBERT

#### **SERVICES FOR SMES**

"I need some help"

Beneens



ZERO EMISSION YACHT

76

**SMES** 

IN 2016

**SUPPORTED** 



#### **CO-CREATION PROJECTS**

"Let's work together"



**SENSOR NETWORKS & AIR QUALITY** 

**ORGANIC STREAMS** LOOKED AT DIFFERENTLY

INTELLIGENT **WATER NETWORKS** 





**FREELY** 

### "Can I use your IP?"

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DATABASE **FOR PROTECTED** SUSTAINABLE **INNOVATIONS** 

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**VITO ONE OF BELGIUM'S TOP 10 PATENT FILERS IN 2016** 



**MEMBER COMPANIES** 



INTERNATIONALISATION **OF FLEMISH CLEANTECH COMPANIES** 

**FCA AWARDS WINNERS** 2016









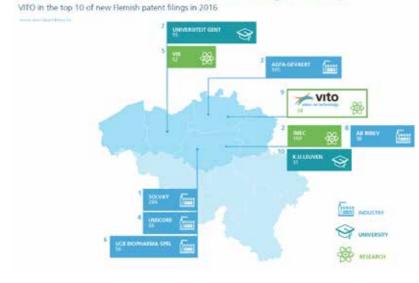
## KNOWLEDGE **VALORISATION AT VITO**

#### VITO BACK AMONG THE TOP 10 BELGIAN PATENT **APPLICANTS!**

Being in the top 10 is quite an achievement. And in 2016 we did proof of the important position VITO occupies in the Belgian innovation landscape. Technological research is

only really relevant if it is used in an innovative product or an innovative even better than in 2015. Which is service for the benefit of industry and society. Which is why it is important to protect our innovations.

#### Top 10 Flemish companies with patent filings for Europe



#### FOUNDING OF IP ACADEMY

the market, VITO set up the VITO IP academy. The goal: maximum valorisation of the intellectual property portfolio by screening existing research, developing business cases

To implement more research in around IP technologies, and supporting implementation. Thus, many research projects could lead to even more added value and jobs in industry and society.

### PLASMA TECHNOL-**OGY FINDS ITS WAY** TO THE MARKET

VITO has been conducting research into plasma technology since the 1990s. In the first quarter of 2017, VITO completed an important technology transfer to its spin-off APEMCO (Atmospheric Plasma Equipment Manufacturing Company).

After the Laser Cladding Venture in 2015, VITO is again bringing its expertise to the market after the research phase is completed. The technology surrounding atmospheric plasma offers numerous advantages for various industries: it allows the sustainable application of functional coatings. There are many applications known in the plastics and textile industries: from water-repellent surfaces to improved adhesion of largely incompatible materials. APEMCO is responsible for commercialising plasma technology, which can add value to many products that require a surface treatment. Together with VITO's long-standing partner AFS/Softal, APEMCO will build and support equipment to allow true industrial implementation of this technology.

VITO remains active in the research and development of practical industrial applications of atmospheric plasma.





# SATELLITES AND DRONES REVEAL THE WORLD IN IMAGES

#### CHANGE DETECTION SHOWS CHANGES IN ENTIRE ECOSYSTEM

Each day, satellites, drones and cameras on aircraft, cars and boats present an accurate image of the world. VITO processes and analyses these images to determine how our environment is evolving and changing.

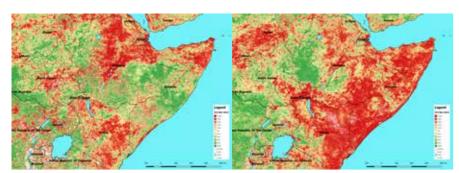
VITO performs these analyses for various customers. One of which is Information Flanders (formerly the Agency for Geographic Information Flanders, AGIV), which was commissioned by the Flemish government to maintain the Large-scale Reference Database (LRD). This database contains geographic information on buildings, lots, roads, waterways and railways. VITO analyses the raw images for Information Flanders.

Jan Biesemans: "Detecting changes in civil infrastructure is an important task. But the incoming images also provide information on the entire ecosystem over time. So based on images, pronouncements can be made on global

and regional trends in vegetation, water quality and forest development. You can also visualise the exact condition of agricultural land and predict possible famine in specific areas. And closer to home, drones are now also being used to detect damage to all types of infrastructure: windmills, facades, bridges ..."

#### **Accurate up to 1 centimetre**

Detecting all of these changes requires various types of images. Jan Biesemans: "Some analyses require more precise data than others. Which is why we are increasingly combining images from different campaigns. Satellites such as SPOT-Vegetation and the Belgian mission PROBA-V chart the world daily. These images have at best a resolution of 100 metres. The images of the European Copernicus programme with the Sentinel satellites not only can view the Earth, they can also zoom in on regions with a resolution of 10 metres. In addition



Vegetation Condition Index over the Horn of Africa at the end of the growing season: left: November 2015, right: November 2016. On 14 March 2017, the 12-12 Consortium in Belgium launched a national call for organising aid. Remote sensing is an accurate and independent source of information about our environment and serves as an ideal quantitative early warning system.

to satellite programmes, many countries and regions are conducting aerial image campaigns. This already allows the creation of images with an accuracy down to 5 centimetres. These can be combined with images made from drones, cars or boats that have an even higher resolution, enabling a much more precise visualisation of the terrain."

#### Open data

The influx of images is huge thanks to the many satellites and aerial image campaigns. Processing these is a major technological challenge. For this reason, VITO Remote Sensing developed the Mission Exploitation Platform (MEP). Jan Biesemans: "MEP is actually a dynamically scalable cluster of computers that can simultaneously perform multiple analyses and that can be deployed locally (at VITO) or in the public cloud. Each researcher can make use of the computing power of MEP. Thus you no longer need to download the data locally, but can work on a cloud platform where the images are already archived."

"Open data is the future. The trend of making data and images freely available is becoming ever more apparent. This is a big advantage, since this also gives us easier access to images. This development is also accelerating research. And the use of the images continues to grow."

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# SMALL CREATURES WITH LARGE POTENTIAL



#### INSECTS RECYCLE WASTE STREAMS AND PRODUCE RAW MATERIALS

What role can insects play in turning society more sustainable? VITO is using its expertise to valorise the potential of insects as high-grade raw material or for waste processing.

Insects have a special characteristic: put them on a mountain of organic waste and they process the waste into their own body mass. If you can separate this mass of insects into proteins, fats and chitin, you again have high quality raw materials, with useful applications in animal feed, chemistry, the agro-industry and cosmetics. Leen Bastiaens: "Insects have two major advantages: they recycle waste and they produce raw materials. Moreover, raising insects is very environmentally friendly. After all, they have low CO<sub>2</sub> emissions, do not take up much space and consume little water. Reasons enough for VITO to more thoroughly investigate the potential of these little creatures "

## From mass of insects to high quality raw materials

In the CHITINSECT project that ended in 2016, VITO together with Catalisti (formerly FISCH: Flanders Innovation Hub for Sustainable CHemistry) investigated how to obtain high-quality components from the black soldier fly. The emphasis was on chitin, a biopolymer based on glucosamine that is found in the exoskeleton of insects. Leen Bastiaens: "The biorefining process that we are testing today in the InDIRECT project builds on this expertise. With InDIRECT, we are searching for a solution for very diverse waste streams. Insects convert organic waste



of different compositions into a homogeneous biomass. The second step is to fractionate these insects into proteins, fats, and chitin. Finally, we are exploring the potential of these fractions for use in marketable end products. This surely must be possible over time. We are also developing a process in which the proteins remain functional. Mild process conditions ensure that the proteins retain among other things certain anti-microbial properties, which allows them to replace, for example, antibiotics that are widely used in animal feed. But chitin and fats from insects also have great market potential."

#### **Insect Pilot Plant**

Maarten Uyttebroek: "In the recently approved European Regional Development Fund (ERDF) project 'Insect Pilot Plant', VITO is working with partners KU Leuven and Thomas More University College to build a pilot plant for the cultivation, harvest and biorefining

of insects. The plant is partially located at VITO in Mol, where VITO will work on the biorefining of insects. The pilot plant can process 100 kg to one tonne of insects per day into high-quality raw materials."

"This scaling up is very important. We know that insects carry a lot of potential, but we must also prove this to the market. Several sectors are already looking forward to the many application areas we could serve in the future with insects."

InDIRECT: this project has received funding from the Bio-Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 720715.

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#### What is your position at VITO?

"I have been working at VITO since 2012 as a researcher for the Sustainable Materials Management unit, in particular in the waste and recycling technologies team. We conduct research into the recycling potential of mineral waste streams. First we see what valuable elements can be obtained from these streams, then we look for outlets for the remaining matrix elements. I am also active in Young VITO, an internal group that organises activities to bring colleagues together. This is how I got to know YEAR. When the previous board member of VITO ended her assignment at YEAR, I was happy to take her place."

#### What exactly does YEAR do?

"YEAR is an organisation that focuses on young researchers across Europe. Our work concerns four pillars: net-

working, training, mobility and representation of young researchers. Research is increasingly conducted in an international context and it is not easy, especially for young researchers, to build up a network outside their own organisation. However, soon they will be required to obtain and lead projects themselves. Which is why we organise activities in which young researchers can meet one another. We also give them training in specific skills such as presentation techniques. And we focus on greater exchange between different research organisations. Finally, we regularly organise surveys on a particular topic. This allows us to formulate a common position that we then convey to policy-makers. For example, we assisted to initiate the Declaration of Young Researchers, which lists the needs and motivations of young researchers."

#### Which YEAR activity are you most looking forward to?

"Our annual conference will take place on 12 and 13 June 2017. This year we will be meeting in Brussels, with VITO as co-organiser. The theme is the development of an idea into a possible project. It will be an interactive conference: ideas will be developed in smaller groups, with the help of professional guidance and training. At the end, an award will be presented for the best-developed idea. We of course hope that many young researchers will participate. After all, it is an ideal moment to meet many people in a pleasant atmosphere."

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# **GREEN POWER FOR DEVELOPING COUNTRIES**





#### TIGER POWER DEVELOPS TECHNOLOGIES FOR PRODUCTION AND STORAGE OF GREEN ENERGY

Today 1.2 billion people worldwide have no access to electricity. Moreover, in remote locations, temporary offices and disaster areas often use polluting diesel generators. The Flemish SME Tiger Power, in cooperation with VITO/EnergyVille, therefore developed innovative technologies for the production and storage of green energy.

Tiger Power founder Chris Prengels discovered a market in India for renewable power supplies that function independently of the grid. As many as 250 million people in India have no access to electricity. In response, Tiger Power developed two technologies: the Sunfold® and the Storager®.

#### Surplus of sun

Chris Prengels: "The now patented Sunfold® runs on solar energy. It is easy to move and install, and is capable of producing 11 to 27 kilowatt hours of green energy daily. The energy is used immediately or stored in a battery. But because the system could be used in places without a grid, it must be able to deliver electricity continuously: even when there is little sun and the battery is low. Which is why we developed the Storager®. The Storager® is able to store 300 kilowatt hours of green energy in the form of hydrogen. When there is a surplus of solar energy that exceeds the system's battery capacity, hydrogen is produced by electrolysis. A fuel cell can convert the hydrogen back into electricity at a later time. The two systems

can be combined and thus serve as a small power plant that supplies green energy day and night, year round."

#### **Energy supply and demand in** balance

The Tiger Power technologies use smart software to maintain a balance between energy supply and demand. For this, the SME worked with VITO/ Energyville. Peter Coenen of Energy-Ville: "The aim is for the system to use as much solar energy as possible: by using it directly, storing the energy in the battery or converting it into hydrogen. It is not possible to convert all the power generated into hydrogen at one time. Therefore you must ensure that part of the excess solar energy is used to produce hydrogen and the rest can recharge the battery. To this end, the various devices must interact in an optimal way and anticipate weather conditions. The system also knows the consumption pattern and takes peak periods into account. This optimisation based on mathematical algorithms was the task of EnergyVille. We developed and programmed the interfaces for the PV system, the battery, the fuel cell and the electrolysis units."

#### Green energy for Africa and India

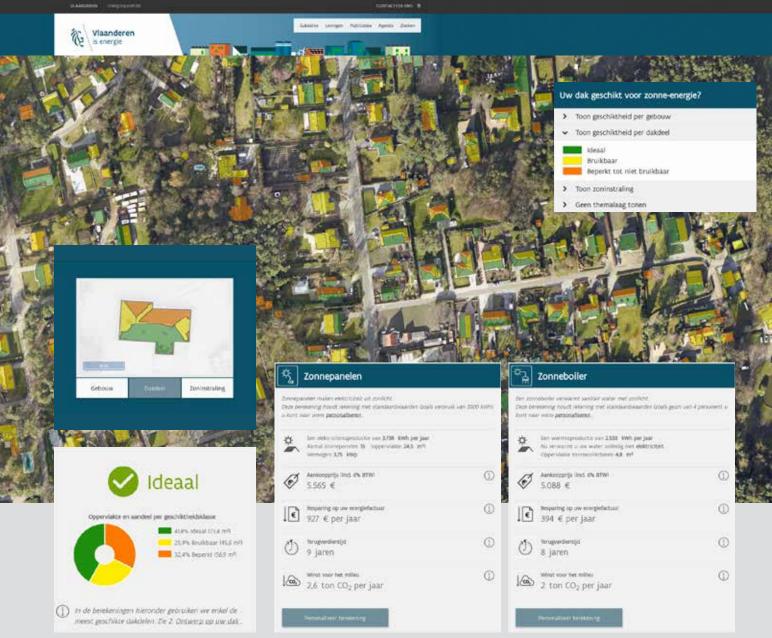
EnergyVille has extensively tested the technology in the meantime. Earlier this year, Tiger Power signed a cooperation agreement with the National Institute of Solar Energy (NISE) in India for the installation of a test setup. This will allow the SME to demonstrate that the system is reliable and therefore worth the investment. In order to build more plants in the short term, the company is talking to several international organisations including development funds. Peter Coenen: "We see many potential applications for this technology. Many people lack access to electricity, not only in India, but also in Africa. Moreover, the population density there is low, which makes the development of a grid relatively expensive. This, combined with the high number of hours of sunshine, means that green energy has a lot of potential."

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he Storager® is able to store 300 kilowatt hours of areen

© Tiger Power



Residents can use the solar map to assess whether it pays to install solar panels or a solar water heater. Each green or yellow roof is suitable. (The website is only available in Dutch. That is why the screenshots are shown here in Dutch.)

## SOLAR POTENTIAL ON FLEMISH ROOFS

Enter your address and you instantly see how suitable your roof is for solar panels or a solar water heater. That is the principle of the solar map proposed on 20 March 2017 by Flemish Minister for Energy Bart Tommelein. Residents can consult the solar map online and immediately see whether their roof is ideal (green), usable (yellow) or unsuitable (orange). For each green or yellow roof, the tool immediately calculates the cost and payback time based on average family electricity consumption (3 500 kWh/year). The annual savings on energy and CO<sub>2</sub> emissions are also shown.

In Elemish Energy Agency (VEA) developed the solar map in cooperation with VITO and Information Flanders. Jurgen Everaerts: "It was a very intensive job. Using the Large-scale Reference Database, we knew the location of all homes in Flanders. From February 2013 to March 2015 several flights were organised with laser-scanning equipment to measure the height of all buildings and other landscape features. Based on this information, together with measurements from

the Royal Meteorological Institute, we modelled the annual solar radiation for each roof."

Performing calculations on all of this information and converting it into a solar map for the whole of Flanders was partly the work of VITO Remote Sensing. Jurgen Everaerts: "It takes tremendous processing capability to generate such a map to cover all of Flanders. Moreover, it was very important to show sufficient detail. Thus, for each location we determined its exposure to sunlight down to a resolution of 25 by 25 centimetres. And guess what? There is a lot of potential in Flanders. There is enough space on all Flemish roofs for 72 gigawatts peak. This amounts to 62 billion kilowatt hours of solar power, while all Flemish households together consume only 11 billion kilowatt hours per year."

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