Energy Ville

ANNUAL REPORT 2025

Walter Eevers, Chair of the Board (left) and Bram De Wispelaere, General Manager of EnergyVille (right)

Preface

The energy transition is not some distant future. It is one of the major societal challenges of today. It will not happen on its own. We need to push and accelerate it. This lies at the heart of EnergyVille's mission: to generate knowledge, develop technology, and foster collaboration to enable that acceleration, in a focused, evidence-based, and impactful way.

The energy crisis and the war in Ukraine have demonstrated all too clearly how Europe's dependence on fossil fuels makes it vulnerable. Energy policy today is about geopolitical independence, security of supply, affordability, industrial competitiveness, societal resilience, and of course climate. The challenges have become more complex and more urgent than ever.

At EnergyVille, we work on solutions that can make a real difference. Electrification, new molecules, building renovation, stronger grids, more connection capacity, and congestion solutions are not separate topics. Together, they form the building blocks of an energy system that is cleaner, stronger and more resilient. One that makes smart use of local resources, embraces circularity, and safeguards affordability, while also supporting the competitiveness of European industry.

Our strength lies not only in technology itself, but also in our ability to look at the energy system as a whole. What impact do new technologies have on the energy mix? What does greater flexibility mean for the market? How do policy choices affect security of supply? Which solutions work not only in the lab, but also in the field: in companies, neighbourhoods, buildings, and on the grid? These are the questions we ask every day, and we connect them to concrete projects, partnerships, and spin-offs that help bring innovation from research into real-world deployment.

More than 700 people from all over the world work together at EnergyVille: bright minds, women and men, young researchers and experienced experts. They do so within a structural and focused partnership between KU Leuven, VITO, imec, and UHasselt. That collaboration brings together fundamental research, applied research, test infrastructure, industrial cooperation, and policy support. This integrated approach is one of EnergyVille's key strengths and underpins our international standing. We take part in numerous European projects and are active in international networks and organisations. In several domains, our researchers and research groups rank among the very best. Their work is recognised and applied internationally. That is something to be proud of. It confirms that the knowledge built here in Flanders is applied far beyond our region.

This annual report shows where EnergyVille is making a difference today: in research, in test environments, in collaboration with companies, and in support for policy. It shows how knowledge is translated into concrete solutions for electrification, new molecules, building renovation, grid reinforcement and congestion. Together, all these projects serve one shared purpose: preparing the energy system of tomorrow more quickly and more effectively.

It is a major task, and one that makes EnergyVille's work even more relevant. Every breakthrough, every test environment, every partnership and every application brings us closer to an energy system that is stronger, less dependent and ready for the future. That is the responsibility we take on, and the reason why we look ahead with confidence.

Bram De Wispelaere
General Manager of EnergyVille

Walter Eevers
Chair of the Board

Executive summary

The energy transition requires technological innovation, industrial application, policy direction and solutions that work in everyday life. In 2025, EnergyVille worked with 62 companies, alongside governments, knowledge institutions and societal partners, to help make that happen. This annual report follows that movement step by step: from new solutions and the people behind them to impact in practice, policy guidance, and concrete applications for citizens, companies and public authorities. This executive summary doubles as a table of contents and provides a clear overview of the key stories of 2025.

Mission and context

Ambition alone will not deliver the energy transition. In the preface, you can read how EnergyVille combines top research, intense collaboration and a broad systems perspective to help build a stronger, more sustainable and independent energy system of the future. The introduction to the research lines shows the breadth of EnergyVille's work today, from materials and components to systems, policy and real-world applications. P.4

New solutions

This chapter highlights the technological progress made in 2025. It shows how EnergyVille continued to advance solar cell technologies, smart batteries, thermal networks, power electronics, sustainable chemistry and other solutions that could help shape tomorrow's energy system.

Perovskite technology moves closer to commercialisation, with strong module-level results and growing industrial relevance. P.14

ABCDE explores a new generation of autonomous battery cells with built-in intelligence and a digital cell battery passport. P.18

CollecThor continues to develop as a modular fifth-generation thermal network for sustainable heat and cooling exchange. P.20

Power electronics is the quiet engine of the energy transition, essential to smart and efficient energy systems. P.22

AgriPV explores how farming and solar energy can be combined more effectively. P.26

FOTON and its pilot project show how new photovoltaic solutions are moving closer to real-world application. P.27

MiniChem Plant helps companies assess more quickly which sustainable chemical processes hold the greatest potential. P.33

The people of EnergyVille

Behind every research result are people and collaborations. In these portraits, you meet researchers who came to Limburg from different countries, disciplines and professional backgrounds, and who are now helping drive the energy transition forward. Their stories show what set EnergyVille apart as an international place to work and do research.

- **Gizem Birant** is helping to develop the next generation of solar cells and tandem photovoltaic applications in Genk. - **P.31**
- **Amauri Martins Britto** develops open-source tools to simulate the behaviour of underground power cables. - **P.32**
- **Yami Chuang** works on more sustainable chemistry through power-to-molecules and the development of MiniChem Plant. - **P.33**
- **Guillermo Borragán Pedraz** studies how behaviour and policy help determine whether the energy transition works for people. - **P.34**

From innovation to impact

This chapter looks at how research moves towards demonstration, validation and application. New infrastructure, industrial collaboration and practice-oriented projects highlight how EnergyVille helps technologies find their way into the real world.

- **Etch** launches its industrial partnership programme around transmission grids, underground cables, and HVDC technology. - **P.38**
- **Heat exchangers** become more efficient through advanced design, simulation, and new production techniques. - **Pag.42**
- **Battery safety** gains a unique test environment in collaboration with PLOT Limburg and Fire Brigade Zone East Limburg. - **P.44**
- **Spin-off Orion Grid Technologies** shows how digital tools can make the electricity grid smarter and more robust. - **P.46**
- **GALILEO** maps the practical barriers and opportunities for smarter, more flexible energy use in industry. - **P.48**
- **In2PV** connects research with applications in integrated solar energy. - **P.50**
- **The spin-offs Pleevi** and **Builtwins** show how digital tools and building data can contribute to smarter buildings. - **P.52**
- The **STORM** pilot in Switzerland shows how software can unlock hidden flexibility in thermal networks. - **P.53**
- The **UHasselt electrolysis installatio**n strengthens research on hydrogen and sustainable molecules. - **P.54**

Providing direction for policy

EnergyVille helps policymakers, industry, and grid operators make sense of complex energy choices. This chapter highlights how system studies, scenarios and analyses provided direction for strategic decisions in 2025.

- **PATHS2050** presents three scenarios for a climate-neutral Belgian energy system by 2050. - **P.58**
- The **Einstein Telescope** study explores how this extremely sensitive infrastructure can be powered sustainably. - **P.62**
- **ALEXANDER** looks at flexibility, low-voltage grids, and the impact of new market mechanisms on users and networks. - **P.65**
- **SWiM** explores how solar and wind energy can be developed together in the North Sea. - **P.66**

Rewind / fast forward

This chapter looks back at a selection of moments in 2025 when EnergyVille brought together research, industry, education and society. These milestones highlight both the breadth of our work and the diverse communities it reaches. - **P.67**

The energy transition in daily life

The energy transition does not just happen in labs and industrial sites. It also takes shape in homes, neighbourhoods, and the everyday choices people make. This chapter looks at how EnergyVille works on practical, understandable solutions for households, districts, and local authorities.

- **EU-DREAM** explores how digital tools and AI can support active end users. - **P.72**
- **oPEN Lab Nieuw Texas** completes an important renovation and participation trajectory, and is now ready for its next phase as a living lab. - **P.74**
- Our **neighbourhood renovation tool** helps plan and support district-level renovation. - **P.76**
- Our study on **carbon-free residential heating** explores realistic pathways away from fossil-fuel heating systems. - **P.77**

Benchmarking and outlook

The final chapter looks back and ahead. An external benchmarking study, completed in 2025, confirmed EnergyVille's strong European position in project acquisition and patent activity. It also showed that the collaboration has built enough critical mass to compete with Europe's leading energy R&D organisations. - **P.78**

Taken together, the achievements of 2025 show an organisation that is firmly rooted in Flanders, strongly connected to Europe, and increasingly capable of translating research into policy direction, application, and impact.

The eight EnergyVille research lines continuously reinforce one another. Together, they show how technology, systems, markets and users are inseparably linked in the energy transition.

Solar energy

Solar energy is one of the key building blocks of a climate-neutral energy system. EnergyVille works on the next generations of solar cells, solar panels, and integrated applications, with a focus on performance, reliability, circularity, and new ways of using solar power. This research line focuses not only on the technology itself, but also on how solar energy can be smartly integrated into buildings, agriculture, and industry.

Power-to-Molecules

Not every sector can electrify directly. That is why EnergyVille explores how renewable electricity can be converted into molecules such as hydrogen and other sustainable resources for industry and energy storage. This research line combines materials, electrochemistry, system analysis and scale-up, creating an important bridge between renewable energy and the chemistry of the future.

Thermal systems

Heat and cold are just as crucial to the energy transition. EnergyVille studies how they can be generated, shared, stored, and controlled more intelligently in buildings, thermal networks and industrial applications. This research line brings together technology, system thinking, and real-world practice, helping make our energy system more sustainable and efficient from a thermal point of view as well.

Battery storage

Batteries play a key role in an energy system with large shares of solar and wind power. EnergyVille studies how batteries can perform better, while becoming safer, more affordable and more sustainable. This ranges from new materials and cell designs to testing, modelling and battery safety.

Battery storage helps make energy available at the right moment, at home, at work, and on the grid.

Electricity grids

The energy transition requires electricity grids that can handle more, are managed more intelligently and operate with greater flexibility. EnergyVille works on the grids of the future: from high-voltage connections and underground cable systems to digital tools for planning, operation, and flexibility.

This research line connects generation, storage and consumption.

Energy strategies and markets

Technology alone is not enough. The transition also requires well-informed choices about policy, investment, and market design. EnergyVille develops models and scenarios that help assess how to make our energy system affordable, reliable, and climate-neutral.
This research line connects technological knowledge with economic and societal insights, helping companies and policymakers make long-term decisions.

Power electronics

Power electronics control and convert electricity where it is needed: in solar panels, charging infrastructure, batteries, heat pumps and electric vehicles. Often invisible, but indispensable. EnergyVille develops more efficient, more compact and smarter electronic systems that reduce energy losses and enable new applications. In that sense, this research line is a quiet but essential engine of the energy transition.

Buildings & districts

Buildings consume a great deal of energy, but they also offer major opportunities to use that energy more intelligently. EnergyVille studies how homes, neighbourhoods, and urban environments can become more energy-efficient, flexible, and sustainable. This includes renovation, smart control, collective energy systems, and charging solutions. This research line shows how the energy transition becomes visible in the places where we live every day.

New solutions

Will solar cells soon be made of perovskite?

Perovskite solar cells have long been considered one of the most promising innovations in solar energy. They offer the prospect of lower production costs, higher efficiencies, and more flexible applications. At EnergyVille, researchers are working to overcome the technical limitations that still stand in the way of large-scale commercialisation.

Solar energy | UHasselt | imec

Aslihan Babayigit, EnergyVille/UHasselt/imec

What gives perovskite its promise is also what makes it difficult to master. The material has a hybrid structure in which inorganic and organic components come together.

"It's what makes perovskite unique as a material, but also complex," says Aslihan Babayigit, researcher at EnergyVille/UHasselt. "You do not just have electron transport. You also have ions moving through the material. So the system is constantly in motion, especially under the influence of light and temperature."

Where conventional silicon cells behave in a relatively stable way, perovskites respond much more dynamically to their environment. That shows up in fluctuating performance and faster degradation.

"Perovskite cells perform very well at first, but they degrade under heat, moisture, oxygen, and UV light. That means they are currently not reliable enough for long-term use in solar cells."

At EnergyVille, that challenge is being tackled across the full value chain, from fundamental materials research to the development of working solar cells and modules.

From material to module and back again

Babayigit and her colleagues focus on the fundamental properties of the material, down to the nanoscale. In 2025, that approach led to an important breakthrough. The team investigated the interfaces between the different layers in a perovskite solar cell, zones that are crucial for both performance and degradation.

"A perovskite cell consists of several ultra-thin layers, each with a specific function," Babayigit explains. "It is often at the interfaces between those layers that defects or chemical changes arise that undermine stability. In other words, those interfaces are often the weakest links, but they are also very difficult to analyse."

The team used advanced techniques such as TOF-SIMS, which enables mapping the chemical composition layer by layer. In doing so, they ran into a fundamental problem.

"We saw that the measurement method itself can disturb the material," Babayigit says. "The ion beam used for analysis can damage the interfaces, so you end up measuring artefacts rather than the material's true behaviour."

The team systematically documented those effects and developed an adapted measurement approach and protocol to avoid them.

"In a field that is evolving this quickly, reproducibility

Perovskite research at EnergyVille

At EnergyVille, perovskite technology is being studied across the full innovation chain:

- Fundamental insight into material behaviour and stability, including research into degradation mechanisms and long-term reliability.
- Development and optimisation of perovskite solar cells and modules: in 2025, a 28 x 28 cm² module achieved an efficiency of 20%, a world-leading result at that scale.
- In collaboration with Soltech, a first tandem module was developed, combining a perovskite top cell with a silicon cell. This demonstrator reached an efficiency of around 28% and shows the industrial potential of tandem technology.

Together, these research lines are bringing the commercialisation of perovskite technology a step closer.

"This is the kind of research you cannot do within a single discipline," says Babayigit. "You need to understand what is happening at the nanoscale and be able to test it in real solar cells."

Aslihan Babayigit, EnergyVille/UHasselt/imec

is essential," she says. "If you are not sure what you are measuring, you keep building on the wrong assumptions."

Uncovering a weak link

With their improved method, the team could identify an important degradation mechanism.

"An interlayer that is often used today to boost efficiency turns out to detach under operational stress," says Babayigit. "That means it is not stable in the long run, even if its initial performance is very good."

That insight has direct implications for the further development of perovskite technology. "It means we need to rethink certain design choices," she says. "But it also gives us a clear direction: we now know where we need to intervene."

At EnergyVille, that kind of insight can immediately be translated into practical advances. Fundamental materials research and the development of actual solar cells run in parallel.

Sustainable solar cells

Alongside stability, sustainability is another important issue when it comes to perovskite. Today's highest-performing materials still contain lead, which raises questions about toxicity.

"That is definitely something we are mindful of," says Babayigit. "But it is important to look at it in context. The quantities of lead are relatively limited and comparable to other applications, and there is a lot of work going into alternatives and better encapsulation to prevent leakage."

That is why research at EnergyVille focuses not only on stability, but also on lead-free materials and safe integration into modules.

"This is the kind of research you cannot do within a single discipline," says Babayigit. "You need to understand what is happening at the nanoscale and be able to test it in real solar cells."

Moving closer to commercialisation

Conventional silicon solar cells are approaching their physical limit, with efficiencies of up to around 27% at cell level.

Perovskites can break through that ceiling, especially when they are combined with silicon in so-called tandem cells. In those devices, different layers absorb different parts of the solar spectrum. Perovskites are especially flexible in this respect, because their chemical composition can be tuned to absorb specific wavelengths. That makes it possible to use sunlight more efficiently than with a single material alone.

"With that combination, we can reach efficiencies beyond what is possible today with silicon alone," says Babayigit.

That brings the path to commercialisation another step closer.

Francqui appointment

In 2025, Bart Vermang (EnergyVille/imec/UHasselt) was appointed Francqui Research Professor. Over the next three years, this appointment will support targeted research on topics including social acceptance of the energy transition, solar energy for the Einstein Telescope, and the development of next-generation thin-film and tandem solar cells.

An autonomous battery cell

EnergyVille researchers are working on a new generation of smart, autonomous battery cells. By integrating advanced electronics and built-in intelligence directly into individual cells, batteries can gain real-time insight, self-management, and early fault detection. As a result, battery systems will be safer, more sustainable and more durable.

Battery storage

imec **UHasselt** **VITO**

Today, batteries are mainly managed at battery-pack level. Conventional Battery Management Systems monitor voltage, temperature, and state of charge, but often miss the fine detail of what is happening inside each cell individually, for example in terms of performance, ageing, or early defects.

With ABCDE *(Advanced Battery Cells with Disruptive Electronics)*, a project supported by VLAIO and Flux50, EnergyVille researchers aim to address this issue. The project focuses on developing battery cells with built-in sensors, electronics and intelligence. In time, those cells should be able to monitor their own temperature, voltage, and state of charge, run self-diagnostics, detect faults at an early stage and communicate wirelessly with the central control unit of the battery management system.

That opens new possibilities throughout a battery's lifetime. Safety issues can be detected sooner, because irregularities and defects become visible earlier. Batteries can also last longer, because their condition can be monitored more accurately. And when batteries are replaced or taken out of service, it becomes easier to assess which cells are still suitable for reuse and which should be recycled instead.

Beyond the technological challenge, the project also has the explicit ambition to strengthen the Flemish and European battery value chain, at a time when safety, lifetime, transparency, and circularity are becoming increasingly important.

Why does battery management matter?

A battery pack consists of multiple individual cells, together with electronics, sensors, cooling and a Battery Management System that monitors and controls the whole system. Today, that management system tracks parameters such as temperature, voltage, and state of charge, and ensures that the battery can be charged and discharged safely.

EnergyVille wants to rethink that approach by developing autonomous, sensor-integrated battery cells. By collecting and processing data in real-time, directly at the cell level, batteries can be made safer and their lifetime can be extended.

"Advances in technology allow us to develop a digital cell battery passport, in which performance, health, and lifecycle data are systematically recorded. That creates greater transparency across the full lifetime of a battery."

Jeroen Büscher, EnergyVille/VITO

CollecThor brings circular heating and cooling to life

Since February 2025, one of Belgium's first fifth-generation heating and cooling networks has been operational at Thor Park in Genk. CollecThor connects buildings so that heat and cold can be exchanged, stored, and reused. At the same time, it serves as a unique real-life test environment for sustainable thermal energy solutions.

VITO **Thermal systems**

Heating and cooling may receive less attention than electricity, but they are equally critical to the energy transition. CollecThor responds to that challenge with an innovative thermal network at Thor Park that became operational in February 2025.

CollecThor stands out because it operates as a very low-temperature, fifth-generation thermal network. Instead of heating or cooling each building separately, energy is shared collectively and managed intelligently across the site. Waste heat from one building can be used to meet demand elsewhere, while surplus heat or cooling can be stored underground in aquifers for later reuse.

The network is also modular by design, which means it can expand as new buildings and applications are added. At the same time, it is part of a broader multi-energy system in which thermal and electrical energy flows are planned and managed together.

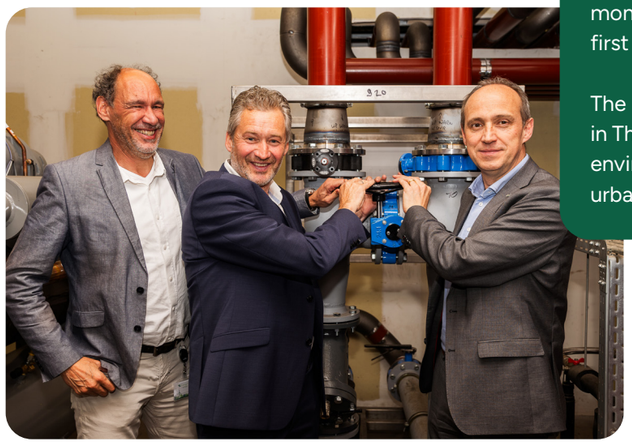
What is a fifth-generation thermal network?

A fifth-generation thermal network operates at very low temperatures and is designed not only for heating, but also for cooling, storage, and exchange between buildings. Instead of distributing energy from a single central source, it allows heat and cooling to circulate within a local system. That makes these networks flexible, efficient, and particularly well-suited to urban environments.

Official inauguration

In May 2025, CollecThor was officially inaugurated at Thor Park in the presence of the mayor of Genk Wim Dries and project partners Fluvius and Tethys. A symbolic moment, exactly 101 years after coal mining first started on this historic site.

The inauguration marked another milestone in Thor Park's transformation into a living test environment for sustainable energy in an urban setting.



Bert Gysen, EnergyVille/VITO - Filip Vercauteren - Wim Dries, Mayor of Genk

"With CollecThor, we are taking a major step towards CO_2 neutrality, while at the same time creating a competitive advantage for the companies on our site."

Filip Vercauteren, director of Thor Park

“Power electronics sits at every junction in the energy system”

When people think about the energy transition, they tend to picture wind turbines, solar panels or electric vehicles. What often remains out of sight, despite its importance, is power electronics. Wilmar Martinez (EnergyVille/KU Leuven) calls it “the quiet engine of the energy transition.”

KU Leuven | Power electronics

“To explain what power electronics is, I usually start with something familiar,” says Wilmar. “Think of your laptop charger or phone charger. Tools we use every day. What these chargers do is convert electricity from the socket into what your device can use. That is essentially what we focus on within the power electronics research line: develop ways of converting energy as efficiently as possible.”

That conversion may seem obvious, but it is anything but simple. Conventional chargers are often bulky, and they warm up quickly. “That heat is really lost energy,” Wilmar says. “You are paying for electricity that never reaches your device. Our challenge is to continually improve this and to convert energy with technology that is smaller, more efficient, more reliable and, of course, more sustainable.”

Wilmar Martinez, EnergyVille/KU Leuven

“In 2025, we made important progress. We succeeded in making converters more compact, reducing losses and increasing reliability.”

Wilmar Martinez, EnergyVille/KU Leuven

A key technology in the background

“Without power electronics, many technologies simply would not work,” says Wilmar. “Take a solar panel: it produces direct current, while the electricity grid runs on alternating current. Without an inverter, a power electronics device, you cannot use that energy or feed it into the grid.”

The same is true for electric vehicles. There, power electronics does more than convert energy between the battery and the motor. It also controls how the whole system behaves, from how fast the vehicle drives to how much power goes to the wheels, and how energy is recovered during braking.

“In fact, power electronics sits at every junction in the energy system: between generation and the grid, between the grid and the user, and between storage and use. It is the technology that connects and controls all those different forms of energy.”
And its importance has only grown over time. Where the energy system used to be relatively straightforward, it has now become far more complex, Wilmar explains: “In the past, electricity was generated in large power plants, often close to users and based on coal, gas or hydropower. These were essentially mechanical systems producing electricity and sending it directly to the consumer. Everything was built around one type of current

More compact thanks to planar magnetics

Coils and transformers largely determine the size and weight of power electronics. Traditionally, these are bulky parts made from copper and magnetic materials.

In 2025, EnergyVille worked on innovative designs such as planar magnetics, where windings are integrated into printed circuit boards. Combined with new materials and optimisation techniques, this leads to more compact designs, better heat dissipation, and higher power density.

and one direction of energy flow, over relatively short distances."

Today, the situation is very different. "We have moved to a system with solar panels, batteries, electric vehicles, and decentralised energy generation," he says. "That means much more energy conversion is needed, and therefore much better power electronics."

Smaller, more efficient, more sustainable

For Wilmar, the direction is clear. "If we want the energy transition to succeed, we need to keep improving efficiency and scalability," he says. "Power electronics will only become more important."

At EnergyVille, the focus is on improving that technology to achieve higher efficiency, smaller systems, longer lifetime, and lower climate impact. "In 2025, we made important progress," says Wilmar. "We succeeded in making converters more compact, reducing losses and increasing reliability."

According to him, EnergyVille itself is an important catalyst for that progress. "The big advantage is that all the expertise is brought together in one place," he says. "I sit next to people working on batteries, solar panels, or energy systems. That close proximity helps ideas move much faster."

Such collaboration also translates into concrete projects with industry and international partners.

Less energy loss, less heat

One of the central challenges in power electronics is reducing energy losses during conversion. Those losses usually appear as heat, which then must be removed.

In 2025, further work focused on efficient converter topologies such as the Dual Active Bridge (DAB), combined with GaN (gallium nitride) semiconductors. These allow higher switching frequencies with lower losses, making systems more efficient, more compact and cooler in operation.

"We work with players in the energy and automotive sectors, and more recently we have also started new projects around data centres and solar energy."

From underground telescopes to space

The applications of power electronics reach far beyond consumer electronics. Today, Wilmar and his team are involved in projects that stretch from deep underground to far into space.

On one side, the team contributes to the Einstein Telescope, a future gravitational-wave observatory deep underground. "That installation is extremely sensitive," says Wilmar. "That means the power supply must also be extremely precise. We design how energy gets from the grid to the system: how many conversion steps are needed, how to build in redundancy, and how to guarantee stability."

At the other end of the spectrum, the team is working with the European Space Agency (ESA). "We are developing power electronics for space applications, such as launch systems and future missions to Mars."

"It may not be the most visible technology," Wilmar says, "but without power electronics, many of today's energy technologies simply would not work. That is what makes this field so fascinating: you are working with the same fundamental technology whether it is for a phone charger, a data centre, a telescope or a rocket."

Harvesting crops and generating electricity on the same land

How can food production and solar energy be combined on the same land, without one displacing the other? That question lies at the heart of agrivoltaics research. In 2025, EnergyVille researchers continued to develop integrated systems for dual land use, tailored to the operational and economic realities of farming and designed to deliver both affordable energy and additional crop protection.

Solar energy

KU Leuven

The focus is on standardised, cost-effective systems, with adapted photovoltaic modules, mounting structures, tracking algorithms, and suitable maintenance practices. Researchers pay close attention to the amount and distribution of light beneath the panels, using advanced models and ray tracing to analyse how those conditions affect crop growth and yield. At the same time, they assess farm energy use and the economic feasibility of these systems.

In 2025, that research took a practical step forward with the launch of a free agrivoltaics web tool. It helps farmers, investors and policymakers better estimate the impact of an agrivoltaic system on crop yield, electricity production and financial viability. In that way, agrivoltaics is steadily moving from a promising concept to a practical solution.

Sunlight as a driver for green hydrogen and methanol

With FOTON, EnergyVille is taking the next step in linking solar energy to sustainable chemical processes. This Interreg project between Flanders and the Netherlands develops systems and materials that use water, CO_2 and sunlight to produce green hydrogen and green methanol, two building blocks that are increasingly relevant for the chemical industry and for energy storage.

Power-to-Molecules

Solar energy

UHasselt

imec

In 2025, the project continued work on three pilot-scale demonstration systems: two for green hydrogen production and one for green methanol. A key focus was the integration of advanced photovoltaic components with electrolysis, so that solar energy can be used directly in chemical processes. One example is an alkaline electrolyser equipped with nickel-based electrodes, onto which catalytically active layers such as Pt and NiOOH/NiOOH:Fe were applied to accelerate hydrogen and oxygen evolution.

A photovoltaic-integrated setup was also designed and tested for continuous outdoor hydrogen production. Since early 2026, the system has been monitored almost continuously to analyse how solar irradiation and electrochemical performance interact under realistic operating conditions. This included studying the relationship between solar input, current generation, and solar-to-hydrogen efficiency, as well as carrying out a series of optimisations, such as adjusting the electrolyte flow, replacing membranes and electrodes, and reducing losses in the electrical circuit.

The results show that the current demonstrator, with an active solar-cell area of around 300 cm^2, can produce multiple litres of hydrogen gas per day under real outdoor conditions. The system also offers clear opportunities for further scale-up through stacked configurations and larger photovoltaic surfaces.

FOTON is a tangible example of what becomes possible when solar energy, materials science, and power-to-molecules are brought together. It shows how renewable energy can do more than generate electricity. It can also provide sustainable feedstock for the industry of tomorrow.

The people of EnergyVille

EnergyVille is a unique environment where people with different backgrounds, areas of expertise and career paths come together around a shared challenge. In these four portraits, we meet researchers from across the globe who found their way to Limburg to help shape the energy transition.

Gizem Birant is building next-generation solar cells in Genk

Gizem Birant is a researcher at EnergyVille/UHasselt, working on thin-film and tandem solar cells. Her academic journey began in Turkey, where she studied physics and gained her first research experience. Eager to step outside her comfort zone and work in a more international setting, she applied for a European PhD project and arrived in Flanders in 2018. "Before I applied, I had never even heard of Hasselt," she says. "But once I got here, I quickly felt this was a place where real synergies emerge."

That multidisciplinary environment remains one of EnergyVille's great strengths for her. She is drawn to the symbolism of Thor Park, where new energy technologies are being developed on a historic mining site. "Old energy and new energy literally come together here," she adds. She also found an atmosphere that felt open, international, and supportive. After completing her PhD, she decided to stay, first as a postdoctoral researcher and now as a staff researcher.

Her work today focuses on tandem solar technology and on flexible solar cell applications. The aim is to broaden where solar can be used, including in agriculture, space, vehicles and other settings where conventional solar panels are harder to deploy.

For Gizem, 2025 was a significant year on many levels. She became a mother and, at the same time, took on a new responsibility as lead of the tandem PV research line within the Institute for Materials Research (IUMAT). "It felt like an important milestone in my career, and a real vote of confidence."

Another highlight was the international TandemPV Workshop she co-hosted with Professor Ivan Gordon. "It was special to bring together more than 200 participants and, at the same time, raise EnergyVille's international visibility.'"

Gizem Birant, EnergyVille/UHasselt

Amauri Martins Britto moved from Brazil to Genk to research power cables

Amauri Martins Britto works at EnergyVille/KU Leuven and Etch on a research topic that may sound abstract at first, but becomes highly tangible in practice: the behaviour of underground power cables. As lead developer of LineCableModels.jl, he builds computer tools that simulate complex scenarios, from short circuits and lightning strikes to disturbances that can spread through cables across a wider network. The research is grounded in mathematics and physics, but closely tied to performance, reliability and ultimately safety, both of the infrastructure itself and of the people working on or around it.

Amauri is an electrical engineer by training and moved from Brazil to Belgium nearly two years ago. By then, he had already built a strong career: from field engineer to consultant, entrepreneur and university professor. Still, he felt a growing desire to focus more deeply on research. That search eventually brought him to Genk. “For this position, we took a big step as a family,” he says. “The transition was not straightforward, but professionally I feel very strongly that this is the right place for me.”

What he values most about EnergyVille is the way different backgrounds, areas of expertise, and institutions come together. In his view, that proximity accelerates collaboration in a very natural way. “You put people together, and ideas start to emerge almost spontaneously,” he says. “I’ve never seen that before anywhere I worked.” He also appreciates how that collaboration goes beyond formal structures: sometimes it starts with a conversation in the hallway or over lunch, and then grows into something sharper and more useful.

A highlight of 2025 was, without a doubt, the launch of a stable open-source version of the cable toolbox he helped build from scratch. The software is already being used by both researchers and industry partners. “That was a real milestone for me,” Amauri says. “We made something that helps researchers move forward and is also genuinely useful in practice. What’s more satisfying than turning a highly specialised area of research into something accessible and usable for the people who need it?”

Amauri Martins Britto, EnergyVille/KU Leuven/Etch

Yami Chuang is working towards more sustainable chemistry

Yami Chuang combines two roles. At imec, she is a programme manager; within EnergyVille, she helps coordinate the Power-to-Molecules research line. In that role, she works at the intersection of materials, electrochemistry and system integration, with a focus on converting CO_2 via renewable energy into carbon-based molecules such as syngas, as well as other more sustainable chemical building blocks.

Yami grew up in Taiwan, moved to Australia to study, and later continued her academic career in Belgium. She first did a postdoc at UHasselt, then moved into industry as an R&D manager, before returning to research. Joining imec felt like a logical next step: she wanted to help develop cleaner industrial processes and technologies.

“The energy transition is too complex to be driven by one group or one technology alone,” she says. “You need to bring expertise together with industry and government.” That is what makes EnergyVille so valuable to her: the combination of complementary knowledge, years of collaboration and an ecosystem that is grounded in real industrial and policy challenges.

Yami Chuang, EnergyVille/imec

A highlight in 2025 was the further development of MiniChem Plant, an initiative designed to help companies evaluate promising technologies more quickly and with greater confidence. “Many industrial partners know they need to innovate, but often lack a clear way to test new materials, devices or system configurations before investing in them.” MiniChem Plant addresses that gap by bringing together modelling, testing and system-level analysis in one flexible platform.

“There are two ways to innovate: we can develop a technology, bring the pieces together and let companies use it in different scenarios, or we can start from a concrete condition or industrial target and ask what would actually work. That is how we can help shorten the path to application while keeping it economically viable.”

Guillermo Borragán Pedraz looks beyond technology alone

When people talk about the energy transition, the conversation often turns to technology and electrification: more heat pumps, more solar panels, cheaper batteries, and better-connected grids. Guillermo Borragán Pedraz looks at the problem from another angle, one that matters just as much: consumers. Why do they make certain choices and not others? What makes them renovate their home, save energy, or adopt a new technology? And how can policy better respond to that reality?

Guillermo studied cognitive psychology in Spain and later specialised in decision-making, modelling, and data analysis during his PhD at Université Libre de Bruxelles. Environmental questions had long been on his mind, and over time, he felt a growing need to use his expertise in a way that could contribute to a more sustainable world. At a French start-up, he worked on energy savings and demand management from the user's perspective. He found that work fascinating, but missed the world of research. Guillermo went looking for a place where science and real-world impact could go hand in hand, and found that at EnergyVille/VITO. "Here, I don't have to choose between rigorous research and societal relevance," he says. "At EnergyVille, we have the space to go deep, while staying in close contact with policymakers and civil society."

Today, his work sits at the intersection of energy use, behavioural modelling and policy. His models take into account more than costs or payback times. They also look at social influence, ingrained habits and the different motivations people bring to decisions about sustainable technology. He studies, for example, why one neighbourhood adopts solar panels faster than another, or why some families move ahead with renovation while others hesitate. The goal is to help policymakers design measures that are better aligned with the human side of the energy transition.

"At EnergyVille, we have the space to go deep, while staying in close contact with policymakers and civil society."

Guillermo Borragán Pedraz, EnergyVille/VITO

Guillermo Borragán Pedraz, EnergyVille/VITO

One of his highlights in 2025 was the team's first scientific publication built around that systems-based approach. The study showed how closely factors such as financial support, regulation, ease of implementation, and consumer engagement are connected when it comes to successful energy policy. In 2026, he is particularly looking forward to a new project that explores how policy can help people and sectors reduce overall energy use.

Outside work, Guillermo's search for sustainable choices is just as concrete. Together with his family, he is building an energy-efficient farmhouse in Limburg and creating a largely self-sufficient place, complete with a food forest and water-saving solutions. "I'm experiencing first-hand many of the things I used to only read about in the literature," he says with a smile. "In construction, you really see how important coordination is, and how quickly things slow down when everyone focuses only on their own part of the puzzle instead of the bigger picture."

From innovation to impact

“Etch brings industry and researchers together to design the transmission grid of the future”

Dirk Van Hertem discusses a unique collaboration around underground high-power transmission.

More renewable energy also means more transmission. But how do you build an electricity grid that is reliable, affordable, and socially acceptable at the same time? Through Etch, EnergyVille is looking for answers to that question together with industry and grid players. The key milestone in 2025 was the launch of the Etch Partnership Programme.

The energy transition is not only about solar panels, wind turbines, or batteries. The transmission grid needs to evolve as well. The grid will need to carry more electricity over longer distances, the system will become more complex, and underground high-power transmission is moving higher up the agenda. While this may sound like a logical sequence of events, its technical execution is far from straightforward.

“The shift towards more renewable energy and new energy flows also means we need more grid infrastructure,” says Dirk Van Hertem, Professor of Power Systems at EnergyVille/KU Leuven and Director of the Etch competence hub. “One of the big challenges in that transition is underground high-power transmission. That is why we founded Etch.”

He is careful not to tie Etch too closely to one specific project, even if one of them did provide an important trigger. “In a sense, Ventilus is part of why we exist,” he says. “That whole debate was the moment we said: we need to get to work on this—collaboratively. But to be clear, Etch is not working on Ventilus itself, and we are not going to deliver solutions within the Ventilus timeframe. Etch is a much broader initiative.”

What is Etch?

Etch, the Energy Transmission Competence Hub, is an EnergyVille initiative funded by the Flemish government and focused on the transmission grid of the future. Its main focus is high-power transmission using HVDC and underground cable systems. Etch combines research, collaboration with industry, training, and infrastructure to develop new knowledge and solutions for a sustainable, reliable and cost-efficient electricity system.

A unique collaboration

For Van Hertem, everything starts with the quality of the research.“ Relevant research starts with scientific excellence,” he says. “As a team, you need to operate at the highest international level.”
Over the past few years, EnergyVille has built strong expertise in electrical transmission networks, and particularly in HVDC (high-voltage direct current), a technology that is especially well suited for long underground connections carrying large amounts of power.

What sets Etch apart, in his view, is its focus on system integration. “We look very specifically at the system,” he says. “Our strength is not in developing a single new technology. We provide knowledge on how technologies should be used, simulated, and integrated into a reliable grid.”

That also makes the collaboration with industry different. “In some other fields, the work goes much deeper into one specific technology, and you almost become an IP supplier. Our approach is much more collaborative. We look at how different innovations, each with their own role and technical characteristics, can function together in one electricity system.”

Dirk Van Hertem, EnergyVille/KU Leuven/Etch

Etch deliberately positions itself as a market-neutral competence hub. Research institutions, technology companies, manufacturers and transmission system operators work together in a pre-competitive environment on questions that no single player can solve alone. In 2025, that system-oriented approach took concrete shape with the launch of the Etch Partnership Programme.

“You only launch something like this once,” says Van Hertem. “It was the moment to make clear what

we want to be. Not a traditional research contract, but a collaboration in which we work together with industry on the major challenges ahead."

That took time, and a fair amount of persuasion. "What we are building has several dimensions," he says. "We want to do research together, offer training, involve partners in lab infrastructure, and at the same time build an ecosystem. For many companies, that is not a familiar way of working together. It took quite a few conversations to make that clear to everyone, including to ourselves, and to show that this was not business as usual."

Major players on board

The response was strong. In 2025, the programme gained real traction, with more than twenty partners now committed. These include major international players such as Siemens Energy, GE Vernova and Hitachi Energy, as well as transmission system operators Elia in Belgium and Transnet in Germany.

For Van Hertem, one important point is that Etch does not follow the classic model in which companies fund research and then receive a result in return. "It is not a case of industry giving money to EnergyVille and us delivering something back," he says. "We are trying to create an environment in which everyone in the partnership can benefit from each other's expertise. We are a facilitator in that process, but not necessarily the intermediary for everything."

For companies, the partnership also offers something very concrete: access to academic expertise, joint research projects, training, and new simulation lab infrastructure. In this way, they gain a shared platform for addressing questions around HVDC, underground transmission and grid integration more quickly and more collectively.

Faster progress, together

The first strategic tracks are already underway. "One example is the use of our new lab infrastructure to study how equipment in one partner's installations responds to the larger frequency fluctuations that come with the integration of more renewable energy," Van Hertem explains. "We can help companies better understand how their installations behave under changing grid conditions, and how they can contribute to system stability as more renewable energy comes online. We also have strategic collaborations underway with partners such as Elia, for example, around stability calculations and the cost-efficient expansion of the electricity system."

What is HVDC?

HVDC stands for High-Voltage Direct Current. It is a technology for transmitting large amounts of electricity efficiently over long distances. That is becoming increasingly important in the energy transition. Electricity from offshore wind farms, for example, has to reach industry, cities, and other consumers. Ideally, this would be done underground, but technically, that is far from straightforward. That is why Etch is researching how this kind of connection can be developed safely, reliably and affordably.

Deepen your expertise

In 2025, Etch and UGain jointly organised the post-academic course Transmission grids, HVDC & underground cables, aimed at engineers and professionals who want to deepen or broaden their understanding of transmission systems. Across twelve afternoon sessions, participants covered topics including cable technology, protection, digital substations, grid control, and HVDC, complemented by hands-on workshops in the Etch-EnergyVille labs. The course is organised every two years, so the next edition will take place in 2027.

At the same time, each of Etch's four research lines launched its first joint research project. "This is where we can show how valuable collaboration really is," Van Hertem says with a smile. "And by 'valuable', I mean how much faster we can move forward together. You have grid operators, technology suppliers and integrators sitting around the same table. That makes it much easier to identify the best technologies, understand their limits, and move towards solutions more quickly."

More efficient heat pumps through improved heat exchangers

Not every breakthrough depends on an entirely new technology. Sometimes, a smarter design of an existing component can make a real difference. In 2025, EnergyVille worked on heat exchangers that improve system efficiency while also making them better suited to specific applications.

Thermal systems

KU Leuven **VITO**

Heat exchangers play a key role in thermal systems such as heat pumps, cooling installations, and a wide range of industrial processes. Their job is to transfer heat efficiently from one medium to another. The better that process works, the less energy a system needs and the better its overall performance.

In 2025, EnergyVille continued to advance the design and optimisation of high-performance heat exchangers. Within the IAMHEX project, researchers used advanced design software capable of simulating and optimising three-dimensional fin geometries. This made it possible to assess more complex designs and tailor them more precisely to specific application needs.

Johan Van Bael, EnergyVille/VITO

From deep geothermal energy to the steel industry

EnergyVille's expertise in heat exchangers is relevant across a wide range of applications. In 2025, its design and simulation tool was used in projects ranging from a heat recuperator in a heat transformer to closed-loop systems for deep geothermal energy and waste heat recovery in the steel industry. The work also resulted in a patent application for a new concept that could further improve heat transfer.

"A better design gives the heat exchanger a lower pressure drop and a higher capacity, resulting in greater overall system efficiency."

Johan Van Bael, EnergyVille/VITO

By reducing pressure drop and increasing thermal capacity, the optimised designs improve overall energy efficiency. In one specific case, resistance was reduced by as much as 35%. By optimising the collectors, the team also achieved a more even flow distribution through the channels, improving the overall performance of the heat exchanger.

The research also moved closer to practical use in 2025. Using the software platform developed by EnergyVille/VITO, two heat pump manufacturers gained new insights into how the heat exchangers in their systems could be improved.

IAMHEX

The VLAIO project IAMHEX ran from 2022 to mid-2025 and explored how compact heat exchangers can be made more efficient. It combined three lines of work: advanced design and optimisation software, innovative production techniques such as 3D printing in copper, aluminium and alloys, and advanced testing methods. Together, these significantly expanded the design freedom available to researchers. That made it possible to develop higher-performing fin structures that improve heat transfer while lowering pressure drop. IAMHEX brought energy and materials research together in a single programme, paving the way for new applications in thermal systems, including heat pumps and cooling systems.

EnergyVille and the fire brigade team up to tackle battery safety

What happens when a battery overheats, catches fire or puts other systems at risk? To better understand those risks and prepare for them, EnergyVille is bringing research, test infrastructure and practical expertise together.

Battery storage VITO

From electric vehicles and e-bikes to home batteries and large-scale storage, batteries are becoming part of everyday life. At the same time, concerns about battery safety are growing. That is especially true in cases of thermal runaway, where a battery enters an uncontrolled chain reaction, overheats and may ignite. In those situations, the risks are difficult to predict and even harder to contain.

Within its Battery Storage research line, EnergyVille has built up many years of expertise in battery research, modelling, and evaluation. In 2025, that work took an important step closer to practical application with the development of a unique test environment for controlled safety testing, created together with PLOT Limburg, the Province of Limburg's training centre, and Fire Brigade Zone East Limburg. This test environment enables realistic safety tests that would be difficult to carry out in a conventional laboratory.

"Investing in knowledge today helps prevent unnecessary risks tomorrow. Especially with new technologies such as battery storage systems, insight is one of our strongest tools for fire prevention."

Dominic Knapen, Chief Officer,
Fire Brigade Zone East Limburg

The collaboration creates value in multiple ways. Researchers gain a better understanding of how batteries behave in real incidents, while fire services and training partners can strengthen their knowledge and preparedness through well-founded testing. But the infrastructure is also available to companies to independently test prototypes, products or safety solutions before progressing to often costly certification procedures. In this way, EnergyVille helps companies identify battery risks earlier, more accurately and more objectively.

"Batteries are essential to the energy transition. That is exactly why safe use depends on solid knowledge, realistic testing and close collaboration with emergency services. Together with PLOT and Fire Brigade Zone East Limburg, we are bringing those elements together. In doing so, we are helping build the expertise in Flanders needed to better understand battery risks, manage them more effectively, and translate that knowledge into guidelines, training and practical solutions."

Sofie Ignoul, EnergyVille/VITO

Test infrastructure for battery safety

To study battery safety in depth, EnergyVille is continuing to invest in dedicated test infrastructure. In 2025, the procurement process began for a battery X-ray tester, which is expected to become operational in 2026. It will allow researchers to look inside batteries without opening them. At the same time, the battery test lab was recognised as test infrastructure within DIANA, NATO's accelerator programme.

Knowledge hub for battery and fire safety

In 2025, plans also began to take shape for a broader knowledge hub on batteries and fire safety. Its aim is to support companies, emergency services, and public authorities with independent expertise, guidelines, and practical tools. A Deep Dive on battery and fire safety, organised by VITO and KU Leuven within EnergyVille, helped lay the groundwork for that next step.

Orion Grid Technologies gives grid operators a clearer view

Distribution system operators do not always have an accurate picture of how their underground grids are laid out. In many cases, network plans are incomplete or outdated. That makes it harder to locate faults, plan investments and prepare the network for new applications. Orion Grid Technologies shows how research in data, modelling and grid analysis can evolve into a practical tool for the field.

Electrical networks

KU Leuven **VITO**

Over the years, electricity grids in residential areas have expanded step by step. Even in the past, those networks were not always fully or correctly documented. With the rapid uptake of electric vehicles, heat pumps and solar panels, that is becoming a much bigger issue. Without a clear picture of cables, connections and network topology, it becomes increasingly difficult to detect congestion, plan investments and prevent disruptions.

For years, EnergyVille has been building expertise in models and tools that help distribution system operators better understand and manage their low-voltage grids. This has led to a range of insights and applications, from state estimation and grid connectivity to congestion detection and scenario analysis. That knowledge helped lay the foundation for Orion Grid Technologies, a spin-off of VITO, KU Leuven and EnergyVille, which translates research into software that can be used directly in day-to-day grid operations.

By combining smart meter data, asset data, and grid models, the Orion platform helps operators map their networks more accurately and uncover new insights. This allows them to identify risks more precisely, make better-informed investment decisions and prepare the grid for further electrification. It shows how research can lead not only to new insights, but also to practical tools for pressing societal needs.

Award-winning research

In 2025, two PhD researchers, jointly supervised by KU Leuven and VITO, received the Gemma Frisius Award for their work on system identification in low-voltage grids. Hélène Ponsaerts (EnergyVille/VITO) and Mohamed Numair (EnergyVille/KU Leuven) contributed to the knowledge base on which Orion Grid Technologies continues to build.

€1 million to support further growth

In February 2026, Orion Grid Technologies announced that it had raised €1 million in seed funding. The investment will help the spin-off further develop its software and deploy it more widely with distribution system operators. It is also a strong signal that the market sees real potential in the technology.

GALILEO identifies room for action in industry

Belgian industry is facing a rapid succession of challenges. Energy prices remain volatile, grid congestion is increasing, and the need to electrify is becoming more urgent. At the same time, companies are expected to decarbonise faster. With GALILEO, EnergyVille approaches the question from a different perspective and starts from a practical reality: what can companies already do today, and what is still holding them back from making their energy use smarter and more flexible?

Energy strategies & markets

VITO: coordinator **KU Leuven**

When people talk about decarbonising industry, the discussion often focuses on flexibility, electrification, energy efficiency and grid management. In practice, however, those challenges tend to look very different. Companies have to deal with production schedules, investment cycles, internal priorities and regulatory frameworks that do not always keep pace. GALILEO starts from that more stubborn reality. Working with companies such as Tessenderlo Group, Nyrstar, Aperam, Tiense Suiker and LCL Data Centres, EnergyVille is examining how much flexibility already exists in industrial energy use, and why unlocking it in practice is often less straightforward than it seems on paper.

"Many studies on the future of industry take a top-down approach," says Helena Gerard, project manager at EnergyVille/VITO. "Within GALILEO, we do the opposite. We go directly to companies and ask: what are you running into today, what makes things difficult, and where do you see opportunities yourselves?"

Through workshops with the companies and the project team, more than 80 different barriers were identified. Some related to technology or investment needs, others to regulation or internal organisation.

"You may have a strong decarbonisation project," Gerard says, "but if a plant manager is mainly assessed on maximising production, internal support cannot be taken for granted. Those are exactly the kinds of barriers you only uncover by talking directly to companies."

This approach makes GALILEO fundamentally different from a conventional research project. Rather than staying at a distance, the researchers worked closely with the companies throughout. In addition to technical workshops and regular consultation with company experts, interim findings were continuously tested against operational reality. Over time, that also built trust.

"Companies struggling with decarbonisation, electrification, grid congestion, or flexibility do not have to figure it out on their own. EnergyVille has the expertise to support them through that transition."

Helena Gerard, EnergyVille/VITO

"It has become a true partnership," Gerard says. "You start to see the companies raising more questions, adding nuance and pointing out factors that need to be taken into account. That is when you realise the project has really started to resonate with them too."

Building on that practical insight, the team began assessing possible solutions. What value does a battery offer? When does an electric boiler make sense? Can heat demand be organised differently? Is there a business case for putting that flexibility on the market?

Although the participating companies come from very different sectors, some barriers appear repeatedly. That means GALILEO goes beyond a series of individual case studies. It builds a clearer understanding, not of one company's needs, but of recurring patterns that cut across sectors.

Gerard sees that as an opportunity to shift the tone of the debate. "There is a lot of concern around the state of our local industry," she says. "That is understandable, but we also want to help create a more constructive dynamic. What is already possible? Which solutions really deliver value? And which obstacles should companies not have to solve one by one, all over again?"

That narrative fits closely with EnergyVille's broader mission. "We are not traditional consultants," Gerard says. "We go beyond conventional consultancy, and we are also honest when something does not make economic sense. Companies expect that independence from us."

In 2025, GALILEO focused first on mapping the barriers clearly. The next step is to develop the solutions further, and in a third phase to test and translate them into guidance for other companies, sectors and policymakers.

A dedicated test field for integrated solar panels

Solar panels are no longer confined to rooftops. They are increasingly integrated into canopies, façades, noise barriers and agricultural applications. These kinds of building-integrated and application-specific photovoltaic solutions require a different approach, both in design and in reliability testing. That is why, through the IN2PV project, EnergyVille is developing a dedicated test platform at Thor Park in Genk, together with Soltech, a Belgian manufacturer of integrated solar building solutions.

Solar energy **UHasselt** **imec**

The 55-are site will allow new integrated solar technologies to be tested and monitored in a controlled outdoor environment. The focus is on full-scale applications, including free-standing structures, where performance, stability and mechanical loads can be assessed over longer periods of time. The field is equipped with advanced measurement systems combined with detailed meteorological data. IN2PV also helps build the infrastructure needed to scale up next-generation solar technologies, including thin-film materials such as perovskites. Through automation and process optimisation, solar panels of commercial scale can be made more efficiently and more reliably. Combined with the new test infrastructure, this will bring integrated photovoltaic solutions closer to large-scale application.

"Thor Park was the obvious location for this test field: The ecosystem at Thor Park is unique. The proximity of knowledge, research and industry creates a strong dynamic. Thanks to this test field, innovations that emerge in the lab and products we build in our factory can immediately be tested and refined."

Bas van de Kreeke, CEO Soltech

Smarter energy control for buildings and charging sites

At EnergyVille, research also finds its way into practice through digital applications that make energy use smarter and more responsive. Spin-offs Builtwins and Pleevi are two examples. Builtwins focuses on smart building control, while Pleevi is designed for smart charging. They share the same underlying idea: aligning energy use more closely with what a building or site actually needs, and what it can handle, at any given moment.

Buildings & districts

KU Leuven **VITO**

Builtwins specialises in intelligent building control through model predictive control: software that forecasts, optimises energy use in real-time, and detects anomalies. This can typically reduce HVAC energy consumption by 20 to more than 40%. The young KU Leuven spin-off is already applying this technology in a wide range of buildings, from offices and care homes to hospitals covering more than 100,000 m². Builtwins is now moving towards a software-as-a-service model and has already delivered several successful projects together with Sweco.

Pleevi, a VITO spin-off, focuses on smart charging at business sites. Its software aligns charging sessions with local energy production, expected demand, and available grid capacity, while seamlessly integrating on-site solar power and battery storage. As a result, electric vehicles can charge more cost-effectively, and more sustainably.

STORM unlocks hidden flexibility in thermal networks

STORM is a smart digital controller for thermal networks that matches heat demand in real time with available energy. By shifting heat demand to moments when renewable energy is more abundant and cheaper, the software helps heating networks operate more efficiently, more sustainably and with greater flexibility.

Thermal systems **VITO**

In 2025, the collaboration with the Swiss energy company Energie 360° continued to grow. In a pilot project involving eight buildings, STORM reduced peak heat demand by 25% without compromising comfort. At the same time, the test showed how much flexibility is still hidden in the network: if all 44 buildings in the district were connected, STORM could unlock up to 770 kW of flexible capacity. Energie 360° plans to use that flexibility to defer investments in additional heat production capacity, especially new gas boilers. That translates into a significant reduction in both costs and CO_2 emissions.

STORM shows how algorithms and software can also have a direct impact in thermal systems. The technology is already operational in more than 20 heating networks across Europe and Asia, making it a clear example of research translated into practice.

Bringing electrolysis closer to practice

Electrolysis is a key technology for producing hydrogen from renewable electricity. In the longer term, that hydrogen could play an important role in industry, chemistry, and energy storage. The PEM electrolysis installation at UHasselt, developed within the Green Hydrogen project, has been operational since 2025. It gives EnergyVille access to infrastructure that allows the technology to be tested under high-pressure and high-temperature conditions much closer to industrial reality.

Power-to-Molecules **UHasselt**

This is especially relevant for companies looking to evaluate new materials, components, or concepts in a setting that is much closer to operating conditions. In that way, the installation helps narrow the gap between laboratory research and higher levels of technological maturity.

The installation is part of a broader expansion of infrastructure within the Power-to-Molecules research line. Other experimental platforms, including facilities for membranes, electrode materials, and lifetime testing, create new opportunities for collaboration and make the path to scale-up more tangible.

Providing direction for policy

“There are different roads to climate neutrality, but none of them allows us to do nothing. That may be the most important message of all.”

Pieter Lodewijks of EnergyVille/VITO explains why PATHS2050 is about more than scenarios alone. By bringing industry, infrastructure players and energy companies into a single modelling exercise, the coalition aims to broaden and strengthen the energy debate.

“We have been working on the models behind these scenarios for more than 25 years,” he says. “We have developed scenarios for Belgium, for Flanders, and, at times, at European level. Usually, we do this work for governments, federations or companies. It is fascinating work, but we also saw the limitations: if you work with one party, you often only get one side of the story.”

VITO **Energy strategies & markets**

That insight helped inspire the PATHS2050 Coalition. Instead of working with stakeholders separately, EnergyVille brought together industrial users, energy producers, and infrastructure and grid operators.

“We thought: what if we bring together different stakeholders, each with their own perspective on the future of the energy system, and ask them to shape scenarios together?” says Lodewijks. “You do not just get a richer debate; you also get scenarios that keep the whole system in view.”

Pieter Lodewijks, EnergyVille/VITO

What is PATHS2050?

PATHS2050 is EnergyVille’s scenario and modelling work on how Belgium can become climate-neutral by 2050 without losing sight of economic resilience. Since 2022, more than 200 researchers have worked on data-driven scenarios for the Belgian energy system. EnergyVille/VITO joined forces with nine leading industrial and energy companies in the PATHS2050 Coalition: ArcelorMittal, BASF, Elia, Engie, Fluxys, Holcim, Luminus, Otary and SCK CEN. The coalition shares ideas and know-how to jointly evaluate possible transition pathways.

He is convinced that this approach has had a major impact on the quality of the work. “The partners really challenge each other,” he says. “Everyone comes in with their own background and sensitivities, of course. BASF looks differently at carbon capture and storage than a grid operator does. Fluxys has a different view of the role of gas than someone reasoning mainly from electrification. And when it comes to nuclear, you can expect equally strong discussions. But that tension is what makes the process so valuable. At EnergyVille, we try to act as a neutral moderator and provide the quantitative framework.”

That process led to the publication of the Main Edition 2025, which develops three different scenarios in depth. For Lodewijks, the real added value lies in the themes that return across all of them.
“There are several common threads across the three scenarios—we sometimes call them no-regret measures,” he says. “The most important one is electrification. Whichever path you choose, if you want to get to net zero, electricity use will at least double. At the same time, total energy demand falls by a third or more.”

He believes this is one of the most underestimated insights in the latest analyses. “Many people still assume that more electricity automatically means more energy use overall. But that is not true. With heat pumps, electric vehicles and more efficient processes, you ultimately need less energy. Electrification does not just increase electricity demand; it is also a major efficiency gain, and it makes us less dependent on imported fossil fuels.”
A second key conclusion is that Belgium will have to produce much more electricity. Offshore wind and solar power feature prominently here.
“What really strikes me,” says Lodewijks, “is the scale of what we need to do. In the case of solar energy, this means repeating our best year on record over and over again, every year for years to come.”

That finding gives the policy debate real urgency.
“Governments obviously have their own energy and climate plans,” he says. “But what you often see is a fairly linear continuation of what is already

happening today. That is not an energy transition. If you want to reach net zero, you have to move faster, and in some areas, much faster."

Offshore wind is a good example of the gap between what makes sense in a model and what happens in practice.

"In our models, additional offshore wind is a very logical building block," he says. "But in reality, you see delays, political shifts, and uncertainty. That is why we decided to dedicate a separate deep dive to this issue. It shows that delays do not just affect emissions, because gas-fired power plants have to fill the gap. They also temporarily push up the energy bill by 4 to 7%."

One important point is that the broad conclusions of PATHS2050 hold even when assumptions change. "That is what we mean by robustness," Lodewijks says. "Of course, you can adjust assumptions about renewables, nuclear energy, or carbon capture and storage. But if the main message still holds, that tells you something. It shows that certain directions remain fundamental, even when the boundary conditions shift."

He also sees a clear role for EnergyVille in that process. "Many teams within EnergyVille work on technologies - batteries, thermal networks, grids, flexibility, hydrogen, and more. With our energy models, we try to bring those insights together at system level. What does a breakthrough in battery technology mean in the wider energy context? What role can thermal networks play? What changes if CO_2 storage is available, or when it's not?"

The impact of PATHS2050 can be felt on several levels: "We organise public events and engage with ministerial cabinets and government administrations, both in Flanders and in Wallonia, where we explain our results in detail." Those conversations, he says, go well beyond the scenario outputs themselves. "It is not just about what comes out of a model, but also about how you translate that into policy: renovation policy, heat pumps, tax shifts between electricity and gas, infrastructure choices. We actively contribute to those discussions as well."

He also sees that the work is resonating in the way specific analyses are being picked up. "Our deep-dive paper on offshore wind delays was discussed in parliament," he says. "That is when you realise a study is really shaping the debate. Of course, it helps that the message is not only coming from us, but from a broad coalition of companies and partners."
It is one of the major strengths of the PATHS0250 approach, he says. "If a research institution makes a statement, that is one thing. But if you bring together players from across the entire energy system, the message carries much more weight."

If there is one conclusion he would want policymakers to take away from the 2025 PATHS2050 results, it is the urgency of making system-level choices now.

"We need to scale now," he says. "That is the essence for me. We should not get stuck on one technology or idea, but understand that certain choices keep returning in every scenario: electrification, increased electricity production, renovation, offshore wind, infrastructure. If you postpone those, you make the whole system more expensive and more difficult."

Importantly, PATHS2050 is not trying to prove that there is only one correct route. "There are different pathways to climate neutrality," he says, "but none of them allows us to do nothing. That may be the most important message of all."

Main edition 2025

In 2025, the PATHS2050 Coalition presented its new results in the Main Edition 2025. The report develops three possible routes towards climate neutrality in Belgium: ROTORS, a scenario with a strong focus on renewable energy; REACTORS, where nuclear capacity plays a larger role; and IMPORTS, which relies more heavily on imported molecules and electricity. The study explores how Belgium's energy system could move towards net-zero CO_2 within each of these pathways, and which choices matter most for policy, industry, and infrastructure.
Despite the differences in approach, the three scenarios share certain common conclusions. In each scenario, final energy demand falls by around one-third by 2050, while electricity consumption more than doubles. Electrification of buildings, transport and, later, industry proves essential in every scenario, as does a major expansion of wind and solar energy, new nuclear capacity where permitted, additional infrastructure, and CO_2 storage for industrial activities that are hard to decarbonise. Clean molecules complement the energy mix and remain essential for international transport and for industrial processes where electrification is not a realistic option.

"Many teams within EnergyVille work on technologies—batteries, thermal networks, grids, flexibility, hydrogen, and more. With our energy models, we try to bring those insights together at system level."

Pieter Lodewijks, EnergyVille/VITO

Powering a telescope that looks back to the Big Bang

The Einstein Telescope is designed to push the boundaries of science. It will also require an energy system that is exceptionally well designed.

Solar energy | Battery storage | Energy strategies & markets | UHasselt | KU Leuven | VITO | imec

The Einstein Telescope is no ordinary infrastructure project. The planned observatory, designed to detect gravitational waves 300 metres underground, places unusual demands on its energy supply. That supply must be reliable, future-proof, and sustainable, while also remaining cost-efficient and compatible with an extremely sensitive scientific environment. In 2025, EnergyVille was asked to investigate how the Einstein Telescope in the Meuse-Rhine Euregio could be powered by sustainable energy.

The study brings together four strands of work: energy modelling, energy generation, energy transmission and energy storage. Together, they make it possible to determine how much energy the telescope will need, which renewable sources are best suited to provide it, how the electricity network should be designed, and what kind of storage will be needed to ensure continuity.

The first results have already produced some clear insights. Current analyses indicate that the Einstein Telescope is likely to consume around 100 GWh of electricity per year, with demand expected to be slightly higher during construction. To supply that energy sustainably, while keeping disturbances to an absolute minimum, the most robust and efficient solution appears to be a combination of DC transmission and battery backup systems. Wind power is not an option locally, since wind turbines are not allowed within a 10-kilometre radius of the telescope. As a result, solar energy becomes a much stronger focus.

According to the first estimates, up to 80% of the telescope's energy demand could be covered by one or two large solar parks in the region. That means at least 20% would need to come from locally integrated photovoltaic solutions, for example, in or around buildings and across the landscape.

But generation is only part of the puzzle. The way energy is delivered to and used within the telescope also requires a tailored approach.

The study highlights not only how complex the energy puzzle of a project like the Einstein Telescope really is, but also how EnergyVille's diverse expertise can help underpin those choices at system level, taking into account technology, cost, surroundings, and wider societal value.

"An integrated, system-level energy model—one that takes into account not only electricity demand, but also heating and cooling, storage, and financial aspects—is essential for a project like the Einstein Telescope. By combining the strengths of the different EnergyVille partners, we want this research to contribute to an excellent bid book and help bring the telescope to our region."

Michiel Ritzen, EnergyVille/VITO

ENERGY MODELLING

We analyse total energy demand, costs, and environmental impact across the entire lifecycle.

vito

ENERGY GENERATION

We research renewable energy sources, with a strong focus on solar energy: vibration-free and scalable.

UHASSELT imec

ENERGY TRANSMISSION

We design stable, efficient, and sustainable electricity networks. By evaluating different scenarios, we develop future-proof grid solutions.

KU LEUVEN vito

ENERGY STORAGE

We investigate how smart energy storage systems store and release electricity when and where it is needed.

vito UHASSELT

"The Einstein Telescope places very specific demands on the electricity network, far beyond those of conventional consumers. That is why we are working on an innovative grid design that combines stability, sustainability, and efficiency. Using a digital twin, we can simulate and optimise different scenarios in order to arrive at a future-proof solution."

Wilmar Martinez, EnergyVille/KU Leuven

Four tracks, one energy plan

The Einstein Telescope energy study brings together four complementary research tracks. First, it maps the telescope's expected energy demand, along with the associated costs and environmental impact. Next, the partners assess which renewable sources are best suited to meet that demand, with solar energy emerging as the main option. A third track focuses on the electricity network itself: how do you design a stable system for such an exceptionally sensitive piece of infrastructure? Finally, EnergyVille is investigating what kind of storage will be needed to guarantee a reliable energy supply during peaks and transition periods. Step by step, these four tracks are being combined into one integrated energy plan.

ALEXANDER explores new rules for the electricity grid

More flexibility in the electricity system sounds sensible. But who should be allowed to offer that flexibility? Who benefits from it? And how can new market mechanisms be introduced without creating problems elsewhere in the grid? These were among the key questions EnergyVille worked on in 2025 within the Belgian project ALEXANDER, with a particular focus on low-voltage networks.

Energy strategies & markets

VITO: coordinator **KU Leuven** **UHasselt**

The project mapped out possible forms of cooperation between transmission and distribution system operators and examined how flexibility can be unlocked without increasing the risk of congestion in distribution grids. At the same time, it looked at how new products, markets, and digital tools affect grid users and end users.

User behaviour was part of the picture too. ALEXANDER studied how households respond to new flexibility mechanisms, for example in combination with solar panels, batteries or energy communities.

In September 2025, the ALEXANDER team organised a panel discussion with Belgium's four grid operators at FLEXCON25, a leading conference on energy flexibility in Brussels. The session was very well received and, at the organisers' request, will return at FLEXCON26.

It also explored the risk of unintended effects, such as users adjusting their behaviour mainly to maximise certain incentives or premiums, rather than to support the system where flexibility is actually needed.

ALEXANDER goes beyond technical insight alone. The project also provides concrete recommendations for policy and market design, taking into account grid constraints, user perspectives, and the broader societal impact of flexibility.

SWiM explores the potential of offshore solar

Offshore wind is now a familiar part of the North Sea energy landscape, and offshore solar is starting to attract growing interest as well. Through the SWiM project, EnergyVille is exploring how commercial zones in the Belgian part of the North Sea could be used for multiple energy applications at once. One of the main questions is how wind and solar can be combined in so-called marine energy parks.

Power electronics

KU Leuven **imec** **UHasselt**

Together with sector partners such as Laborelec (energy expertise and system analysis), De Blauwe Cluster (innovation in the blue economy) and the Royal Belgian Institute of Natural Sciences (marine and ecological expertise), SWiM is assessing which types of installations are technically viable and what their impact could be. Researchers are examining issues such as space use, energy yield, electrical connections, and environmental effects. The aim is to translate those findings into technical guidelines and policy recommendations for offshore photovoltaic systems.

"By combining the complementary expertise of the partners, we will define the boundary conditions for integrating offshore solar and wind energy. Together with the relevant stakeholders, we will develop pathways for the effective deployment of this promising combination of technologies. That can strengthen Belgium's position in innovative renewable energy generation."

Johan Driesen, EnergyVille/KU Leuven

Rewind / fast forward

22 March 2025 - TEDxUHasselt

EnergyVille was a silver sponsor of TEDxUHasselt 2025, an event that inspires young people and professionals around a wide range of societal themes. At the sponsor fair, EnergyVille presented its work to the public.

27 March 2025 - Powering the Future

Under the banner Powering the Future, Sirris-Agoria, Thor Park, POM Limburg and EnergyVille organised four thematic workshops for industry in 2025. The sessions focused on thermal batteries, circular battery storage, financing, energy trading, and flexibility.

26 April 2025 - Children's University

EnergyVille welcomed KU Leuven's Children's University to its site in Genk. Through interactive sessions, children aged 8 to 13 were introduced to energy, technology, and sustainability. Researcher Sebastiaan Jamaer took his young audience on a journey from onshore wind turbines to the impressive offshore giants in the North Sea.

28 April 2025 - Energy Masterclass

In collaboration with KBC, EnergyVille organised an Energy Masterclass in Leuven for senior executives. The session focused on strategic and societal energy challenges.

11 June 2025 - Energy study for the Einstein Telescope

EnergyVille partners launched a large-scale energy study for the Einstein Telescope in the Meuse-Rhine Euregio. It explores how this exceptional research project can be supplied with energy in a sustainable, stable, and future-proof way.

11 June 2025 - Research symposium on battery technology

During the symposium Unravelling the true potential of your battery, EnergyVille brought together experts from research and industry at Thor Park. With around 100 participants from Belgium and neighbouring countries, the event confirmed EnergyVille's role as a meeting place for the battery sector.

30 June - 2 July 2025 - International EnergyVille Summer School

The International EnergyVille Summer School brought together PhD students and postdoctoral researchers around our eight research lines. The three-day programme also helped strengthen international connections and reinforce EnergyVille's appeal as a research environment.

26 August 2025 - New General Manager

Bram De Wispelaere was introduced as the new General Manager.

7-10 September 2025 - IEA DHC International Symposium

Thor Park hosted the IEA DHC International Symposium on District Heating and Cooling. The event gave international visibility to EnergyVille's expertise in thermal networks and thermal systems.

15 September 2025 - Launch of the ETCH Partnership Programme

EnergyVille took an important step in building an industrial ecosystem around future transmission grids. The programme brings companies and researchers together around HVDC technology and underground cable systems.

29 September - 1 October 2025 - ISOS 16

Thor Park hosted ISOS 16, the international summit on the stability of organic and hybrid photovoltaic technologies. The event brought together researchers from around the world to address a crucial challenge for the future of solar energy.

21 October 2025 - Energy Mission 2025: From Watt to Wow

During Energy Mission 2025, Thor Park became the meeting point for experts, entrepreneurs, and researchers from the energy sector. Organised by Flux50, Sirris-Agoria, POM Limburg, Thor Park and EnergyVille, the event focused on strategic energy partnerships, innovation, and collaboration to accelerate the transition to a more sustainable energy system.

3-6 November 2025 - World Bank Energy Storage Partnership

EnergyVille hosted the annual event of the World Bank Energy Storage Partnership. Lectures, networking moments and site visits turned Thor Park, Genk, into an international meeting place for expertise on energy storage.

23 November 2025 - Day of Science 2025

EnergyVille once again took part in the Day of Science, with activities in Leuven, Diepenbeek, Mol, and Genk. Through demonstrations, lectures, and interactive formats, energy topics were made tangible for a broad audience of all ages.

December 2025 - Johan Driesen appointed IEEE Fellow

Professor Johan Driesen was appointed IEEE Fellow, one of the highest distinctions in the international engineering community. The recognition honours his contribution to the integration of renewable energy and electric vehicles into distribution grids. Congratulations, Johan!

The energy transition in everyday life

Digital tools can engage more people in the energy transition

Getting more people involved in the energy transition starts with tools that are easy to navigate and choices that are straightforward to make. Today, the vast majority of Europeans still do not actively manage their energy use, even though price signals, digital services, and flexible technologies are creating more and more opportunities to do so. Through EU-DREAM, EnergyVille is exploring how digitalisation and artificial intelligence can make those opportunities more accessible to end users.

Energy strategies & markets

VITO

As more renewable energy enters the system, balancing supply and demand becomes more challenging. That makes it increasingly important for households to align their energy use more intelligently with the energy available at a given moment. At the same time, research shows that many users are still disengaged because energy markets, digital applications, and technical choices feel too complex. EU-DREAM looks at how digitalisation and AI can lower those barriers.

The project explores tools that can translate energy information into plain language, automatically factor in price incentives and user preferences, and help people navigate choices about energy use, flexibility, and the use of self-generated electricity. It also examines how artificial intelligence, digital twins, and user-friendly interfaces can improve the interaction between end users and energy services. Within that broader effort, EnergyVille played a dual role in 2025. On the one hand, we studied how digitalisation and AI can further engage end users in energy and flexibility markets. On the other, we led the project's work on market design for the uptake of digital tools and flexibility services. Because technology alone is not enough: market mechanisms and regulation must evolve as well if people are to make real use of these new possibilities.

"The Open Thor Living Lab is central to our mission to support vulnerable consumers through innovative digital solutions. With the EU-DREAM tools, we want to help end users manage their energy use in a simpler and more intuitive way, without expecting them to navigate the full complexity of energy markets on their own. In that way, we aim to make the energy transition more accessible, while also contributing to greater comfort, lower energy costs, and a better alignment between household energy use and the needs of the system."

Annelies Delnooz, EnergyVille/VITO

Open Thor
LIVING LAB

Open Thor Living Lab as a test environment

One of the six European living labs within EU-DREAM is located at Thor Park in Genk. There, EnergyVille is investigating how digital tools can also be relevant and usable for vulnerable consumers. The living lab includes social housing and brings together renewable energy generation, storage technologies and electrification solutions such as heat pumps and home batteries. Particular attention goes to ease of use, trust and energy literacy, and to how technology can practically support people in managing their energy use and participating in energy and flexibility markets.

Homes in Nieuw Texas turned into a living lab

In the Genk neighbourhood of Nieuw Texas, 2025 saw the completion of the renovation of 27 social housing units, marking the beginning of a new phase in the European oPEN Lab project. The focus is now no longer on renovation alone, but on what these interventions mean in practice for residents' comfort, affordability, and energy performance in everyday life.

Buildings & districts

VITO: coordinator **KU Leuven**

UHasselt **imec**

Nieuw Texas shows what the energy transition looks like in practice. Not in abstract models or large-scale infrastructure, but in the homes where people live, cook, and sleep, and where they pay their energy bills. The renovations combined several techniques, including prefabricated façade panels, extra insulation, solar panels, smart ventilation and a modular energy box with, among other things, a heat pump and a buffer tank. Combined, these interventions made it possible to carry out a deep renovation of the homes in a relatively short time.

What is Nieuw Texas?

Nieuw Texas is a social housing neighbourhood in Genk, close to Thor Park and EnergyVille. Within the European oPEN Lab project, it was selected as a pilot site for the transition towards a positive-energy neighbourhood. In total, 27 social housing units owned by Wonen in Limburg were renovated. As a result, Nieuw Texas is now a residential neighbourhood where researchers can study how renovation, energy, comfort, and affordability come together in real life.

"We are at the start of a new chapter, one in which we can gather real insights into energy performance, comfort, and affordability. oPEN Lab is truly becoming a European test bed for the cities of tomorrow."

Maarten De Groote, EnergyVille/VITO

"The renovation was quite disruptive, but I can already feel the difference. There are no more draughts, the rooms are much warmer in winter, and I feel more comfortable in my home."

Aynur, Nieuw Texas resident

But the way the process was organised was just as important. Residents were involved from the outset through information sessions, individual guidance and the opportunity to help shape certain choices. The ambition was to carry out as many renovations as possible without requiring people to move out. In practice, the project also showed how important flexibility and support are when renovation works have a major impact on privacy and daily life.

With the renovation works completed, the living lab phase has now begun. In each home, more than 200 parameters are being monitored, ranging from temperature and air quality to energy use. The first results are promising: demand for heating and hot water appears to have been cut roughly in half, while indoor comfort has also improved noticeably.

The first findings also underline how important follow-up is after installation. New technologies only deliver their full potential when they are properly adjusted after installation, and continued support for residents remains essential.

A second renovation track in Tuinwijk Waterschei

Alongside the social housing renovations in Nieuw Texas, oPEN Lab is also renovating seven privately owned homes in the Tuinwijk of Waterschei. There, the challenge lies mainly in the heritage character of the houses, combined with the socio-economically vulnerable position of the homeowners. In 2025, the first four renovations were completed, while the final three entered the finishing phase. The next step is to start monitoring the installations there as well.

A digital renovation model for all of Flanders

Smart renovation starts with a simple question: where can the biggest gains be made, and which interventions make the most sense? To help answer that question, EnergyVille developed a digital renovation model for Flanders on behalf of the Flemish government. The model makes it possible to map homes and neighbourhoods virtually, calculate renovation scenarios and support better-informed decisions. It includes both a neighbourhood renovation tool for local authorities and a home renovation tool for the advisory services that support individual homeowners.

Buildings & districts **VITO**

In 2025, the first phase of this work was completed. The focus was on validating and refining the underlying algorithms and making the platform more robust. The neighbourhood renovation tool helps local governments roll out renovation policy in a more targeted way, while the home renovation tool supports scientifically grounded renovation advice tailored to individual homes.

In 2025, the project entered a second phase focused on keeping the platform operational and extending it to new use cases, including apartments and circularity. In that way, the digital renovation model is evolving into a tool that can support renovation policy and renovation advice on a much broader scale.

Tom Mondelaers, EnergyVille/VITO

Carbon-free heating at home

Many homes in Flanders are still heated with fossil fuels. As a result, even homes with a good EPC label can still have relatively high CO_2 emissions. Energy efficiency alone is therefore not enough to reflect the true climate impact of residential heating.

Buildings & districts **VITO**

A revision of the EPC could help change that. By taking CO_2 emissions explicitly into account alongside energy use, it becomes possible to create a clearer framework for decisions on heating systems and renovation.

Using simulations for different housing types and neighbourhoods, EnergyVille analysed which solutions are most effective. The results show that once emissions are factored in, heat pumps often emerge as the best option, while CO_2 emissions fall significantly. At the same time, phased renovation strategies would make the transition more manageable for households.

Nele Renders, EnergyVille/VITO

A European Benchmark for future growth

In 2025, EnergyVille commissioned an external benchmark to better understand its position in the European energy landscape. The exercise confirmed a number of clear strengths and helped bring the next strategic choices into sharper focus.

EnergyVille has always compared itself, implicitly, with Europe's leading energy research organisations. But how strong is that position when measured systematically against other actors in the field? That question lay behind a benchmarking study carried out by Elsevier Analytics, which was completed in 2025.

The study was designed to look beyond scientific output and citation impact alone. It also set out to quantify industrial engagement and policy relevance. To do so, it worked from thematic datasets for each of EnergyVille's research lines, complemented by comparisons with best-in-class players in the European energy R&D landscape. The results painted a clear picture.

"EnergyVille has a strong position in the European energy research landscape," says Kris Baert, research manager at EnergyVille, who coordinated the Elsevier analysis on behalf of the organisation. "Scientifically, we perform well. In European research funding, we perform very well. And when it comes to patents, we really stand out."

Stronger together

The benchmark explicitly confirmed EnergyVille's strong position in Horizon Europe and other European research frameworks. "We already knew we were doing well in attracting European projects," the team reflects, "but the scale of that success still surprised us."

Beyond the funding itself, that is also a strong signal that EnergyVille's open innovation model, which is built on collaboration, shared infrastructure, and a close link with society, is recognised internationally.

For Baert, collaboration between the four partner institutes is clearly a key driver. "We have seen strong growth in both income and projects over recent years," he says. "Even if that growth cannot be attributed entirely to the collaboration itself, it still shows that there is a real leverage effect: together, you achieve more than you do separately."

According to Baert and Poortmans, EnergyVille's unique strength lies not only in its combination of different fields of expertise, but in the shared vision that brings them together in support of the energy transition.

Valorisation as a foundation

Patents emerged as one of the most striking strengths in the benchmark. "We were genuinely surprised by how strongly our patent position stood out," they say. "That strength confirms that EnergyVille is not only building knowledge, but also has a solid foundation for translating that knowledge into applications that can help strengthen and renew industry. It shows that EnergyVille's open innovation model delivers results on that front as well."

A dynamic network

By analysing EnergyVille's research lines alongside the joint activities of its four partners, the study also highlighted where further integration or expansion could be valuable. The study turned out not only to be a measurement tool, but also a way to identify potential new partners and collaborations, both within and beyond the existing partnership.

"The benchmarking showed us how EnergyVille's own network can continue to evolve," explains Poortmans. "In a research landscape that is becoming increasingly competitive, particularly outside of Europe, that kind of strategic clarity is essential."

The combination of European visibility, a strong patent base and a shared system vision gives EnergyVille a credible profile in a landscape where scientific excellence must go hand in hand with societal and industrial relevance.

"The study confirms where our strengths lie and what can support our next steps," Poortmans says. "It shows that we have a strong foundation for further growth in expertise, collaboration and impact."

"At the same time," he adds, "it also makes clear that continued European investment in energy research will be essential if we are to maintain and strengthen that position in an increasingly competitive international landscape."

"The Scientific Advisory Board encouraged us to take a closer look at where EnergyVille stands today, where the collaboration proves its added value, and where there is still room to grow,"

Jef Poortmans, R&D Strategy Coordinator at EnergyVille and Programme Director at imec

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Copywriting: Liesbeth Aerts
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