A world in flux

VLAIO flux

Clusters for Growth

Initiating change, building (for) tomorrow

The world is in transition, or so they say. According to global statistics, we are still consuming more energy on a worldwide scale, and we continue to talk about addition rather than transition. We find ourselves in a comfortable situation where any change is mainly perceived as a step backward. And "policy" reinforces this perception with its pursuit of feasibility and affordability. Feasibility, as you can probably imagine, is a word that can carry many connotations. Depending on the voluntarism or conservatism one displays, the same things may or may not be feasible. Feasibility thus becomes a hollow term that primarily reflects one's own value system.

With this brochure, we aim to highlight what is technologically feasible in Flanders and, more importantly, what is worth investing in for the coming years.
It provides an overview of the projects in which Flux50 is involved, and through which our companies work day by day towards building the future.

Our goal is to demonstrate, together with you, that a change in the energy system is indeed technologically feasible and perhaps also socially desirable. Affordability, on the other hand, is a matter of societal choices, a matter of what we want to invest in and what we do not. This choice is often difficult because it comes with a lot of uncertainty, which is inherent to change and therefore to transition.

Initiating change is not something you do alone.
Going alone might make you faster, but going together takes you further. And for a transition, you need to jump quite far. There are also many stakeholders involved. With our projects, we bring these stakeholders together and share insights, backgrounds, and experiences. We position ourselves as a facilitator, the hub within the quadruple helix where businesses, knowledge institutions, governments, and society come together to work on the wicked problems of tomorrow.

Transitions are far from straightforward, and energy transition is certainly no exception. This has also led to the development of a substantial scientific foundation for transition thinking. One of the frameworks is the multi-level perspective (MLP). The MLP model assumes that the dynamics of transitions (societal processes of change) always play out on different 'levels.'

The theory suggests that the micro-level is essential to demonstrate that a transition is not only necessary but also possible. It answers the question: can we really change?

Determining accents
Due to technological evolutions and sharpened ambitions on the international, European, Belgian, and Flemish levels (including the EU Green Deal and recovery plans) it was necessary to determine a number of new accents within the defined innovator zones. A strategic roadmap was developed in 4 focus groups, each describing the ambitions, challenges, innovation priorities, and potential impact. In addition, the roadmaps contain a concrete action plan for the coming years to realise the envisaged impact:

- Energy Communities and Positive Energy Districts (EC & PED)
- Renovation (REN)
- Sustainable Thermal Energy (STE)
- Large Scale Energy Storage and Security of Supply (SoS)

The basic outline of this vision for the future, theme by theme, can be found in the infographics in this brochure, along with details of the projects realised over the past 6 years.

Feel free to contact Ariane Decramer (Ariane.Decramer@flux50.com) if you want to learn more about any of the projects or if you wish to get in touch with our companies, knowledge and research institutions, or living labs.

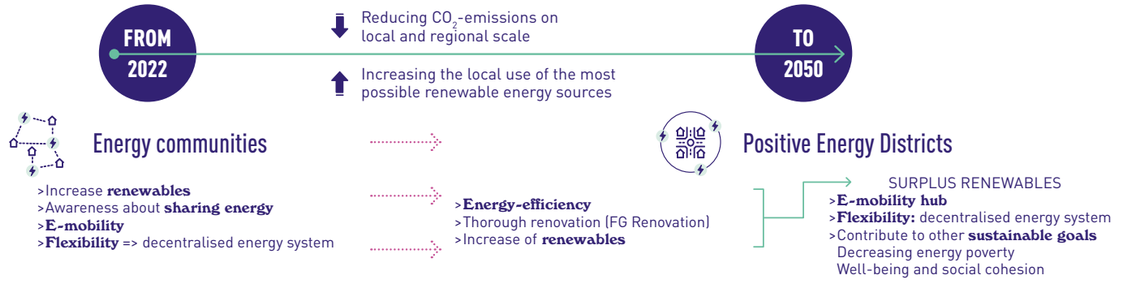
Enjoy the reading!

Frederik Loeckx
Managing Director Flux50

Energy Communities and Positive Energy Districts (EC &PED)

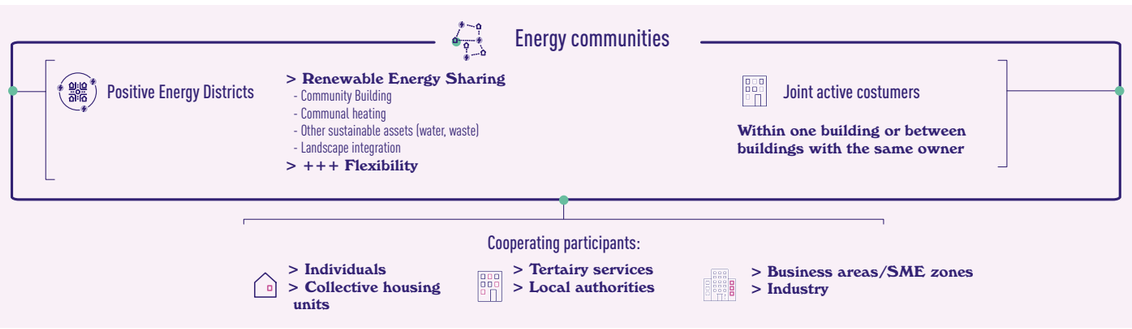
Ambition

Energy communities are a tool for supporting the energy transition. They can contribute to the goals of energy efficiency and renewable energy.



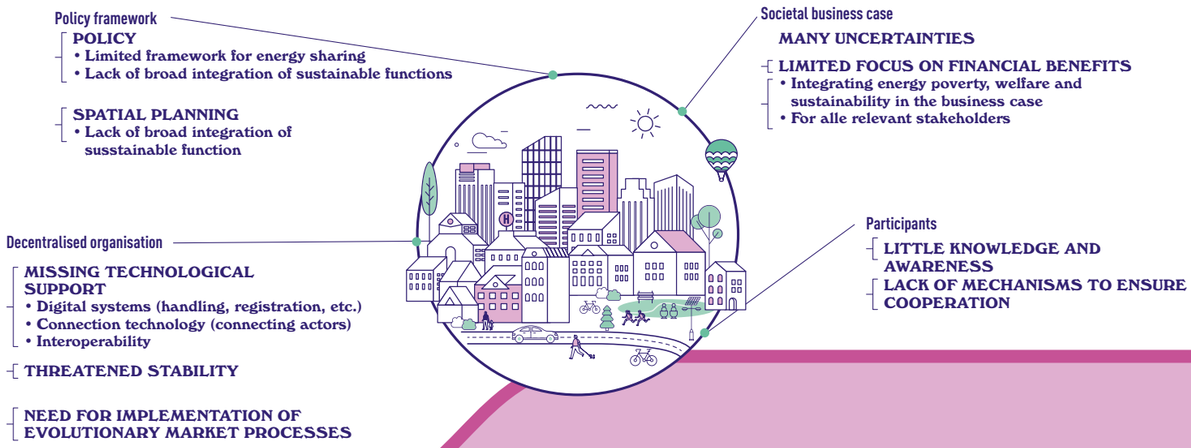
Flux50 scope

In the scope of this focus group, there is a special focus on positive energy districts (PED). They are energy-positive on an annual basis and use a lot of innovations to achieve a climate-neutral, urban infrastructure.



Points of interest in Flanders

The evolution to energy communities is not as clear as first expected. Technical innovations must go hand in hand with an adapted policy framework and a broad social vision.



Energy Communities and Positive Energy Districts (EC &PED)

Connected Buildings

Flux50 action plan

A direct action plan has been established for the coming years that considers all stakeholders.

ACTIONS 2022/3

Activating policies
> Providing solutions
> Actively participate in setting up market processes, -procedures, and systems
> Organising information sessions on urban planning

Re-evaluating the business case
> Energy prices in the year 2022
> View the broad social benefits

Initiating exemplary projects
> Make use of accessible opportunities (industrial estates and SMEs)
> Bringing together market players
> Organising matchmaking sessions

Sensitising and activating participants
> Exporting knowledge and best practices:
- Making implementation easier: innovative technology & market processes
- Eliminating uncertainties
- Organise workshop for practical implementation EC/PED in collaboration with Fluvius

Filling in missing technology
> Identifying gaps
> Launching challenges -> innovation
> Organising information sessions on technological solutions

GOAL 2025

10 Energy Communities

5 Positive Energgy Districts

Impact

In addition to the intended climate ambitions, the evolution towards energy communities opens up economic opportunities.

Consortium:Bagaar, Insaver, June, EnergyVille/ VITO

Budget: € 1.444.160
Grant: € 588.583

This pilot-scale development project is a follow-up to the Connected Buildings feasibility study that showed that the market demands remote energy services that handle data obtained from various home sensors. Residential customers appreciate relevant energy audits without home visits and continuous energy advice based on (near) real time measurements. The consortium aims to offer remote energy advice via the June platform linked to EBECS (VITO/EnergyVille building energy calculation service).

Installing additional sensors for data on indoor temperature, presence in the building, and humidity greatly enhances the accuracy of the delivered advice. This requires the optimal functioning of the full chain of sensors, connectivity, data analytics, and customer approach with advice and investment offers. This advice will trigger consumers to make investments in their homes related to energy efficiency, renewable energy, flexibility, and storage.

The set of sensors and energy investments also ensures continuous monitoring, which collects sufficient data for the learning and improvement process based on artificial intelligence and machine learning.

100 households were provided with the necessary sensors with sufficient stability and data quality from the Nb-IOT network. For customerservice , satellite data was used to determine the volumes of the homes. 3 different types of advice were proposed:

- the most economic situation (fastest payback period),
- the most ecological situation (most cost-efficient way to achieve energy label A), and
- the legal minimum requirements.

To improve the algorithm and advice, 3 different iterations were carried out.

The projects worked out very accurate PV/battery advice based on quarter-hourly measurement data.
Due to corona, the effective installations based on the calculated advice have not yet implemented. The consortium will assist customers to ensure a trouble-free installation.

After installation of the new energy infrastructure, the loop is closed by measuring the data to objectively demonstrate the impact on comfort and cost savings. This will result in a quality stamp for future installations and enable predictive maintenance modelling.

The project provides sufficient insights for further development of products and services for both the B2Cand B2B segments.

COOCK CEMS

Consortium: Volta together with the Eloya, Nelectra, and Techlink federations

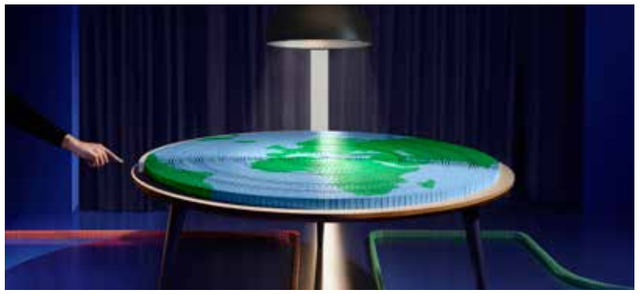
Budget: € 809.584
Grant: 50 to 100 % of the total budget

This is a COOCK project (collective research and development and collective knowledge dissemination) where the emphasis is on disseminating knowledge to the chosen target group. The advisory group acted as an important sounding board in finding the suitable knowledge dissemination.

Customer energy management systems (CEMS) are necessary applications that control the energy management of buildings for consumers and prosumers who want to use renewable energy sources (such as PV), electric vehicles (EV), heat pumps (HP), and smart appliances to achieve climate goals and keep energy costs affordable.

Electrical installers (EI) are the appropriate target group to guide their customers through this energy transition. Through direct contact and the need for quality installations of these new products and systems, electricians prepare the way for new energy services. Through generic cases, the possibilities and applications in this new market of energy management systems become clear. In the project, this knowledge is conveyed by all possible modern educational means such as brochures, webinars, videos, technical articles, e-learning, workshops, and the maakjemeterslim.be website. This website is a useful reference for many installers, containing information from energy management system providers, as well as information on regulations, technical know-how, and the latest innovations.

The ultimate goal of the project is to pick up this market for the entire EI sector. Installers and other stakeholders should retrain for better customer relations, continuity, or reorientation of their business. COOCK CEMS will undoubtedly create new jobs. Flemish manufacturers will also develop products that capitalize energy data provided by sensors, digital meters, and smart appliances.



For the wider society, COOCK CEMS contributes to enabling smart grids: optimising the consumption of renewable energy, spreading consumption to minimize the need for grid capacity, and creating flexibility.

During the project, many events and webinars were organised, the recordings of which have been made available on the maakjemeterslim.be website.

The greatest added value for the installers is the practical information they receive which they can use immediately in their working environment. Through the outcomes of measured data from two houses equipped with an energy management system, we give the installers more insight into its possibilities. We have also set up a practical workshop, see photo below, that allows them to get straight to work in a simulated environment.

Companies from the electrotechnical sector have set up business units offering products specifically for the energy management system (EMS) market. Most companies invest in innovation with their own resources but a few have also applied for subsidies from VLAIO (mostly SME growth subsidy). This is an important step forward as this was previously a rarity within the electrotechnical sector.

Realisation of the Sustainable "Vlaamse Staak" in Opwijk

The ROLECS demonstration

This pilot project, supported by the Flemish region, in cooperation with Haviland, the municipality of Opwijk, POM Vlaams-Brabant, Powerdale, Th!nk E, and Wattson, aims to realise a sustainable energy concept for De Vlaamse Staak SME business park. Because of the high cost of extending the natural gas grid to the business park, alternative sustainable energy concepts were sought.

The feasibility of various alternatives was studied by Boydens Engineering, Fieldfisher, Th!nk E, and Wattson. A true district heating network based on geothermal energy was not considered due to the high investment cost. Heating the buildings based on heat pumps (HP) and solar panels (PV) was suggested as a sustainable solution. Pending the possible establishment of a renewable energy community (REG), an ESCO-light approach is envisaged that optimises the energy concept for each SME individually.

2 elements were important from the start. First, the advice from Wattson on the realisation of the HP/PV concept starting from the design phase of the building. Second, that the dimensioning of the concept elements could be done based on the specific energy needs of each SME. Wattson finances and manages the heat pumps through monitoring, checking energy performance and maintenance. The monitoring system, developed with Powerdale, aims to optimise the energy consumption of each SME. This optimisation is based on active control of various loads (e.g., heat pump and thermal buffer tank, electric charging station for EV, electric forklift truck, etc.)

in function of the available solar energy in each SME. Based on almost two years of monitoring, we come to the following interesting insights:

- A high degree of self consumption can be obtained (75%+) in SMEs with on-site activities and a high level of buffer potential (e.g., air-water heat pump with a thermal buffer).
- In SMEs where much of the activity is on relocation, combined with, for example, an air-to-air heat pump, it is much more difficult to match locally generated solar power with energy demand.
- The added value of a renewable energy community is currently rather limited within the current regulatory framework.

De Zaat te Temse, het Cordeel Business Park 4.0

Consortium: Usage driven power station: Eoluz, i.Leco, Imtech, and Smart Software Development.

Consortium: Hydro energy power station: Cordeel, Ecosource, Eoluz, i.Leco, Imtech, and Turbulent.

Consortium: Optibids: Blueways International, Imtech, Powerdale, Scholt Energy Control, VDL Bus Roeselare, and VUB.

Budget: € 16.554.411
Grant: € 6.862.608

Condeel, the construction company, has a site in Temse, called De Zaat. It is an integrated ecosystem built on 3 pillars.

The first pillar is the usage driven power station development project (budget €3,152,002; grant €1,339,178) where the needs of the users of the various buildings and the profiles of energy production are identified and aligned. The project uses deep learning to log and process data from building occupancy, production processes, energy needs, and renewable generation systems. Energy use is predicted, visualised, and optimally tuned.

The second pillar is the hydro energy power station development project (budget €8,899,005; grant €2,521,720) where innovative energy production processes and storage facilities will be designed, implemented, and tested for further application at other sites. Initiatives include:

- A tidal power plant will be installed at the beginning of the Scheldt dock. An innovative hoover robot will suck up obstructing sand and silt and return it to the Scheldt. A large turbine will be designed with an additional production of 20% compared to two small turbines (from 500 to 600 MWh). This design will be implemented for thorough testing in real operational conditions.
- The energy mound provides a basin of water at altitude to which water is pumped with surplus renewable energy. This delivers electricity back via a turbine in the event of a shortage of renewable energy.
- Simulations are being carried out on an innovative small-scale turbine, pending final design and installation. A variation of the turbine provides maximum flexibility which is important for efficiency and economic valorisation.

- A building management platform that incorporates the various building management systems for interoperability. To ensure system stability and data quality, an intermediate communication layer was installed for further data transport to the cloud.
- The floating solar panels on the dock have very many applications worldwide. De Zaat will host demonstrations of innovative solutions for the floats, which are usually large in volume, and for the anchors, .

The third pillar is electro-mobility where the expanded vehicle fleet, charging infrastructure, and renewable energy applications will serve as one of the 3 pilot sites of the Optibids ICON project (budget €4,503,404; grant €3,000,608). The current results are already exceeding targets.

- Self-consumption now stands at 68%. The tidal power plant is likely to have a negative impact, but the energy mound can largely compensate for this, so the 65% target is certainly achievable.
- The reduction in carbon footprint (target 10%) is already 23.5% through the integration of external renewable energy sources and storage facilities.
- Energy costs have been greatly reduced by 14.6% compared to the targeted 8%.

Moreover, the EU-H2020 Creators project was initiated to roll out their concepts with demonstrations at 10 different sites across 7 countries and involving 500 SMEs. The focus is on standardisation, forms of financing, setting up energy communities, and the social context to make the applications economically viable. De Zaat aims to achieve CO certification as one of its final objectives.

Energytix

Consortium:Energytix BV, IRC.be, and SDM.

Budget: € 1.690.267
Grant: € 845.134

This project focuses on designing a platform that can support the operation of energy communities, or parts of them, from start to finish. To address this, the project will develop and test the energytix.cloud platform.

In the initiation phase, the project brings companies, individuals, politicians, and other actors together to conduct studies that contribute to the development of a sustainable energy network.

It then enables the smart steering of renewable energy throughout the operation of the energy community. Users can identify, activate, and then closely monitor their energy infrastructure on the platform.

The platform has a number of unique features:
- The system is easily scalable and applicable to different sizes and types of energy ecosystems.
- The workflows are intuitive and easy to follow for all types of users.
- Bi-directional communication is possible for an infinite number of assets.
- Other external services can be easily linked.

Energytix.cloud uses AI, machine-to-machine communication, and machine learning to produce forecasts of energy production and consumption. These forecasts are based on historical data from the transmission and distribution grid, the energy market, own active installations, local meteorological stations, etc. Self-learning algorithms predict energy production and consumption every 15 seconds to minimise imbalance on the grid and to control installations as efficiently as possible. If an imbalance does occur, it is added to the dataset and the platform calculates this situation for the future. To make the model more tangible, a simulator will be developed based on a digital twin. Using hardware controllers, it can simulate all existing installations in the studied energy community to accurately predict future energy production and consumption. This is a valuable tool that increases the usability and simplifies the study phase.

The project is unique in its existence due to the specific combination of state-of-the-art technology and its intended purpose. This will allow measurement, analysis, prediction, and control in a single platform. In addition, the project is applicable to both industrial and private users, as well as to the set-up of any energy community.

After a successful research phase, it has proven possible to develop all the envisaged features for the platform so that Energytix.cloud is ready to be further commercially marketed.

Green Energy Park at Zellik

Project MAMÛET
Consortium: ABB, PowerPulse, Priva Building Intelligence, SDM Projects, and VUB.

Budget: € 4.985.984
Grant: € 3.470.471

Project OPTIBIDS
Consortium: Blueways International, Imtech, Powerdale, Scholt Energy Control, VDL Bus Roeselare, and VUB.

Budget: € 4.503.404
Grant: € 3.000.608

Green Energy Park is located in the Research Park in Zellik and will be a strategic living lab centre for energy and mobility, smart regions, hospital of the future, and bio-tech. The business park will be developed into a local energy system (LES), including an electric microgrid and a district heating network fed from a data centre.

In the context of energy and mobility, the EVERGi team from VUB-MOBI is a partner in 2 interdisciplinary and cooperative research (ICON) projects resulting from the intense feasibility study phase.

MAMÛET (Machine learning for real-time Advanced Multi Energy Trading), the first ICON project, investigates the intelligent management of the LES with energy vectors such as electricity, thermal, HVAC, and mobility by a renewable energy community (REC).

The MAMÛET research themes are self-learning algorithms for state estimation and prediction, optimal management and control strategies, business and exploitation models. One of the first achievements is the smart digital table top. This is an interactive simulator that allows new energy models and algorithms to be tested and visualised in an interactive scale model of the research park.

Optibids (OPTImised BI-Directional & Smart vehicle charging in LES), the second ICON project, aims to integrate electro-mobility into local energy systems. Strategies for smart and bi-directional charging are being designed, as well as DC charging systems, inside and outside the vehicle, in combination with the local DC storage system.

These hardware concepts, with V2G capacity and developed within the project, will be tested together with the smart charging strategies in 3 pilot sites, including the living lab, the smart village lab of Green Energy Park. User behavioural and economic aspects will be investigated by analysing charging data and surveying EV drivers inside and outside the pilot sites. This living lab approach allows the creation and validation of the technology and associated services to take place in real conditions and provide natural valorisation.

Green Energy Park is also a partner in ROLECS, the ICON project that studies the roll-out of energy communities. The first large-scale living lab is under development. The smart village lab, where the smart home in the smart residential neighbourhood is central, makes it possible to develop and test intelligent systems for the smart and sustainable management of various flexible homes.

In the smart home lab, communication between the digital meter and various smart home systems can be put into practice. Electrical and thermal energy can also be exchanged between different smart homes or with a smart energy grid with the collective energy systems such as neighbourhood batteries and collective charging infrastructure for electric vehicles.

The RegEnergy Interreg project will take care of the installation of the electrical storage infrastructure and the European

Regional Development Fund (ERDF) Smart Multi Energy Lab (SMEL) will take care of the development of the electricity distribution network and the electrical installations at the houses (indoor installations, meters, control centre, heat pumps, DHW tank, thermal buffer tank, home batteries, ICT part, security, etc.). Green Energy Park is also part of the ConnectSME project where the unique living lab offers development and testing opportunities to companies, knowledge institutions, governments, and end users.

Managing Uncertainty in Positive Energy Districts Design (MUPEDD)

Consortium: DLA Piper, Endeavour, Groep Van Roey, KU Leuven, REBEL, Stebo, and VITO/EnergyVille.

Budget: € 1.742.331
Grant: € 1.116.340

Established on October 1, 2021, Managing Uncertainty in Positive Energy Districts Design (MUPEDD) aims to conduct fundamental research in the field of techno-economic and social uncertainties: bringing new data and innovative data analysis and modelling techniques to the field of Positive Energy District (PED).

The goal is to expand knowledge on financial, legal, and organisational areas related to the realisation of urban densification projects and PED developments in the wider urban area, with the aim of supporting the decision making process of relevant market players and maximising take-up. For the two use case districts (data pool projects), at least six validated PED scenarios or mitigation strategies will be delivered, covering techno-economic, financial, legal, and organisational aspects, and eight methods around uncertainty mitigation and navigation for urban densification projects. The project plans to achieve a response rate of 35% of households for surveys and meetings in 10 targeted neighbourhoods from the project data pool.

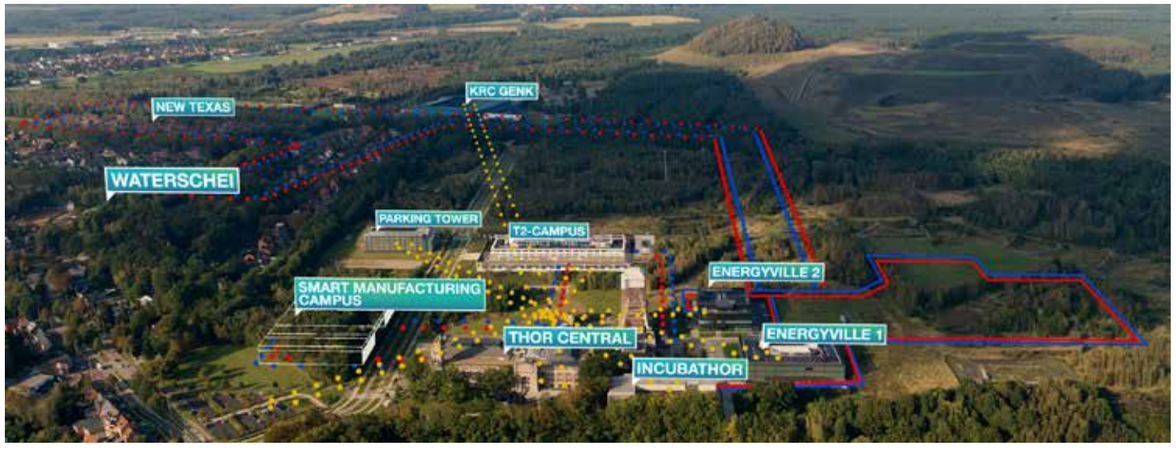
At least five different personas are generated in the two use case projects and at least five key benefits are identified to participate in PED projects with approval of 80% of the proposed personalised benefits and services by the participants in the final phase of the PED project. The optimal communication approach with at least five key parameters will be defined.

This approach will be approved by at least 70% of the participants during the project via a digital or offline contact. Site-specific uncertainties on building energy performance will be reduced by at least 45% by using open data rather than regional or national data. For a robust design evaluation, the tested innovative simulation techniques should reduce the calculation time, compared to traditional Monte-Carlo approaches, by at least a factor 50. At least three sets of minimum data will be compiled to satisfy uncertainty requirements at key decision points during the PED development process. By including sociological and behavioural predictors at the individual level, the success rate will increase by 20-50%. With the inclusion of local data from the design phase, a success rate of about 60% can be achieved during the project based on historical project data.

The project is developing a valid protocol for lab testing and is testing one convincing campaign element to further improve model predictability. A success rate between 60-70% is targeted compared to historical data from reference projects within the consortium. Better management of uncertainties will increase PED uptake by +30% (compared to similar baseline densification projects).

Increased uptake will ultimately lead to 20-30% lower energy consumption (kWh), 10-20% higher renewable energy production (kWh), increased capital investment in renewable energy assets (>10%), and lower operational (fixed and variable) costs (<10%). Optimal stakeholder uptake scenarios, including communication strategies by stakeholder type, have been approved by at least 70% of participants.

oPen Thor Living Lab



From a past of coal to a unique living lab for the future
Based on the challenges of the future and with a clear focus on climate ambitions, Thor Park and its surroundings have become a unique living lab for technology, energy, and innovation.

The breeding ground for this living lab can be found, among others, at EnergyVille, a collaboration between research partners Imec, KU Leuven, UHasselt, and VITO, that is developing the technologies and knowledge to support public and private stakeholders in the transition to an energy-efficient, carbon-free, and sustainable built environment.

EnergyVille is in Thor Park, which was recognised as the first regulation-free zone in Flanders in 2020. This recognition marked the start of a large-scale living lab in which the energy concepts of the future can be extensively tested. Today, this living lab extends over the Thor science and business park, the Nieuw Texas social housing estate, the adjacent Waterschei garden suburb, and the buildings and grounds of KRC Genk. This has made it into a unique ecosystem of residential, scientific, and industrial stakeholders, leveraging large-scale innovation projects - both locally and internationally.

At EnergyVille at Thor Park, in addition to a lot of (inter)national and European initiatives, several research projects supported by Flux 50 are being carried out. For each of these projects, there is intensive cooperation between knowledge institutions and companies.

A selection of these innovation projects:

- Direct current: projects with ABB, BASF, Bekaert, Blueways, Flanders Make, Imtech, KU Leuven, Th!nk E, and VITO.
- Solar energy: projects with Azteq, Borealis, Imec, KU Leuven, Laborelec, Soltech, UGent, UHasselt, and VITO.
- Digital substation: projects with ABB, BASF, KU Leuven, Siemens, Tractebel, and VITO.
- Privacy and servitisation of energy data: projects with AE, BaoLiving, Calculus, Centrica, June, KU Leuven, NXP, Smappee, VITO, and WTCB.
- Energy communities and microgrids: projects with 3E, 70GigaWatt, ABB, Antea, Aspiravi, Blixt, C-Valley, Ducoop, Electrabel, Energent, Farys Solar, Fieldfi sher, Fluvius, Imec, Ingenium, KBC, KU Leuven, Laborelec, Magenta Tree, Metha Advocaten, Openmotics, Powerdale, Quares, Th!nk E, ThermoVault, UGent, VITO, VUB, and Wattson.
- Renovation: projects with AGC Mirodan, Avineon, Imec, June Energy, UGent, VITO, and Zero Emission Solutions.
- Sustainable, smart buildings and cities: projects with Agoria Smart Cities, Ahrend, EcoSource, Flux50, Junovation, Kamp C, Th!nk E, VITO, and VVSG.
- Energy flexibility in industry: project with KU Leuven, UGent, and VITO.
- Electric mobility and smart charging: project with Alfa Technical Installations, Blue Corner, KU Leuven, MOVE, Multiobus, Nextensa, and VITO.
- Advanced design and optimisation of heat exchangers using additive manufacturing: project Iwith KULeuven and VITO.

Power Data Backbone for Digital City Poles

Consortium: Crescent, Imtech Belgium, Powerdale, Safety-Product, and Tres.
Technology supporting partners: Arco Information, Citymesh, Fluvius, KBC, and Nokia.

Budget: € 2.885.621
Grant: € 1.352.344

A digital citypole is is a co-creation model where four societal evolutions converge:

- electromobility with the need for charging points and V2G capabilities.
- the fibre-optic network necessary for the expansion of 5G and self-driving vehicles.
- the energy transition towards decentralised production and DC networks.
- digitalisation with the availability of big data to enable new business models and P2P transactions.

This vision of co-creation is supported by Tres and their collaborating partners: the E2E IoT integrator Crescent, Imtech Belgium for the management of the complex technical projects, Arco Information for the information capture for the digital workflows, Safety-Product for the mechanical aspects of the poles, and Powerdale for the EV charging points and platforms. Added to these are Nokia for the 5G input, Citymesh for the installation of 5G and applications, Fluvius as grid operator, and KBC for reliable financial transactions.

There are powerful drivers for this ' Digital Citypole' infrastructure as it gives cities and towns the opportunity to generate recurring revenue for their public lighting poles that currently carry a heavy maintenance cost. Notwithstanding the obsolescence of public lighting, 40% of the maintenance cost will still remain.

Allowing services and applications on these public transport poles can generate revenues that exceed maintenance costs. Many central cities such as Antwerp, Kortrijk, and Leuven are striving to become smart cities where new applications with big data can be tried out and where citizen participation can emerge in an open network to support citizens' needs.

The development of 5G cells is made possible by their integration into digital city poles. For 5G, a strategy was developed on 'small cells' together with Nokia, where cells were installed every 150m in an urban environment, which requires low levels radiation. For the 70% of city dwellers without a driveway or garage, this also addresses the need for inconspicuous charging points in the public domain for e-vehicles, e-bikes and e-scooters. These charging stations, which disappear into the ground when not in use, are connected to and controlled by the city pole.

So, the sustainable solution is to combine the digital city pole concept with an integrated electricity and fibre network. This is the power data backbone. The use of energy and data is recorded per application. Payment for this usage is made by an energy and data usage package that takes into account the type and usage time of the application.

Certification of hardware and applications is necessary because confidential data is handled and asset management needs to be done. That is also why the financial institution uses Blockchain technology for the payment transactions. For standardisation and user-friendliness, one solution is to set up an energy ledger for all charging operators.

A growth path towards roll-out and commercialisation was mapped out starting with a demo set-up at the Arenberg Science Park followed by an initial implementation at a business park of 24 digital smart-prepared DC poles of which four poles are 5G-prepared. Subsequently, the project will proceed with the installation of 20 digital 5G-prepared poles at the Arenberg Science Park. One of the project's ambitions is to create a testing ground which covers the Gasthuisberg, Science Park Arenberg, Faculty of Computer and Engineering Sciences, and OHL area where all kinds of future-oriented applications can be tested. Self-driving shuttles is just one example of those future-oriented applications.

Privateflex

Consortium: AE, Centrica Business Solutions Belgium, KU Leuven, NXP Semiconductors Belgium, and Smappee.

Budget: € 2.650.152
Grant: € 1.850.535

The flexibility (Flex) of household appliances or batteries needs to be aggregated across hundreds of households to extract volumes big enough to be tradable on energy markets or to provide ancillary services. A home controller determines the local available flexibility, but customers do not want to share their raw data easily. However, the aggregator needs to know the total amount of flex in the system to use it efficiently. Likewise, the customer also needs to know how much flex is deployed when, and this must be verifiable.
One solution to this is to calculate flexibility with encrypted data (COED).

The project therefore aims to achieve the following objectives:
1. Design security, communication, and process architecture on the local energy management system.
2. Evaluate the COED algorithm for flexible computation without releasing local data outside the household. Flexibility is determined via machine learning.
3. Maintain privacy via homomorphic encryption and secret share information.
4. Implement specific coordination strategies to manage demand.
5. Design efficient methods to activate flexibility, scalable to 1000+ customers.
6. Define a mechanism that rewards households for flexible deployment, without releasing private data.

Privateflex is developing a scalable and privacy-friendly energy-flex-trading methodology, which will increase customer acceptance of demand response (DR) programmes, as well as help the evolution towards a smart and sustainable energy grid. For privacy protection mechanisms, the implementation has shown promising results for the non-disclosure of individual data, plus the acceptable calculation times and communication costs that allow sufficient scalability.

In the current proof of concept phase, the project is implementing the solution in a series of Belgian households. This will demonstrate the effectiveness of the algorithms and identify and mitigate thresholds and obstacles to maximise user participation. This knowledge and experience will lay the foundation for higher TRL solutions that will enable cross-sectoral developments for consumers other than residential consumers and prosumers. These solutions will be integrated into existing customer systems for cost-effective GDPR compliance to bring residential flex to market in higher volumes.

The project developed a privacy-friendly reward scheme and a method to check locally whether the requested flexibility has really been activated based on data from the digital meter. The project will enable a better understanding of reference architectures for future energy communities, provide insights into customer behaviour, and open opportunities for network optimisation. Specific questions from new or existing customers within the energy and utilities sector can be solved.

The new market processes (energy sharing, P2P sales, and flexibility trading) need to go beyond GDPR rules in terms of privacy to ensure that individual participants and energy community members that take part in these market processes have sufficient trust in the system. Privateflex is using privacy-by-design and COED to work on inherently better solutions.

SELFIE

Consortium: Aug.e, Branch, DCINERGY, De Watergroep, Imtech, Interleuven, and Powerdale.

Budget: € 4.949.407
Grant: € 2.142.720

In order to reach EU climate targets, efforts must be made to significantly increase the energy efficiency and self-sufficiency of buildings. Energy self-sufficient buildings cannot be realised from heat pumps alone due to the high demand for energy.

The project intends to demonstrate that the path to energy self-sufficient buildings and low energy-consuming sites and districts, is based on maximising the use of heat as a renewable CO_2 neutral energy transition source and reducing electrical losses by maximising the energy efficiency of buildings.

The key to achieving this goal is the integration of the various energy components:
1. Renewable energy sources (solar panels, solar collectors, and heat) that provide 100% of the needed power.
2. Heat storage during summer for use in winter. This stores residual heat ,among other things, as a result of the cooling of buildings.
3. Energy storage which contributes to increasing the flexibility of the energy system by using the available network capacity more efficiently.
4. An autonomous DC microgrid.
5. An energy management system that controls the thermal and electrical power with the capability to convert energy forms if necessary.

The two innovative technologies (heat / DC) are integrated and developed locally at the building and site level in combination with a comprehensive energy management.

The whole of the heat storage and supply has been realized and demonstrated with the connection of a 4,000m2 office building. To demonstrate the progress of the other objectives, several proof-of-concepts have been implemented, including the application and scaling of the successful concepts on the new Keiberg-Vossem business site in Tervuren.

To guarantee the thermal comfort in the building, the main innovation is the adoption of a thermal system and the conversion of heat into current and vice versa. Thermal energy is collected in summer, and released in winter to ensure a comfortable indoor climate year-round. The active cooling and passive heating system used for the winter requires a minimal amount of electric power. The electricity generated in the winter is used to control the circulation pumps, lighting and fans, as well as for the actual operations or charging of electric vehicles.

The main innovation lies in the adoption of a DC microgrid, which should deliver the highest energy efficiency while operating autonomously. At the same time, a fundamentally new electrical architecture has been proposed for the office spaces: a touch-proof DC nano grid.

The overall energy management system integrates all thermal and electrical flows into a detailed simulation model. This is at the core of exploiting all assets to achieve the elf-sufficiency and energy efficiency objectives. After modelling, implementation, monitoring, and evidence-based tuning, the model will result in better valorisation and energy self-sufficiency.

The study and work are currently underway.

Smart Business Area of the Future

Consortium: Continental, Engie Electrabel, Intervest, and Quares.

Budget: € 5.044.033
Grant: € 1.979.841

A feasibility study in 2018 responded positively to two key questions:

- Can the consortium of 4 partners in the Mechelen Noord business area establish a renewable energy community (REG), exchange energy, and guarantee a more stable distribution network?
- Can the storage capacity of electric vehicles, combined with local energy storage, be used as a reliable peak power plant?

The pilot site was launched in early December 2019 to demonstrate that sharing and valorising green energy will increase the penetration of renewable energy sources, reduce the social cost of electrical storage, and avoid network congestion on the distribution network. Mechelen Noord (8.5 ha) has 20 medium-voltage cabins, a peak capacity of 5.2 MW, an annual consumption of 23 GWh, and 3200 parking spaces.

Within the project consortium there is broad enthusiasm to establish an energy community between participating members at Mechelen Campus. Currently, the mapping of their usage profiles in combination with the installation of charging infrastructure is ongoing and solar panels will be connected a subsequent phase.

Simultaneously, a business area in Herentals currently being constructed by Intervest has also shown interest in becoming an energy community. The site also offers a faster transition to placing specific assets, such as solar panels.

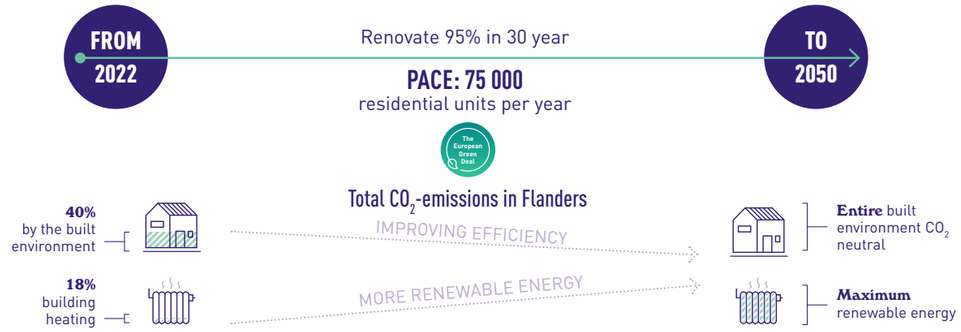
A great deal of attention is also paid to the legal completion of these energy communities. To date, there are still a number of legal restrictions concerning energy communities in the region, but involvement with the grid operator, Fluvius, and regulators is helping to come up with an appropriate and working structure. At present, the installation of the hardware components (digital meters and sensors, PV installations, EV charging points) is being finalised while data capture and processing has already begun.

At a later stage, the energy management system, with the billing system and the business model, will be tested and implemented.

Renovation

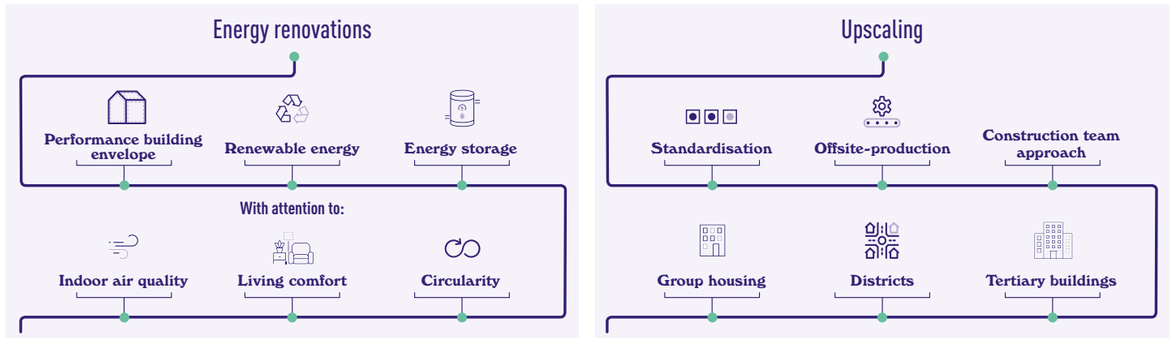
Ambition

It is crucial that Flanders substantially reduces the CO_2-emissions from the built environment. This can only be done by accelerating and scaling up energy renovations.



Flux50 scope

For a successful upscaling and acceleration of renovation there are several bottlenecks that need to be resolved.



Renovation

Building Service Platform BSP4ESCO

Points of intrest in Flanders

Climate neutrality on the building or district level requires an integrated energy approach that pays attention to comfort and quality of life. This integrated approach for upscaling is both technical, organisational, and financial.

Flux50 ambition and actions

A direct action plan for the coming years was established to maximize upscaling of renovation from an innovation point-of-view.

ACTIONS 2022/3

Integration of construction teams & systems
> Inspiration session with cases

Innovate
"One-stop shops for renovation"
> Co-creation event with players from the value chain

Facilitate of collective pilot projects
> Lessons-learnt from ongoing pilots
> Overview of potential cases with decision makers and developers
> Apply innovation and integration concepts

Finance
Developing new models
> Workshop "financing innovative renovation"

GOAL 2025

Development of new renovation models

Establishing living labs

Policy supportive

Impact

There is a huge economic potential for all parties in the value chain from these renonvation ambitions.

VALUE CHAIN

Economic Upscaling

1. **Decision and investment**
> Cities & towns
> Public housing companies
> Developers

2. **Financing**
> Banks
> Project developers

3. **Concept**
> Engineering consultancies
> Architects

4. **Execution and supply**
> Construction companies
> HVAC Techniques
> PV
> Building materials (sustainable & circular)

5. **Maintenance and "energy-as-a-service"**

At an average of **€ 50.000 per renovation** and **€ 600.000** collective **housing units** to renovate in **30 years**
= €30 BN.

Consortium: Beneens, Benetech, Calculus, and Solutes.

Budget: € 523.961
Grant: € 258.528

The development of a building service platform (BSP) aims to support the accelerated renovation of the Flemish building stock and encourages more efficient energy use. This can be done by providing stakeholders with more insights and tools and using the declining workforce in the EU building sector more efficiently. Following a successful feasibility study, this pilot project also investigates whether the BSP is the key to new business models for building ownership and sale.

By combining AI and closely monitoring comfort, air quality, building occupancy, user behaviour, and external weather indicators, the BSP enables energy savings. It also allows the lower sizing of HVAC installations without comfort loss.

The BSP4ESCO project realises the ability to financially monitor building management through an energy service company (ESCO) model. The feasibility and profitability of the ESCO contract can be monitored in real time. An ESCO model of a full design build finance maintain and operate (DBFMO) contract replaces the one-off fixed-price sale with a fixed price throughout the life span of the building for both construction, maintenance, and energy consumption.

During the project, the project partners also successfully implement sustainable building trends such as cross laminated timber (CLT) and borehole energy storage (BES).

Buildings can be built faster, cheaper, and more sustainable thanks to a BSP. Energy consumption can be reduced by up to 15%, as can operating costs over the entire life cycle of the building without any comfort loss. In addition, the lifespan of HVAC installations can be extended by up to 20%.

BSP creates new business opportunities in the form of ESCO contracts. This model can provide financial leverage for the installation of renewable energy sources and energy saving technologies.

The BSP concept has opened up commercial opportunities for each of the project partners in their area of expertise.

Developing Applied Building Photovoltaics for Performance and Reliability (DAPPER)

Consortium: imec, KU Leuven, UGent, and UHasselt.

Budget: € 2.144.216
Grant: € 2.144.216

Starting on June 1, 2021, the DAPPER project seeks answers to the following questions:

- How do we increase the reliability of photovoltaic systems integrated in buildings, the so-called Building Integrated Photovoltaics (BIPV)?
- How do we improve predictions of energy generated by solar panels in or on top of buildings?
- How do we facilitate smart monitoring, predictive maintenance, and energy management?

The project has looked for new designs of facade-integrated PV panels and their power converters, new concepts to optimise integration in building facades and search for the right choice of components, and design rules.

DAPPER has developed data-driven models and digital twins that enable constant monitoring and performance prediction, detect anomalies early, and better predict their mutual interactions. In combination with a physical model of PV panels in a building, this enables better designs of buildings with BIPV and better performance prediction, including lifetime effects.

Part of the project entails looking for data analysis procedures that can be implemented in building energy management systems, in combination with advanced sensors. Links have also been made with related projects such as PV OpMaat (Interreg Vlaanderen/NL) and SolSThore (SALK/EFRO).

Thanks to the results of DAPPER, Flemish companies in the building sector will be able to make better predictions about the performance of PV systems envisaged in buildings making their concepts less risky. By better understanding the factors affecting the reliability of such systems, smarter component choices can be made, which will result in better designs. Energy yield monitoring to reduce operational losses is a standard for large-scale PV installations, but it is too expensive so far to be applied in smaller systems, e.g., on buildings.

DAPPER's project results will help to lower this threshold by enabling integration into energy management systems, which are being implemented in more and more buildings. The construction of new NZEB buildings and the "thorough" renovation of existing buildings has a huge leverage effect on energy consumption, as buildings today consume about 40% of our energy.

The application of photovoltaic technology plays an important role in these works. By making them more efficient, DAPPER significantly supports job creation in the construction sector.

A partner company is planning a new production site at the Thor Park in Genk, where BIPV modules specifically for the construction sector are produced locally. DAPPER is supporting them with the results of the project.

De Sociale Energiesprong

Consortium: BAM Interbuild bv, Cordium cvba, Energinvest bvba, Enervalis, and VEB.

Budget: € 1.506.992
Grant: € 763.764

The De Sociale Energiesprong project aims to accelerate the large renovation backlog within social housing in Flanders in line with the 2050 climate objectives. What makes this approach special is the high speed of renovation and the limited impact on residents during the works.

Three research questions were central:

1. Can a comprehensive and climate-neutral renovation model be developed for social districts in Flanders in order to achieve short- and long-term climate objectives?
2. What are the technical and operational characteristics of such a performance-based energy renovation compared to the classical renovation approach?
3. What alternative and innovative financing possibilities offer solutions to the global budgetary challenges of the Flemish Government, the Flemish Society for Social Housing (VMSW), and the Social Housing Companies?

The Sociale Energiesprong model

The Sociale Energiesprong (SES) model offers a global one-step renovation leading to climate neutrality, with an optimal business case compared to a classic renovation path which requires a second renovation after 20 to 25 years. The technical renovation model is based on off-site prefabricated wall and roof panels (including windows, doors, and PV solar panels) and an energy module with heat pump and control software. Operationally, this allows for a set of 2 to 4 houses to be renovated in about 10 dayscompared to the several months required for a conventional renovation project.

A lot of attention has been paid to the needs and comfort of the residents during and after the works. This requires extremely detailed preparation and very good (almost daily) communication with them.

Financing options

Financing solutions were further analysed, focusing on the specific needs of the Flemish Government, the Social Housing Companies, and the VMSW. This specifically looks at off-balance-sheet treatments that may be made possible by performance-based models such as Energy Performance Contracts (EPC). This contract works with a bonus system. KPIs are set in advance, which are monitored after renovation so that the contractor can be rewarded when KPIs are achieved, and fined if KPIs are not achieved.

Also attached to the project is the renovation of 4 SHM Cordium social housing units in Hoeselt. This pilot project is already showing the positive effects of the efforts made. On average, there is an 85% reduction in energy consumption for heating and a visible increase in user comfort. This, together with good communication and cooperation, ensures a high level of satisfaction among residents. On the basis of the project in Hoeselt, policy recommendations will also be formulated for the Flemish Government so that the Sociale Energie Sprong can catch up.

The next step within this project is to scale up the pilot project in Hoeselt (4 homes) to neighbourhood level. In time, this project could potentially be extended to all social housing in Flanders, which was approximately 173,000 homes at the end of 2020.

Digital Twins For Upscaled Retrofits (DITUR)

Consortium: AGC, AVINEON, EnergyVille/VITO, Imec/SMIT, Imec-mict-UGent, JUNE, UGent – IDLab, and ZES.

Budget: € 3.808.874
Grant: € 2.626.016

The plans for the construction sector are clear: CO_2 emissions must be reduced. Energy consumption will have to decrease, and this can be achieved by using more efficient techniques and installations and better insulating buildings. The EU argues that the biggest challenge for reducing energy consumption in buildings lies in increasing the rate, quality, and efficiency of building renovation.

The DITUR project uses digital twins to investigate the potential of data analysis. This supports the renovation challenge of the current housing stock, throughout the renovation process from identification to realisation, including optimisation of process efficiency for the actors involved in the construction process. To achieve this, the level of detail required in the data models and the costs and benefits of such intensive data acquisition and analysis need to be investigated.

Initially, a digital twin would serve two purposes. It is a tool to provide housing owners with tailor-made insights regarding the energy saving potential for specific and clustered buildings. In doing so, the digital twin could be a digital marketplace for energy-related stock data and data analysis. Besides developing the digital twin itself, applications will be researched and insights built to increase the involvement of citizens (building owners) in the process.

Part of the DITUR project is to investigate possible valorisation avenues of the digital twin model to support renovation. Scaling up to more cities or regions, involving market players, and internationalisation are among the possibilities.

European Digital Innovation Hub-Energy in the Built Environment (EDIH-EBE)

Consortium:
- **Project partners: Embuild Vlaanderen in collaboration with Techlink and Embuild Limburg, EnergyVille, Flux50, Imec, KU Leuven, T2-campus in collaboration with SyntraPXL, UHasselt, VDAB, and VITO.**
- **Supported by: Enterprise Europe Network Vlaanderen, IncubaThor, Thor Park, Vlaams Supercomputer Centrum (VSC), and Voka-Vlaams netwerk van ondernemingen.**
- **Funded by: DIGITALEUROPE, NUHMA / MyCSN, Provincie Limburg (België), and Stad Genk.**

Budget: € 3.350.523
Grant: € 1.675.262 (EU)

Digitalisation is both inevitable and crucial for the competitiveness and sustainability of the Flemish economy. Many companies and public sector organisations working around energy applications in construction are still unaware of all the opportunities offered by further digitalisation.

Yet, the use of advanced digital technologies is essential to improve products, processes, and services. Furthermore, the utilisation of digital toolsaccelerates energy efficiency for the construction and renovation of buildings and neighbourhoods. This will eventually have a significant impact on the energy consumption of Flemish homesand will increase the ease of use of new technologies for residents.

EDIH-EBE
European Digital Innovation Hub Energy in the Built Environment

To accelerate this digital transformation, a central digital and physical access point was established at Thor Park in Genk: European Digital Innovation Hub Energy in the Built Environment (EDIH-EBE). The EDIH-EBE offers various services that increase the digital knowledge and skills of Flemish companies and organisations, giving them a competitive edge. The focus here is on the intersection between construction, energy, and ICT.

EDIH-EBE offers an accessible and centralised system of expertise and support.. All the services needed to achieve a digital transformation can be found online at www.edih-ebe.eu and physically at Thor Park. This approach simplifies digital transformation and ensures a successful transition towards digitalisation.

Companies and organisations looking to prepare themselves for a digital future can turn to EDIH-EBE with their questions.

This one stop hub brings together various actors from the construction and energy sectors and ensures maximum cross-fertilisation between these partners. This collaboration produces key services, such as:
- training, courses, job placement, and internships,
- testing, experimentation, and validation in small demonstrations in digital, physical, and living labs,
- tailor-made expert panels for discussion and advice,
- investment support,
- events that bring the ecosystem together with a focus on innovation, and
- international collaboration.

Moreover, many of these services are offered for free for SMEs, or at different conditions for larger companies, thanks to the support from the Digital Europe Programme, the implementing partners, and the co-financiers: the province of Limburg, the city of Genk, Limburg climate company Nuhma, and MyCSN and the implementing partners.

Medegefinancierd door de Europese Unie

Intellovate

Consortium: Bast Architects & Engineers, Creamo Sustainable Business Creation, E20, and Renotec.

Budget: € 328.671
Grant: € 197.202

When renovating offices, the main focus is on increasing comfort, including in terms of ventilation, heating, and cooling. However, the installation of ventilation ducts in office spaces is considered a loss of space. Incorporating them in an insulated facade would be an asset, as it would have a minimal impact on space utilisation (and therefore on rental income). This added value could justify the increased cost of implementation. In addition, the off-site prefabrication process of the facade parts would reduce construction time and optimal planning could even avoid complete vacancy.

The Intellovate building concept has successfully demonstrated these objectives with a mock-up assembled at Renotec's subcontractor, Jonckheere Projects. The prefabricated panel, with joinery and the necessary ventilation ducts, doesn't reduce

the insulation value. However, the placement of the ventilation ducts on the outside of the facade does require special attention to connections and mounting techniques. And it is also necessary to remove the external cavity leaf of the facade, which causes minimal disruption at the outset. Site time, on the other hand, is limited and can be done without scaffolding. The rapid renovation, limited disruption, and high-quality facade finish enable building owners to reap significant profits when letting or selling.

The concept is ideal for flat and uniform facades with central ventilation. Office buildings built from 1975 to 2006, with flat and uniform facades and central ventilation, are most eligible for the Intellovate concept.

The increased renovation potential of large office buildings is estimated to be around 10%, or 100 office buildings a year. The 10% market share captured by the consortium has led to about 10 renovation projects. In the period from 2025 to 2050, a total of 272 buildings could be realised using the Intellovate concept. This means a total turnover of € 544m over a period of 25 years or € 22m annually, accounting for 11 renovations per year.

The next step is a pilot project to validate the concept on a demonstration building.

Mobile Green Energy Systems (MGES)

Consortium: ACT Research, Cast4all, Creamo, Karybel, KBC, and S2ENSO.

Budget: € 293.120
Grant: € 146.561

Near Grid Solutions develops and builds energy solutions to connect electrical systems to the distribution grid in locations where the distribution grid does not have the necessary capacity.

The use of noisy and odorous diesel groups for events and cities' desire to make events more sustainable meant there was a need for a green energy system. Plus, cities were also looking for ways to electrify their urban fleets and store renewable energy. Indeed, cities and municipalities need support and solutions for energy transition. A mobile battery system can be used by the city for various applications such as temporary charging stations, energy supply at festivals, energy storage of surplus solar energy, and the provision of grid support services.

Analysis

The consortium joined forces to build the necessary knowledge and insights with a feasibility study. The technological exploration provides the design conditions both electrically and mechanically.

Market exploration clarified who the customers are, how these customers can be reached, what their needs and requirements are, what business model to use, and what business case can be identified.

An initial system design of the Mobile Green Energy system (MGES) shows that it is technically possible to meet the requirements as identified in the market exploration.

The examination of the regulatory framework is also important: which standards and regulations must be met? Are there any regulatory restrictions that make it impossible to go to market?

Discussions with the cities of Antwerp and Ghent made it clear that a positive business case is not possible due to the small number of times the MGES would be used.

The priority is to use the distribution network. Prompted by climate and environmental objectives, low emission zones, and the need to avoid odour and noise pollution from diesel, alternative sectors were sought. Construction companies and event organisers showed interest in reports on the carbon footprint, cost of electricity supply, sub-metering for irregularities, and permanent alerts on temperature, water flow, and diesel consumption.

As metier knowledge on electricity proved insufficient for further analysis, measurement campaigns at construction sites and events were carried out by implementing a dedicated MGES visualisation platform. From this knowledge, it emerged that a construction site tower crane would be an ideal testing ground for the MGES battery.

Impact

Near Grid Solutions was established to commercialise the MGES battery as a Green Box. More than a battery, the Green Box is an energy solution for contractors.

The first mobile city battery was presented to press and public at the Vandenbussche yard in Stekene on September 10, 2020.

Soteria

Consortium: Centrica Business Solutions Belgium, Elia, Fluvius, N-side, and Thermovault.

Budget: € 155.826
Grant: € 64.471

Soteria is a collaboration between Centrica Business Solutions Belgium, Elia, Fluvius, N-Side, and Thermovault, under the internet of energy initiative (IO.E) umbrella. The group aimed to design and test a FSP/DSO/TSO coordination and data exchange mechanism, based on IO.E. Additionally, the solution would optimally unlock the available capacity on existing LV networks for FSPs, so that they can offer residential flexibility to TSOs in a network-safe way. Thus, FSPs get more freedom to include residential customers in their flexibility pools, who in turn can earn a little bit of money, and can make their (potentially cheap) residential flex available to society without the risk of developing local network congestion.

Soteria created two key results: first, an interface specification that describes, step by step, the required interactions between the FSPs, DSOs, and TSOs. Second, a subset of this design was fully implemented at two physical locations in the field: measurement data from DSO substations combined with FSP measuring data were translated into available bandwidth on the local network in near-real time. FSPs made location-conscious bids and were allocated a portion of the local network bandwidth based on a market optimization algorithm. This resulted in FCR or aFRR-like activations with residential boilers based on the results of day-ahead (FCR) and 15-minute (aFRR) operating cycles of the Soteria process.

During our tests, the FSP was able to activate 27 boilers at the same location completely without congestion risk. Further tests showed that, for some types of feeders, more network capacity could be unlocked on a single feeder than is currently permitted on an area equal to 6 football fields.

The research shows that the coordination of the process itself, made possible by IO.E, is technically feasible and scalable. Nevertheless, there are also various challenges to be overcome and work to be done to scale Soteria. This is more about producing or processing the data in the Soteria process rather than the data exchange itself. Notable obstacles include 1) the availability of LV measurements and possibly even basic data to calculate "bandwidths" on the granularity proposed for Soteria and 2) the integration of these steps into existing market designs and timetables which are often organized at national or even EU level. This means that Soteria's principles need to be integrated into market systems where many stakeholders have a role to play.

As such, Soteria has drawn up an extensive corpus of work outlining many potential fundamental principles to enable the long-term integration of network-safe flexibility into our electricity grid. Soteria's work clearly shows that an underlying communication platform like IO.E is indispensable to coordinate this type of process. However, this is not enough on its own. Instead, it will need to be complemented by building capacity with each individual stakeholder, step by step.

With an energy system on the brink of disruption, the Soteria team concludes its work and is even more convinced that the challenging path ahead of us must be taken by bringing together the long term skills and perspectives of all stakeholders of the energy system.

Living lab XMPL / Snowball

Consortium: Amplifino, Smappee, and Yuso.

Budget: € 2.894.729
Grant: € 1.291.492

Buildings today account for about 40% of the total energy consumption and 36% of CO_2 emissions in the European Union. The XMPL living lab consortium at Snowball, aims to reduce this amount. The project is a collaboration between software developer Amplifino, Home Energy Management System developer Smappee, and energy supplier Yuso assisted by Howest and UGent and with the support of Flux50, and VLAIO.

Snowball's pilot is building a brand new and future-oriented energy management system based on artificial intelligence. A variety of new energy technologies has been installed in the pilot. For instance, the Snowball site is cooled and heated with a 300,000-litre ice buffer, there is a 180 kWp solar farm, a 2.5 MWh battery to store surplus solar energy, and an AC and DC charging park for 50 electric vehicles. Snowball is also equipped with a range of IoT sensors, from which 2 million data points are collected daily. These datasets are used to build forecasting models and algorithms.

On this basis, the entire site is monitored and controlled, with no loss of comfort. It has also resulted in significant savings in

energy costs. The new energy management system goes one step further and generates revenue by leveraging its flexibility in the energy market. This is an additional incentive for the end user, making the implementation of the state-of-the-art energy management system an obvious choice.

Today, the consortium validating and optimising the models. As a demonstration area, Snowball continues to develop, for example through the Interreg ConnectSME project. As a brand new Cleantech hub, Snowball aims to facilitate and promote sustainable entrepreneurship. "Lead by example" is Snowball's adage. The XMPL living lab therefore fits perfectly into this picture.

Sustainable Thermal Energy

Ambition

The Sustainable Thermal Energy focus group investigates how the sustainability of thermal energy in the built environment can be accelerated. Heat pumps and heat networks are receiving special attention.

FROM 2022 → 100% sustainability **OF THERMAL BUILDING ENERGY** → **TO 2050**

85%
energy demand in the residential and tertiary buildings sector **for heating + sanitary warm water**

Growing demand for **cooling**

85%
energy demand supplied by **fossil fuels**

< 1%
applications are for **heat pumps + heat grids**

Heat pumps
Talk of town → **Action of the town**

Heat grids
Large-scale heat network initiatives
→ **making them future proof**

Flux50 scope

The scope includes thermal comfort as a whole with focus on existing buildings for various sectors.

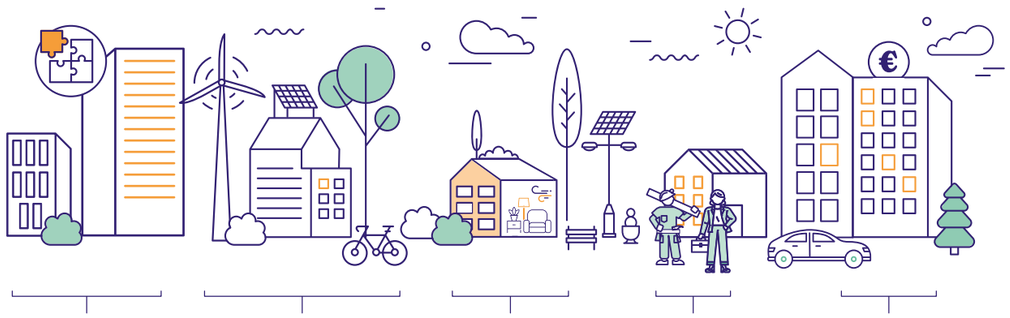
Thermal comfort
- Heat
- Cooling
- Airconditioning

Type
- 3,5 million existing buildings

Application
- Residential
- Small business areas
- Tertiary

Points of intrests in Flanders

For the transition to sustainable thermal energy, it is important to pay attention to several technical, financial, and societal needs.



Lack of systems integration
- Selection tools and dimensioning
- Intelligent steering
- Hybrid combinations without lock-in
- Integration in renovation concepts (low T)

Need to focus on sustainability
- Materials
- Refrigerants

End-user expectations
COMFORT:
- Healthy indoor climate
- Comfort-as-a-service
- No noise pollution
- Compactness

Need for training and motivation
- Customised training for installers
- Targeted motivation of project developer

Affordability & inclusiveness

Sustainable Thermal Energy

Flux50 action plan

To realise the intended ambitions towards 2050, a direct action plan for the coming years has been established.

ACTIONS 2022/3 → **GOAL 2025**

HEAT PUMPS

Inspire
> Deep dive "heat pumps in a one-stop shop for renovation"
> Inspiration session "hybrid heat pumps in an integrated approach

Facilitate
> Event: "Innovation meets market" (lessons-learnt from pilot projects)

Reliable investment
> In existing (Flemish) buildings
> For residents /project developers

Quality installers
> First pole
-> Enable full breakthrough

HEAT GRIDS

Positioning
> Roadmap meetings with large-scale heat grid initiatives

Consultations
> Input Heat Plan Flanders 2025

5 projects for 2025-2030
5 different cities with innovative heat grid breakthroughs in progress

Impact

A transition to "thermal energy" includes economic opportunities for all suppliers in the value chain.

VALUE CHAIN HEAT GRID & HEAT PUMP

Design
> Consultancies
> Architects

Supply of components
> HVAC
> Controllers
> Energy Storage
> Pipes
> PV
> Floor heating

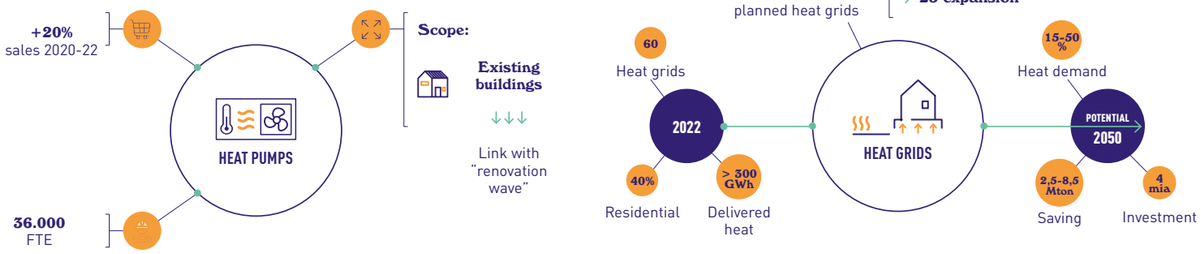
Service providers
> Energy suppliers
> Comfort as a service

Investment
> Property developers
> Public housing companies
> Cities and towns
> Energy-as-a-service

Distribution

Installation and maintenance
> Installers
> Maintenance technicians

The economic opportunities are reflected in investments to replace installations for both heat grids and heat pumps as well as in the need for a significant workforce for the installation and renovation sector.



The Community Hybrinator

Consortium: Ecopower, Efika Engineering, EnerGent and EnergieID.

Budget: € 330.872
Grant: € 161.260

EU climate targets and current political events call for feasible and quick solutions to become independent from fossil fuels. Extensive renovations are difficult to implement by households and commercial heat pump solutions are often very expensive and usually incompatible with other brands' solutions.
A solution that is more open and cheaper is urgently required.

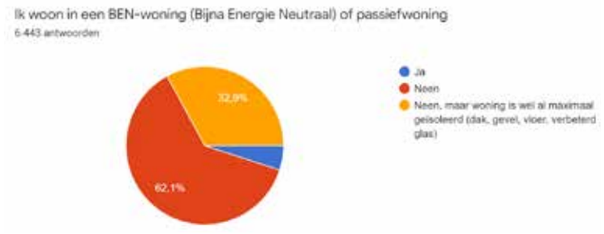
Therefore, the following objectives were prioritised:

1. Calculating the market potential of hybrid heat pumps via an analysis of the Flemish housing market, data analysis from EnergieID, and a survey of 60,000+ participants from the cooperative Ecopower and Energent.

2. Testing 3 different hydraulic integrations of the hybrid heat pump. The hybrid heat pump with buffering as a thermal battery increases self-consumption and substantially replaces the share of fossil gas in existing homes.

3. Investigating smart control and aggregation to integrate hybrid heat pumps into a controllable energy community.

The large-scale data analysis gave a unique insight into existing techniques and willingness to invest by Flemish households. It showed that gas boilers make up just under 70% of heating



appliances, 95% of the households have high-temperature heating with radiators or convectors, and that even for motivated participants it is not straightforward to renovate thoroughly. As a result, a relatively limited intervention, such as a hybrid heat pump, turns out to be 1 of the best alternatives to quickly save CO_2 in existing homes. A hybrid heat pump with flexible heat storage is a heat pump coupled to an existing gas heating system.

3 installations were successfully implemented. Depending on the solution chosen, 51% to 97% of gas was replaced by green electricity during the project. This result has since been further improved. A self-consumption rate of over 33% was achieved in all homes, with PV installations covering the entire consumption, including heat pumps. With current gas prices, the cost-benefit analysis has become positive for the end user.

The systems are controlled by an open-source smart home controller (i.e., the COmmunity FlexibilitY box or COFYbox) to increase their consumption of renewable energy and enable price-based demand response. This energy management system is being further developed in one of the largest community-driven developments in Europe. These developments should also enable a user to join a cVPP (community-driven virtual power plant) that enables citizen energy communities to offer collective flexibility services.

Finally, the project has provided insights to support the evolution towards real-time energy delivery (Ecopower) and for use in larger renovation projects (Efika).

Transition Sustainable Heat

Consortium: Kelvin Solutions, Umicore and Warmte Verzilverd.

Budget: € 252.375
Grant: € 151.425

This project aims to develop a (replicable) methodology to move from steam-based high-temperature heat to lower temperature in industry, based on renewable energy sources. This transitional strategy should address technical and financial challenges and risks, resistance to change, and many other obstacles.

In the first phase, a study was conducted on the typical processes and temperature regimes in 5 different industries. This was to refine existing insights and expertise. Flemish and international best practices were screened for their technical solutions, financial model, as well as critical (non-technical) frame conditions for the approval process.

In the second phase, we collaborated with industry process experts on these critical decision criteria and possible transition strategy solutions. The result was translated into a standard methodology, which was applied in the practical third phase.

The application and testing at Umicore and a major pharmaceutical player in Puurs were extremely positive and created the necessary impact. It provided the pharmaceutical company with a clear and well-founded future vision for the realization of their internal sustainability goals in conjunction with their expansion plans in Puurs. At Umicore, it not only provided the required buy-in from the management and corporate levels, but also released the necessary budgets and even increased internal sustainability ambitions.

The output of the projects is estimated at € 20 to 40m and € 10 to 20m, respectively. The ambition is to reduce CO_2 by more than 30%.

The developed methodology is currently also being actively applied at other industrial companies including Aurubis in Olen, Imec, Kaneka, and Metallo (Aurubis) in Beerse. At Kelvin Solutions, for example, the developed methodology has become an innovative asset that supports their further economic development. Socially, this project is contributing to the transition to sustainable industrial heat.

Upheat INES

Consortium:
- **UGent - Thermal Machines (TM): Prof. Steven Lecompte**
- **UGent - Applied Thermodynamics and Heat Transfer (ATHT): Prof. Michel De Paepe.**
- **KULeuven - Heat Integration into Smart Energy Systems (HISES): Prof. Sylvain Quoilin**
- **KULeuven - Flexible Heat Pumps and Cooling Systems (FHP-CS): Prof. Alessia Arteconi**

Budget: € 760 450
Grant: € 760 450

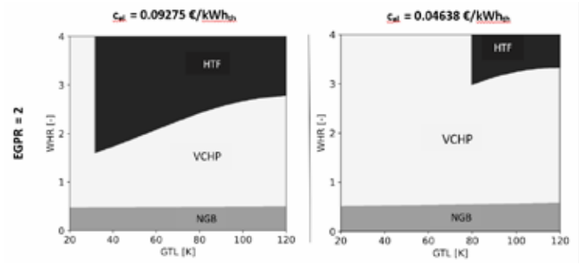
Upheat-INES aims to address the fundamental challenges for the implementation of high-temperature heat pumps delivering heat up to 200 °C. By reaching these temperatures, heat pumps could meet 37 % of the European industrial heat demand. The electricity required by these heat pumps can be fully renewable.

In Upheat-INES 1.0, the lack of awareness of innovative industrial heat pump (VCHP) applications was tackled by the development of a comprehensive database with integration concepts for distillation, drying, thermal oil heating, and steam production. Financial competitiveness with other heating technologies has been demonstrated for natural gas boilers (NGB), electric boilers (EB), and heat transformers (HTF). In this analysis, different gross temperature lifts (GTL), waste heat availability ratios (WHR), electricity prices (cel), and electricity to gas price ratios (EGPR) have been considered. Figure 1 highlights the potential under specific boundary conditions.

The integration of high temperature heat pumps has been further accelerated by improving its performance. To this end, a thermodynamic and financial optimization framework was developed. Within this framework, the working fluid, detailed cycle configuration, and operating conditions were optimized.

This was applied to a large set of generic and specific process data to identify an innovative proof-of-concept (POC).

The POC uses a mixture of water and ammonia, which has been shown to be highly efficient with several technical benefits. Furthermore, it is an environmentally friendly and future-proof choice. The design forms the basis for the construction of a laboratory scale heat pump capable of delivering about 100 kW of heat at temperatures up to 200 °C. This POC will be constructed and extensively tested Upheat-INES 2.0, the continuation of Upheat-INES 1.0.



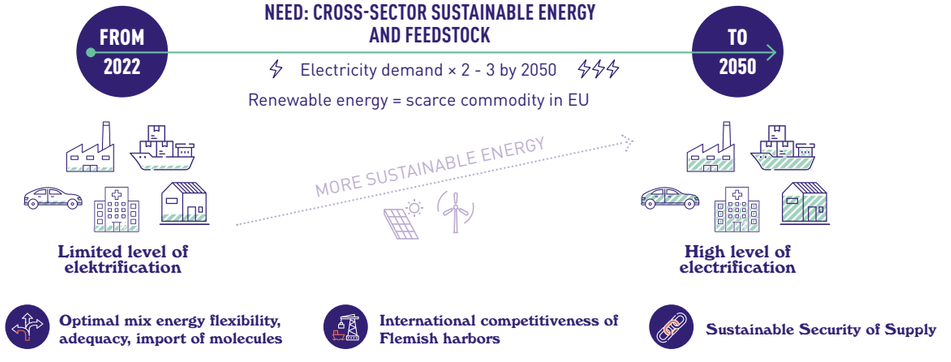
FLANDERS INDUSTRY INNOVATION MOONSHOT

In samenwerking met CATALISTI

Large-scale Energy Storage & Security of Supply

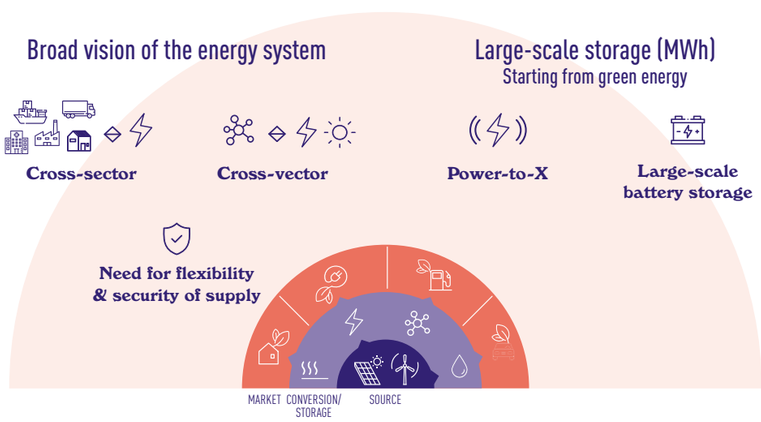
Ambition

In orrder to make the growing electricity demand sustainable, a major increase in renewable energy is needed. This focus group examines how we should innovate large-scale energy storage and security of supply.



Flux50 scope

The scope focuses on a broad vision, of the energy system and storage, and elaborates on the role of various energy storage options in this broader framework.

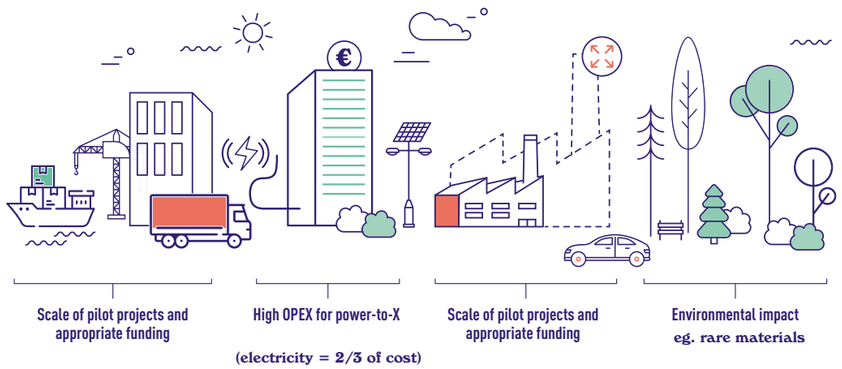


Large-scale Energy Storage & Security of Supply

ARCLATH

Points of interest in Flanders

A broad vision calls for cross-sector and cross-vector energy plans and related (large-scale) investments.



Flux50 action plan

Overarching cooperation (also with other spearhead clusters) is central in the established action plan for the coming years.

ACTIONS 2022/3

- **Positioning overarching energy plan**
- **Innovation flow through to pilot projects** (e.g., Power-to-X, battery storage)
- **Co-organisation of a stakeholder event**
  - > International energy import value chain
  - > Role of energy and molecules

GOAL 2025

- **Innovation in concrete cross-sectoral energy plan**
  - > Phased approach
  - > International context
- **Energy import value chain**
  - > Minimum 1 being carried out
  - > International

Cooperation between clusters

Impact

Investment projects in this domain are typically large-scale infrastructure projects that may even have an international dimension. They are crucial for our harbors as a whole.

VALUE CHAIN

Concept
> Study, engineering agencies

Transport & conversion
> Harbour companies
> Network operators for energy/molecules
> Shipping
> Producers of storage/conversion technologies

End use
> Energy suppliers, BRPs, aggregators
> Flemish industry (ETS-non-ETS)

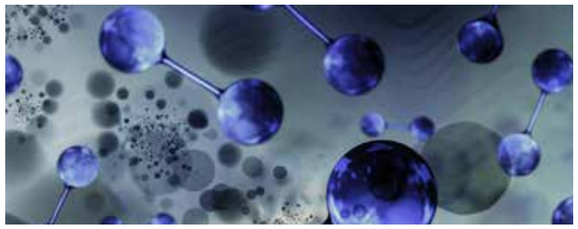
Investment projects
(€5m up to > €50m)

IImport sustainable molecules:
H_2 import study
> 2035 110 TWh
> 2050 750 TWh

Consortium: Johan Martens (coordinator, KULeuven), Sara Bals (UAntwerpen), Pegie Cool (UAntwerpen), Joeri Denayer (VUB), Silvia Lenaerts (UAntwerpen), Pascal Van Der Voort (UGent), Veronique Van Speybroeck (UGent), Johan Verbeeck (UAntwerpen), and Sammy Verbruggen (UAntwerpen).

Budget: € 1.474.775
Grant: € 1.474.775

Arclath (Artificial clathrates for safe storage, transport, and delivery of hydrogen) is a sprint CSBO project that ran from March 2019 to November 2021 as part of the Moonshot initiative's energy innovation research project (MOT4). This programme is funded by the Flemish Government with the aim of using innovative research to encourage breakthrough technologies that reduce the carbon intensity of Flemish industry. Specifically, the MOT4 track focuses on the huge carbon emissions resulting from energy consumption in the energy intensive sector . The Catalisti and Flux50 spearhead clusters are working closely together on this.



The global rollout of hydrogen as an energy vector is hampered by the lack of an energy-efficient and safe way to store and transport hydrogen gas. Hydrogen is usually as a compressed gas (compression) or as a liquid (liquefaction). The high pressures required for compression, typically between 350 and 700 bar, require energy and costly pressure-resistant installations. The liquefaction of hydrogen occurs at -253 °C, making it very energy intensive. Our research has uncovered an alternative storage technology, namely the adsorption of hydrogen molecules in clathrate hydrates. Clathrate hydrates, or clathrates for short, are ice-related materials composed of a sequence of water molecules (Figure 1). The structure of these materials consists of cages just large enough to store small molecules such as methane, carbon dioxide, and hydrogen.

The formation of hydrogen clathrates by cooling water in the presence of hydrogen gas requires very high pressure of above 2000 bars, making practical application impossible.

Figure 1. Environmentally friendly hydrogen clathrate hydrate on a palm warming up and melting.

The ARCLATH project aims to enable hydrogen storage in clathrates at practical pressures by stabilising the clathrates. Specifically, this involves the development of porous materials that influence the kinetics and thermodynamics of clathrate formation (Figure 2).

Figure 2. Electron microscopy image of two porous materials developed within the framework of ARCLATH.

In this way, the ARCLATH consortium has succeeded in storing ≈ 3 weight% hydrogen in a clathrate hydrate at 60 bar and a temperature of -3 °C. This amount corresponds to the amount of hydrogen stored in a pressure vessel of the same volume at 350 bar. Development of new porous matrix materials will allow the synthesis of new clathrate structures with ever-increasing hydrogen storage capacity (Figure 3).

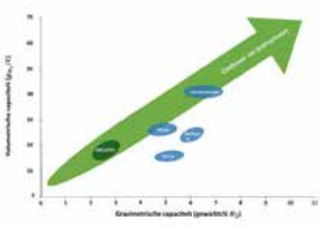


Figure 3. Volumetric and gravimetric storage capacities of hydrogen storage technologies. The green arrow indicates the potential of hydrogen clathrates and ice structures.

At the same time, the ARCLATH II follow-up project also envisages scaling up the experiments and developing processes and storage reservoirs to translate the results obtained into a practical application. The potential impact of ARCLATH is significant, as it can solve an existing technology gap. The safety, energy efficiency, and environmental friendliness of clathrate technology compared with the transport of hydrogen in the form of ammonia and hydrogenated polyaromatic hydrocarbons make the technology potentially applicable everywhere. Clathrates can help with public acceptance and the entry of hydrogen technology.

FLANDERS INDUSTRY INNOVATION MOONSHOT

In samenwerking met CATALISTI

Digital Substations (DIGSUB)

Consortium: BASF Antwerp, ENGIE- Laborelec, ENGIE-Tractebel, Hitachi Energie, KU Leuven, Siemens, and VITO.

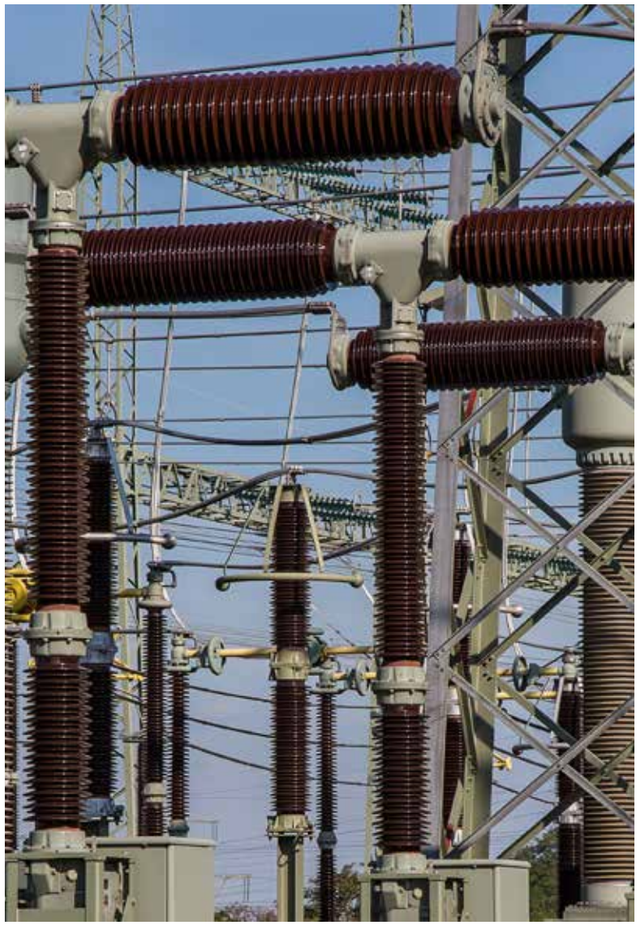
Budget: € 1.282.208
Grant: € 896.991

The transition to digital substations requires current substations to change secondary equipment from traditionally wired, copper analogue cables to digitally connected components, for example using fibre optics. This has clear advantages in terms of complexity, size, configuration time, and cost. In terms of standards, IEC61850 is being promoted internationally to ensure that all components, with different functionalities and from different vendors, work together seamlessly. Even with the obvious advantages of digital substations, adaptation is too slow due to uncertain reliability, limited staff knowledge (requiring in-depth knowledge of both power systems and ICT), and the reliability level of legacy systems.

The overall aim of the project is to make the digital substation concept more acceptable to the end user through robust reliability assessment with methodologies and tools for faster testing, better fault management, and faster deployment. The Digital Substations (DIGSUB) project developed a risk assessment in the form of a failure mode and effect analysis (FMEA) which includes a detailed analysis of digital substations and their potential failure behaviour. DIGSUB has also developed a lab-scale digital substation and drafted semi-automatic test procedures for IEC61850.

Both the test procedures and the guidelines will lead to reduced engineering time when setting up a digital substation. Although the project is not yet finished, the estimated benefits appear to be feasible. The digitisation of high voltage (HS), medium voltage (MS), and low voltage (LS) grids is a necessity for the energy transition. Short installation time, more cost-efficient operation through better fault detection, and targeted preventive maintenance are favourable factors for smart grid management.

The knowledge institutions will set up a competence centre for digital substations where users and manufacturers can meet to test integration without compromising their actual system operations. Looking to the future, this will also include offshore digital substations due to the growth of offshore wind farms. Starting from a feasibility study and a research project to a full scale development and demonstration project, these digital substations can form a pathway to an application that ensures the cost-efficient operation of wind farms.



InduFlexControl

Consortium: EnergyVille, KU Leuven, UGent, and VITO.

Budget: € 1.500.000
Grant: € 1.500.000

InduFlexControl (or in full: "control algorithms for flexibility in power-to-X and industrial processes") is a sprint CSBO project that ran from March 2019 to November 2021 as part of the Moonshot initiative's energy innovation research project (MOT4). This programme is funded by the Flemish Government with the aim of using innovative research to encourage breakthrough technologies that reduce the carbon intensity of Flemish industry. Specifically, the MOT4 track focuses on the huge carbon emissions resulting from energy consumption in the energy intensive sector. The Catalisti and Flux50 spearhead clusters are working closely together on this.

In this context, InduFlexControl has developed data-driven modelling techniques and control methodologies to harness the flexibility of energy-intensive industry and enable its active participation in energy transition, while remaining cost-efficient and minimising CO_2 emissions.

To this end, these techniques take into account:
- relevant energy-intensive processes and their auxiliaries such as steam or refrigeration,
- the technical and economic constraints of these processes, and
- energy markets and networks, all of which may affect achievable energy flexibility.

We use radically new control and steering techniques that integrate predictive controllers with strong process knowledge (model predictive control) and data-driven machine learning solutions (deep learning). This enables the constraints of industrial processes, energy market design, and energy network configuration to be combined to unlock and usefully apply industrial flexibility.

These techniques allow us to combine the best of both worlds, in other words, model-based approaches for robustness and model-free/data-driven techniques to address the uncertainty and complex nature of energy-intensive processes. In its follow-up project, InduFlexControl is looking into how the integration of power-to-X technologies, storage, and ultimately the alternative design of selected components in energy-intensive industries can further increase the flexibility available to reduce the carbon intensity of energy-intensive industries even more.

FLANDERS INDUSTRY INNOVATION MOONSHOT

In samenwerking met CATALISTI

Multi-DC MULTI-MACHINE ENERGY MANAGEMENT

Consortium: BASF Antwerpen, Bekaert, Blueways International, Flanders Make, Imtech Belgium, and KU Leuven.

Budget: € 2.318.461
Grant: € 1.490.240

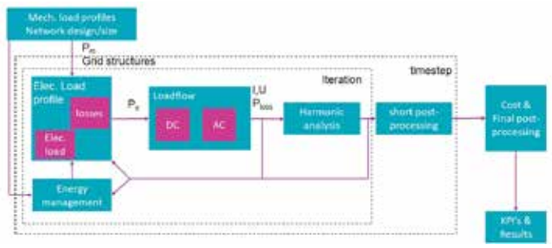
Industrial electrical systems have an ever-increasing number of power electronic inverters. Indeed, their use results in more efficient variable-speed machines and facilitates the (future) integration of storage to reduce downtime. In the proposed MultiDC project, we aim to interconnect the internal DC buses of machines to reduce the number of power electronic converters and their respective connection capacities. In the process, efficiency also improves, harmonic contamination due to passive rectifiers decreases, and filters are eliminated. This brings about a much more efficient platform to share energy between machines and enables the effective integration of electrical energy storage.

Compared to the current AC grid, an industrial DC system will result in a halving of the installed power conversion capacity, lower losses (-5%), and higher availability, or in summary a lower total cost of ownership. However, today there are hardly any validated DC system architectures and consequently there were no methods to evaluate, assess, or compare them; neither between each other nor with the current situation. Secondly, an overlapping control architecture for stable, safe, and effective operation of these systems was also lacking. Consequently, very little experience was available and there were no real-world guidelines for robust industrial DCs.

MultiDC aims to enable the use of industrial DC systems, with lower investment (CAPEX) and operating costs (OPEX) and higher availability, through experimentally validated innovative DC system architectures, integrating modular storage, real-time power management and small-signal stability. MultiDC provided the necessary supported tools to enable performance assessment, design, sizing, and comparison of these innovative DC architectures.

Multiple system architectures were proposed within the project, and ultimately a design tool was created to gather this knowledge and apply it to each generic case through an automatic calculation. The process followed by the algorithm is visualised in figure 1 below. The user has to specify certain load profiles and the network topology of the system. During each time step, a load flow calculation is made based on the load during that time at the DC level. Then the AC part of the network is calculated in a load flow using the DC load flow as reference. After all the time steps are iterated, the overall result is calculated based on some predefined KPIs which were the result of an extensive discussion between the partners.

Industrial use cases were developed to achieve higher energy efficiency (Bekaert and Imtech) on one hand and higher system availability (BASF) on the other.



Hydrogen Panels

The Rolecs "Oud-Heverlee"

In 2019, Professor Johan Martens of KU Leuven, together with his colleagues Tom Bosserez and Jan Rongé, made world headlines with hydrogen panels. These panels convert water vapor from the air into hydrogen gas using sunlight.

Hydrogen gas is considered one of the renewable energy carriers of the future, especially if it has been produced from green energy sources. It can be stored and transported. Green hydrogen will undoubtedly be used intensively in industrial processes. The use of green hydrogen will significantly reduce CO_2 emissions in the long run.

For their hydrogen panel, the researchers do not use a normal electrolyser, but rely on a steady supply of water from ambient air via a process called 'water splitting'. This combined with the electricity generated from solarpanel, they can produce green hydrogen in a single compacted package. This is the 'hydrogen panel'.

"We get a yield of up to 15 percent, that is, 15 percent of the solar energy that falls on the panel is converted into chemical energy that is stored in hydrogen gas," explains Martens.

Flux50 played a role in the further development of the hydrogen panel by supporting the first real life demonstration in a residential home as part of the ROLECS interdisciplinary cooperative research project. A panel, measuring 1.6 metres by 1 metre, produced hydrogen gas in the summer. This fuel could then be used for heating and electricity production in the winter. The property also has solar panels for electricity and a solar boiler for hot water. On paper, the three techniques together should be sufficient to produce enough energy all year round.

Flux50, together with Catalisti, also follows the steps towards market introduction in the HyPPr later stage innovation project within the framework of the Moonshot innovation programme.

The HyPPr project aims to develop a pilot manufacturing line and living lab that supports the design, upscaling of production, and integration of these innovative hydrogen panels. Both projects are funded by VLAIO.

3RConnect

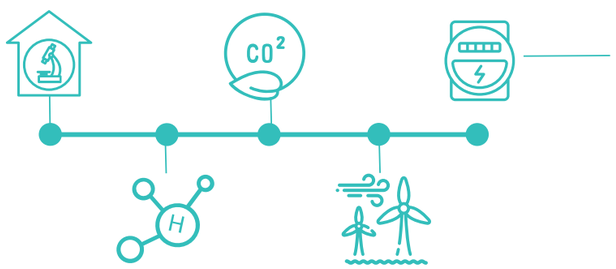
Flanders is buzzing with energetic expertise you can rely on. Our region is your perfect gateway to the European Union.

Flanders Leads the Way in Innovation

Energy Assests in Flanders

4 Energy Living Labs

Carbon Capture Hub



Hydrogen Hub

Offshore Wind Expertise

Energy Management

- Capacity pricing through efficient peak management
- Maximisation of self-use
- Dynamic tariffs
- Flexibility.
- P2P sales
- Energy sharing
- 61 Flemish Energy Management and Steering Systems summarised on maakjemeterslim.be

Flux50 Ambition

As a spider in the web of the complex systems in the energy transition Flux50 network connects you to the most innovative quadruple helix, success stories and top notch technology of the energy ecosystem in Flanders.

Consortium: CLEAN Danmark, Comissao de Coordenacao e Desenvolvimento Regional do Norte PT, Flux50, Greater Copenhagen Danmark, Smart Waste Portugal, and VLAIO.

Budget: €499.644

The Circular Economy Action Plan (CEAP, 2020) is an important cornerstone of the European Green Deal. The commitment to recycling and maintaining critical and strategic materials (Critical Raw Materials Act, 2023) should make Europe less dependent on imports. And the Net Zero Industrial Green Deal targets a dedicated European ecosystem for the production and innovation of so-called 'net-zero technologies' in view of the Union's 2030 decarbonisation target.

3R-Connect aims to bring together technological innovation for circularity from different regions into one project. It falls under the European Innovation Ecosystems" (Horizon) work programme, which aims to ensure connectivity between regional systems to accelerate new technological developments for pressing societal challenges.
Transitions such as the one towards a circular economy require a holistic systems approach that brings the quadruple helix together and also connects different regional competence centres.

3R-Connect is starting from three core regions: Flanders, the Greater Copenhagen region, and northern Portugal. Each regional innovation ecosystem will separately assess its circular capabilities and potential for the textile, construction, and plastics sectors.

In the cross-regional phase, the regional competence analyses are compared. Actions needed for all regions are bundled in a European cross-regional Transformative Action Plan (TAP), while distinctive local competences can be accelerated. After which, they flow into the connected network of innovative regions through knowledge exchange.

The project has a methodological and a substantive objective. Methodologically, the project aims to refine the S3-Innovation Model as a tool to arrive at shared European TAPs, as well as using it as a method to connect different regional competence centres.

In terms of content, the aim is to develop a cross-regional TAP for the reduction and reuse of (critical and strategic) raw materials within the plastics, textiles, and construction sectors. In this way, the ground can be methodically levelled to subsequently implement the TAP.

Medegefinancierd door de Europese Unie

Battery Academy

Consortium: Flux50 together with EIT InnoEnergy, KU Leuven/EnergyVille, and Mpiris.

Budget: € 88.328,21

The aim of this project was to gain insight within the battery value chain in Flanders, in particular into the competences that will be essential for the labour market in the future and to encourage companies to start working with this knowledge. It is important to anticipate the dynamics of the labour market and to better adapt the training and education offer accordingly. This skills forecast deals with a market at the heart of the energy transition that is in full development: electrical energy storage. In turn, this energy transition is a basic issue in the climate transition and the pursuit of carbon neutrality.

Previous studies show that Flanders plays a role in the value chain of this important technology in terms of research and development. With this study, we also want to extend this knowledge to the rest of the labour market, a market that, according to a European study, will account for 4 million new jobs in the future and calls for initiatives to upskill 800,000 others.

The work builds on previous feasibility studies and collective research undertaken at the initiative of Flux50 and is part of the establishment of a European Battery Academy.

When carrying out the competence projections, the VLAMT process is carried out as described below:

Phase 1: the initial preparation phase ensures that clear choices are made in advance in terms of the research process.
Phase 2: the preliminary research phase serves to explore the future of the sector and its competence needs. This preliminary research is done through desk research and an exploratory workshop.
Phase 3: the analysis phase constitutes the actual research of the focus study. What was brought to the surface in phase 2 is now analysed in detail with a view to changing competence and training needs.
Phase 4: the decision-making phase, involves drawing conclusions, preparing an action plan, and disseminating a final report to the various target groups. The conclusions are formulated in the form of recommendations.

Battery Accelerator
Following the final event of Battery Academy, the Battery Accelerator learning network was launched on 20 April 2023. The aim of this network is to inform members about developments, regulations, and opportunities from the sector, as well as answer their questions. In doing so, the Battery Accelerator hopes to build trust, encourage cooperation, and exchange knowledge.

ConnectSME

Consortium: Clean Tech Delta,Green Energy Park, Snowball, Stichting Brainport Smart District, Technische Universiteit Delft, Technische Universiteit Eindhoven, and VITO.

Budget: € 2.050.000
Grant: Interreg subsidy: € 1.025.000 (50%)

To achieve its climate goals, Flanders attaches great importance to the introduction of new sustainable technologies as outlined in the Flemish Climate and Energy Plan. The Netherlands' Mission-Oriented Innovation Programs(MMIP) also advocate for the introduction of innovative technology.

Unfortunately, there are few promising pieces of technology that reach the market, and it rarely proceeds beyond the research and development phase. Especially for SMEs, it remains difficult to bring their solution to the attention of both public authorities and private companies. Therefore, urgent action is needed to roll out sustainable innovative solutions at a quicker rate. Studies show that testing solutions in real market conditions can be a catalyst for this. The insights gained here lead to further refinements of the product and increases the chances of commercial success.

The aim of ConnectSME is to connect companies that are strongly committed to sustainable development with six living labs in the border region:Open Thor Living Lab, Snowball, Green Energy Park in Flanders, Green Village, Metalot, and Brainport Smart District in the Netherlands. Each of these labs are pioneering this field by connecting their infrastructure to promising innovations, removing barriers to cooperation between clusters and regions. COVID-19 threw a wrench into the works at the start of the project, as even Dutch companies were not allowed to visit the Flemish living lab. Distance and the financial effort required from SMEs also proved a stumbling block at times. Clear communication and demonstrating the added value for the SMEs was, therefore, essential.

In the end, the practical voucher system supported 23 companies and allowed them to testtheir products or services. Here, cross-border cooperation was facilitated and supported. The technologies are very diverse, from intelligent housing systems and innovative ventilation and heating systems, to the smart charging of electric cars and a vehicle-to-grid charging station. These innovative products have also been presented per living lab to a wide audience in order to increase the familiarity with the products.

Additionally, the Flemish and Dutch living labs became better acquainted with one another and established a mutually-beneficial system of knowledge-sharing.The two groups of living labs also stay in regular contact to see if they can tackle other projects together in the future.

CrossRoads2 Sustainable Energy

Consortium:
Stichting CrossRoads2 and VLAIO.

- **Project partners: Bedrijfstrajecten vzw, BOM, Flux 50, LIOF, NV Economische Impuls Zeeland, REWIN, Team Stimulus Programmamanagement, and VLAIO.**
- **Co-funders: the Dutch provinces of Limburg, Noord-Brabant, and Zeeland, Nederlands Ministerie van Economische Zaken (the Dutch Ministry of Economic Affairs), and the Vlaamse Gewest (Flemish Community).**

Budget: € 6.850.000
Grant: € 2.580.000

CrossRoads2 Sustainable Energy is part of the fifth European programme Interreg Flanders-Netherlands and is built on the previous success of CrossRoads (2010-2014) and CrossRoads2 (2016-2020). Over the past three years, the project has encouraged small and medium-sized companies in Flanders and the southern Netherlands (Zeeland, North Brabant and Limburg) to collaborate in cross-border innovation for climate and energy-related projects.

During four openings, companies may apply for grants for innovative and technically feasible project ideas focused on low-carbon technologies. Of the 32 support applications submitted, 21 projects were eventually awarded grants, totalling €2,848,330.28. This supported 48 SMEs from Flanders and the southern Netherlands. Each such partnership consisted of at least one Flemish SME and one southern Dutch SME.

CrossRoads2 Sustainable Energy emphasises the importance of knowledge exchange with neighbouring countries, and how climate challenges are best overcome through collaboration and team-driven efforts. The total potential CO_2 reduction is 375,000 tonnes of CO_2 equivalents for the period 2023-2027. This reduction is equal to the sum CO_2 emissions of nearly 9,000 households.

Cross-border cooperation also makes a positive contribution to the competitiveness of the region and participating companies. Over 90% of the companies expect an increase in turnover over the next five years, which will also translate into new hires and R&D investments. The initial investment of a € 2.8 million ERDF grant has achieved a leverage effect of factor 4 per year. After five years, this will become a factor of 20.

An additional benefit of the added value is displayed in the area of network expansion and knowledge building around technological and market-oriented issues. The vast majority of the projects will, therefore, evolve towards sustainable cooperation in the future.

Between 2023 and 2027, CrossRoads will continue to stimulate cross-border collaborations across the Flemish-Dutch border. Via a call system, support will be made available for promising innovations that contribute to the realisation of societal priorities, such assustainable entrepreneurship, sustainable energy, industry 4.0, and health.

Scan QR-code and you can find the full final.

Interreg Vlaanderen-Nederland
Europees Fonds voor Regionale Ontwikkeling

CROSS ROADS SUSTAINABLE ENERGY

Every1 project

Consortium: Eworx, Flux50, Inesc Tec, International Cleantech Cluster, Joanneum Research, National Technical University of Athens, Open University, RdA Climate Solutions, Steinbeis Europa Zentrum, Technische Universiteit Eindhoven, and Th!nk E.

Budget: € 3 300 000
Grant: € 3.300.000

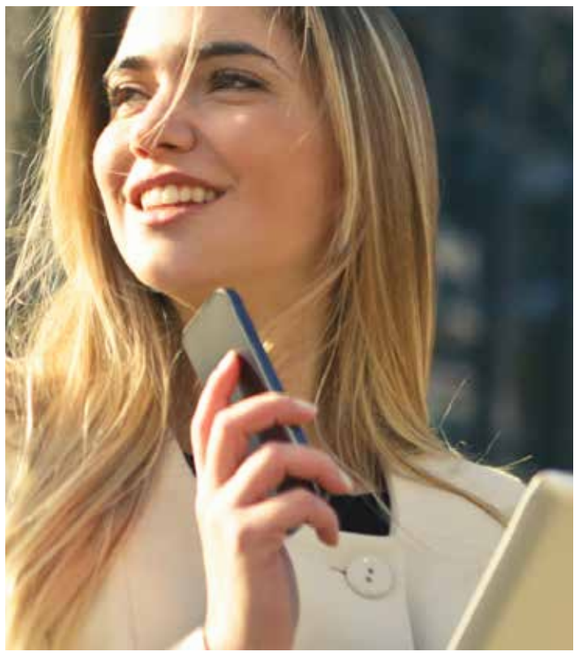
Empowering eVeryone's Engagement in eneRgY: the Every1 project, funded by the European Union, aims to develop training and networks for the digitalisation of the energy transition. Leading experts in energy, education, ecosystems, and social sciences form the Every1 consortium. Together they will develop a powerful concept to engage all European stakeholders in the digital energy market.

Every1 starts with a thorough analysis of ecosystems and stakeholders (citizens, cities, energy communities, companies, regulators, and distribution system operators) to identify who they are, what they know, how they use information, and where they look for it.

In addition, use cases and assessments of current and new solutions (products and services) will help to understand how stakeholders can take up their role in the digital energy market. Based on this gap, learning pathways will be developed with diverse material to highlight what local ecosystems can offer.

Every1 simultaneously aims to create a market by sharing best practices with policymakers and regulators, facilitating conversations about bottlenecks, and creating partnerships.

The project will launch a solid outreach campaign to target the local level. It will use effective social media campaigns, content in multiple languages, and media channels used by local stakeholders. Based on the proven EXPLORE-SHAPE-UNITE methodology, ecosystem operations consist of guided one-to-one support, group activities, webinars, matchmaking, and more. Future ecosystems will be actively engaged and trained and the capacity-building materials will be more widely adopted by collaborating with various initiatives and networks.



EVERY1

Medegefinancierd door de Europese Unie

oPEN Lab

Consortium: Projectcoördinator VITO en partners.

Budget: € 2.950.000
Grant: € 19.880.000 (EU)

Building on the expertise of 33 partners, the EU-funded oPEN Lab project will revitalise urban areas across Europe and lead the transition to Positive Energy Neighbourhoods (PEN). Through activities in three open innovation living labs in Genk (Belgium), Pamplona (Spain), and Tartu (Estonia), oPEN Lab will identify commercially viable solutions to achieve positive energy urban environments in line with the EU's goal of being climate neutral by 2050. The project will promote a sustainable customised neighbourhood design, seamless industrial renovation works, renewable energy generation combined with energy storage, urban amenities, smart operation, and life cycle thinking. The ultimate goal is to roll out a holistic and positive energy vision for neighbourhoods across Europe.

The aim of ' oPEN Lab is to identify replicable and commercially viable solution packages that can realise positive energy neighbourhoods within existing urban contexts, seamlessly integrate into the local energy system as an active micro-energy hub, and to test these technologies and packages as an integrated solution on a neighbourhood scale.

The three open innovation living labs will test combinations of different near-market technologies and services and study their performance as a unique control system. The focus will be on demonstrating innovations in an integrated approach that combines sustainable design tailored to the local context, while establishing seamless industrial renovation workflows. These open innovation living labs also seek to combine renewable energy generation with energy storage systems, organize urban service facilities, encourage smart operation, and support life-cycle thinking and circularity all along the value chain. This style of thinking considers the life cycle of the building and its environment, with a view to scaling up and broad replication is also important. With a view towards a holistic and positive energy vision for the neighbourhood, a user-centred and participatory approach with the neighbourhood community will be developed.

Partners:

RegEnergy

Consortium:
3 Counties Energy Agency (IE), Brest métropole (FR), Climate Alliance (DE), Flux50 (BE), Ormondo Upgrading (IE), Plymouth City Council (UK), Waterford institute (IE), and Waterschap Rijn en Ijssel (NL) .
Flanders: Ecopower, Flux50, and VUB.

Budget: € 1.490.000 (Flanders)
Grant: Interreg subsidy: € 897.000 (60%) + co-financing (15% VEKA and 10% Provincie Vlaams-Brabant)

The European InterReg NWE RegEnergy project explores the link between urban energy demand and rural energy generation through renewable energy partnerships. The specific objectives concerning energy storage for the Flemish sub-project, led by Flux50 were:

- The development of a smart micro-grid to implement as a Local Energy Community.
- Establishing a living lab to test micro-grid operations.
- Optimising self-consumption and balance between intermittent PV production and consumption.
- A feasibility study linking a residential district into low-temperature heat grid.
- Setting up contractual agreements between energy producers, consumers, grid operators, authorities, and landowners to support the business case around renewable energy and micro-grid balancing.

Smart Village Lab: a living lab in development
The Universitair Ziekenhuis Brussel (UZ Brussel) and the Vrije Universiteit Brussel (VUB) have set up the non-profit organisation Green Energy Park, with the aim of facilitating energy and electromobility research and development. Among other things, it is developing a large-scale living lab where companies, research institutes, and governments work together to co-create solutions related to these societal challenges.

In anticipation of Green Energy Park's large-scale living lab, a smaller scaled living lab has already been built, which is capable of accommodating the initial research needs. This living lab, the Smart Village Lab, includes a distribution cabin with a number of low-voltage channels, around 100kW of PV, energy storage systems, controllable loads, EV chargers, space for additional experiments, and a basic energy management system. The Smart Village Lab was realised by Flux50 and Green Energy Park, through two projects: Interreg NWE RegEnergy and ERDF SMEL-1.

Neighbourhood batteries
Within the RegEnergy project, the first energy storage systems were integrated as an essential part of a micro-grid testbed. The two large storage systems are coupled to a 150KW-400V link and can be deployed in either a grid-connected topology or a microgrid (behind-the-meter arrangement). One system uses 343kWh of NMC modules; the other 385kWh of LFP modules. Both systems are container-based, with thermal conditioning, protection, and monitoring features. One of the systems is based on modular 3-port inverters, making multiple AC and DC channels available and giving additional research opportunities. The typical use cases in which these systems are deployed are: optimisation self-consumption (between PV and charging posts), peak shaving, and manual control in which interaction with PV, EV (fast) charging, and proprietary EMS functions are investigated. In early 2023, technical integration for AFRR services was set up, so that the battery containers can be used to support frequency on the Elia grid in periods when there is less research work.

The living lab supports Flemish and European research and development projects enabling new technologies to be immediately tested and further refined in a real environment to improve quality. Companies that want to test or demonstrate integration with neighbourhood batteries are also welcome.

Interreg North-West Europe RegEnergy
European Regional Development Fund

SmartEnergy
COSME Cluster Excellence project

Consortium: Project partners: ArchEnerg Cluster, Cleantech and energy Innovation Cluster (IT), Environment Park (IT – coordinator), Flux50 (BE), Minalogic (FR), TENERRDIS (FR), and TWEED (BE).
Funded by European Cluster Excellence Program

Budget: € 433.000
Grant: € 293.000

The SMARTENERGY project has brought together six European clusters that, through the European ClusterXChange program, promote cooperation and exchange between companies, research institutions, and technology transfer centres.

The general objectives of the project are:
1. Increase the enterprise support capacity of the participating clusters.
2. Mobilise the ecosystems of the participating clusters.
3. Scale up technology innovation for our and other SMEs, clusters, and organisations (in the EU).
4. Strengthen the strategy of each cluster.
5. Develop a common strategy for new collaborations.
6. Facilitate exchanges with our regional authorities.

The ClusterXChange programme has established co-financed exchanges of at least three days in Belgium, France, Hungary, and Italy. During the COVID period, the consortium organised six webinars on energy transition topics. Flux50 and cluster TWEED focused on energy communities. The series attracted more than 250 participants from seven different countries.

Companies appreciated the cross-sector approach to energy and digital technologies proposed by SMARTENERGY through the ClusterXChange program. Today, a wide variety of specialisations are needed to address the complexity of energy transition, which is something an isolated company may not always be able to manage successfully on its own.

Intercluster strategy: towards cross-pollution for the digitalisation of energy transition.

The individual cluster strategies and enquiries from our partners' ecosystems were the basis for an intercluster strategy to test the potential of innovative cross-sectional digital energy technologies in various areas.

The project shows how digital technologies can facilitate the objectives of both the digital transition and the energy transition that Europe is pursuing within the new Fit for 55 package.

Instead of the joint strategy becoming the pillar for the establishment of a new EU cluster alliance for energy transition as originally planned, we decided to strengthen the existing networks already active at the European level, such as the International Cleantech Network, of which Flux50 is a member. This strategy has already served as the basis for new EU project proposals.

SMART ENERGY
Digitalising Energy in Europe

Co-funded by the COSME programme of the European Union

Smart Multi Energy Lab (SMEL)

Consortium: Flux50

Budget: € 777.000
Grant: € 388.000 (Subsidy EFRO + Hermesfonds)

The University Hospital Brussels (UZ Brussel) and the Vrije Universiteit Brussel (VUB) have established the Green Energy Park organisation with the aim of facilitating research. This includes developing a large living lab where companies, research institutes, and governments can collaborate and co-create solutions to societal challenges around energy and mobility.

The test site will include a large-scale, innovative electrical grid, an ultra-low-temperature district heating network and extensive electrical mobility facilities for research purposes. The data centre will valorise its residual heat by connecting it to the district heating network.

Smart Village Lab

In anticipation of the large-scale Green Energy Park test site, a smaller scale test site has already been built which can accommodate the primary research needs. The Smart Village Lab living lab consists of a smart distribution cabin, an EV charging field, a Control Centre, neighbourhood batteries and the Smart Home Lab.

The Smart Village Lab was implemented by Flux50 and Green Energy Park, on the basis of two projects: Interreg NWE RegEnergy and EFRO SMEL-1. Within the SMEL-1 (Smart Multi Energy Lab 1) project most of the infrastructure was created. This includes both passive elements such as the ground works, e-charging field, cable tunnels, canivaus, control centre and fence, as well as active elements such as HVAC, electrical installations, Smart Home Lab, security (fire, theft, access), communication, measurement, and monitoring.

A smart home in a smart neighbourhood

The Smart Home Lab consists of 6 flexible homes that are mainly used for the development of systems that allow a home to be managed intelligently and sustainably. The homes will exchange electric and thermal energy with each other through a Smart Energy Grid which is a collective energy network that includes systems such as neighbourhood batteries and communal charging infrastructure for electric vehicles.

Europese Unie

Each of the flexible houses includes a typical residential electrical installation with a digital meter, distribution board, and PV system. These can also be expanded with home energy management systems, home batteries, and charging poles.

As for the electric consumers, there is a combination of real and simulated devices. The simulated devices are controllable consumers that can play the actual (pre-measured) load profile of the device (via controllable dimmers), so that the power profile on the electrical board is very similar to that of a home with real devices.

Research, development, training, and demonstration

As an example of potential use case, you can connect solar panels to a car, home battery, washing machine, or heating system. With the arrival of a capacity tariff and the opportunity to maximize self-consumption, it will become important to spread electricity consumption throughout the day (peak monitoring) or in direct relation to the sun. Smart energy management is a possible solution. Testing such systems is an example of a project that can leverage the lab infrastructure.

The Smart Home Lab can be used for innovation, testing, demonstrations, and training.

The pilot site supports Flemish and European research and development projects, enabling new technologies to be immediately tested in a real environment and further refined to improve quality. Companies who want to test or demonstrate integration with (neighbourhood) batteries are encouraged to make use of this high-tech and adaptive facility. The living lab is also used for training and can be visited by schools and the general public. Thus, everyone can get acquainted with these innovations and their importance in the social energy transition.

VLAIO

EFRO
EUROPEES FONDS
VOOR REGIONALE
ONTWIKKELING

SOLARISE

Consortium:
University of Picardie Jules Verne Amiens - UPJV (FR)
- **Knowledge institutions: KU Leuven (BE), TC Ghent (BE), University of Portsmouth (UK), and UPJV (FR).**
- **Cities and municipalities: Brighton & Hove (UK), Fourmies (FR), Heerhugowaard (now: Dijk en Waard) (NL), Middelburg (NL), Middelkerke (BE), and Zoersel (BE.)**

Supporting project partners: Camp C (BE), Enercoop (FR, and Flux50 (BE).

Budget: € 4.180.000
Grant: € 2.510.000 (Interreg)

The goal of the SOLARISE Interreg 2 Marine project is to encourage the use of solar energy, with a special focus on locations where solar power is less obvious. The project focuses on historic and public buildings, as well as social housing sites. SOLARISE also aims to introduce new technologies to a wider audience and reduce the impact of solar energy on the electricity grid by combining it with storage capacity.

The SOLARISE project has produced multiple findings in various fields of sustainable energy. In the technical field, there are the results regarding the interaction between PV production and battery storage and how the seasons impact this relationship. SOLARISE has also discovered technical challenges to the installation and deployment of hybrid panels (PVT), which generate electricity and heat, as well as the weak regulation on home batteries. It is crucial to assesswhether the combination of techniques is feasible and appropriate at an early stage.

With regard to public projects such as PV on school buildings or gyms, it has become clear that engaging citizens from the first moment of planning and providing the opportunity to invest increases the level support for renewable energy projects.. This makes it easier to implement additional sustainable projects. This also applies to the social housing projects within SOLARISE, where an innovative approach to energy parts has enabled economically weaker groups to enjoy the benefits of a sustainable living experience.

Implementing sustainable measures for monuments or historic city centres has been a common challenge. . Regulations aimed at preserving historical character often limit the possibilities of making them more sustainable. The project has exhibited that there are already several techniques that can sustain historic buildings without affecting their appearance, such as roofs that heat an underlying pipe system and produce sustainable heat.

In addition to all these practical findings that will provide future projects with guidelines for a good project approach, the SOLARISE pilot projects have also contributed to sustainable energy production. In total, solar panels with more than 460 kWp have been installed, representing an annual CO_2 saving of approximately 80 tons!

Interreg
2 Seas Mers Zeeën
SOLARISE

STorage of Energy & Power Systems (STEPS)

Consortium:
Project Manager: OostNL (NL)
Knowledge institutions: Cambridge Cleantech (UK), Technical University of Darmstadt (DE), UGhent (BE), University of Galway (IE), and University Twente (NL).
Business support partners: 3 Counties Energy Agency (IE), Flux50 (BE), House of Energy (DE), OostNL (NL), POM East Flanders (BE), and The Faraday Institution (UK).

Budget: € 5.060.000
Grant: € 3.040.000 (Interreg) + co funded (10% VEKA, 10% VLAIO)

The core of the Interreg North-West Europe STEPS project (Storage of Energy & Power Systems) is taking significant steps in the field of energy storage. This project revolves around innovative companies that develop solutions for energy storage. In the medium-sized energy storage systems sector, we see a lot of mass production from the US and Asia flooding the EU market. Many of these mass production solutions are not tailored to the needs of local market segments, who would benefit from tailor-made storage technologies, new technologies or other business models. Innovative Northwest Europe (new) energy storage products are currently often stuck on TRL5/6 due to barriers, such as fragmented legislation and funding sources, limited access to pilot sites, and limited knowledge of end-users.

Business support programme

In STEPS, business support partners and knowledge partners from Belgium, Germany, Ireland, the Netherlands, and the United Kingdom have joined forces to strengthen the competitiveness of innovative providers of energy storage (e-storage) in NWE, by promoting tailor-made storage, further developing and testing new technologies, developing new business models, strengthening the value chain, and more.

Through two calls, 40 SMEs received support (value € 12,500) from universities to further develop their energy storage solutions. 20 SMEs were given the opportunity to apply their product or service concretely on a test bed (value € 50,000) to increase the TRL from 5 to 6/7 or higher. In these test environments, the generation and distribution of electricity come together with energy storage products. The parties can further develop their products for the specific electricity market in the country concerned, as well as for Northwest Europe.

For example, Octave tested its storage system on Terranova Solar to compensate for reactive energy from pumps at the water treatment plant. Bright Energy searched for the limits of its construction site battery at Green Energy Park. Locquet Motors, Near Grid Solutions, and Solenco also used the test beds.

Other activities include:
1. Advising 200 local e-storage SMEs when entering new markets in NWE, by mapping the specific regulations, business opportunities, and financing options in those regions.
2. Create market pull in NWE for e-storage solutions by responding to end-user needs and raising provider awareness. In Flanders, two events were organized around batteries for construction sites, in which 2 times 85 people from the construction world, through presentations and demonstrations from five providers, learnt that construction site batteries have played a mature and financially attractive role in larger buildings in recent years, especially in combination with tower cranes.

While the project will be completed in the summer of 2023, it will continue in the form of a learning network around energy storage within the framework of Flux50.

Interreg
North-West Europe
STEPS

Inspire, connect, and accelerate

Flux50 provides inspiration to the innovation sector, connects businesses, governments, and knowledge institutions in Flanders, and drives the acceleration of the energy transition.

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