
# ECOFLEX

*With the support of the Energy Transition Fund*

## D7.3 Replicability and feasibility of the massive roll-out of ECOFLEX solutions.

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Abstract for dissemination (PU)

*One of the central objectives of the ECOFLEX project is to demonstrate that flexibility solutions developed and tested in the project's pilot sites can be replicated and scaled to other contexts, both regionally and nationally. The feasibility of such large-scale roll-out depends not only on the technical robustness of the solutions, but also on the institutional capacity, stakeholder engagement, and ecosystem readiness to adopt them. This report lists the events where the ECOFLEX project was presented, and which feedback was encountered. It also describes the different (known) sites that could make use of the developed solutions or built upon the lessons learnt within the ECOFLEX project. During the events, and especially the final event and the workgroup on data management and flexibility, we reached a lot of representants from both the mentioned sites and mentioned projects. Hence, results and lessons learned have been shared among all stakeholders of the flexibility value chain in order to take them further in their work.*

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# List of abbreviations

| | |
|---|---|
| **aFRR** | Automatic Frequency Restoration Reserve |
| **BRP** | Balancing Responsible Party |
| **BSP** | Balancing Service Provider |
| **EMS** | Energy Management System |
| **FSP** | Flexibility Service Provider |
| **ToE** | Transfer of Energy |
| **ToU** | Time-of-use |
| **UFP** | Universal Flexibility Platform |

# 1. Introduction

## 1.1. Challenges

This deliverable discusses the feasibility and the potential replication at large-scale of the proposed solutions within the ECOFLEX project. Therefore, prior to deep-dive into the solutions, it is imperative to highlight the different challenges that have been identified during the course of the project. The main question is: "*How can we include small consumers and prosumers to participate in flexibility?*". Since, low-voltage flexibility procurement to TSO products (e.g. aFRR[1]) have recently been approved – during the course of the second year of the project – by the regulators; some technical, market-related and regulatory challenges arose, as illustrated in Figure 1.

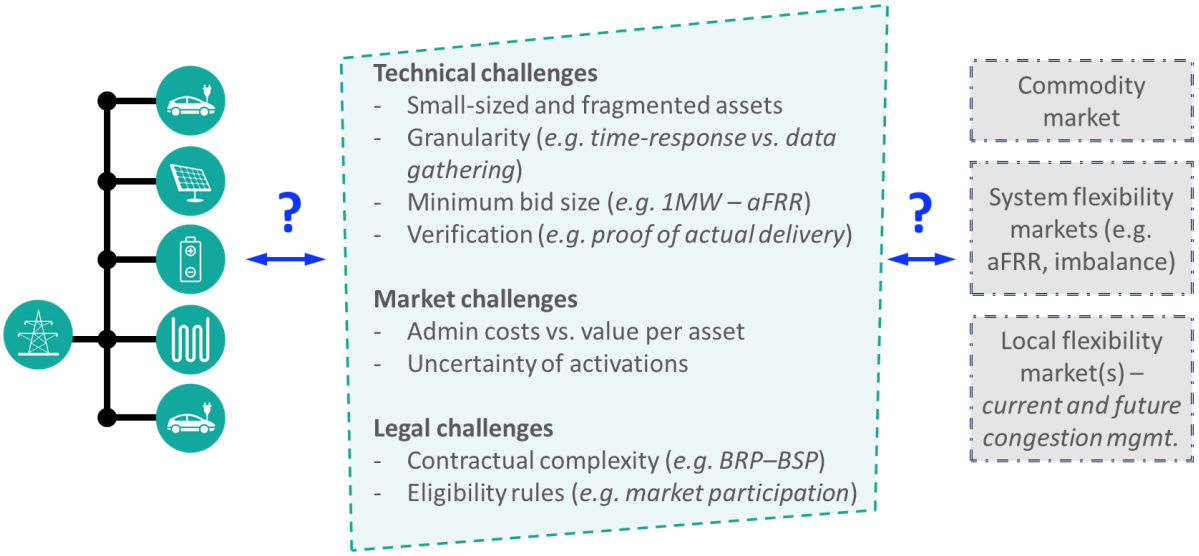


**Figure 1.** Overview of the identified challenges for the participation of low-voltage assets to the system flexibility markets, local flexibility markets and commodity market.

Among the technical barriers, we identified fragmentation of the small-sized assets which complicates participation, due to the requirement of an overarching control and communication platform. The latter not only requires to coordinate the different assets (located at distinct locations), but must also exchange in real-time information to the different stakeholders who access the markets. Furthermore, these small-sized assets – typically managed by local energy management systems (EMS) – communicate through different protocols and/or at different time resolutions, further complicating widespread adoption. Despite these practical complications, a mismatch in granularity between the EMS's data gathering (e.g. 15-minute base) and the time-response for flexibility services (e.g. 4sec for aFRR) also forms a barrier.

Next, the minimum bid size such as the 1MW requirement to participate in aFRR, also constitutes a hurdle for low-voltage flexibility assets at end-users premises, with asset-sizes typically ranging several kilowatts. Which brings us to the following challenge: verification. Indeed, due to the small power bids involved, proof of actual delivery can also be challenging. This can be exemplified in the context of imbalance steering, where BRPs may not recognise a deviation from the baseline, hence, they do not renumerate participants. Closely related to

[1] aFRR is open to all technologies and players since September 2020 except from active customers at low-voltage levels. The latter has been approved by the regulator to go live on the 1st of October 2024.

this is the uncertainty of activation, for instance bids constituting several small assets to form a higher volume (e.g. 1MW) are more prone to not being activated due to the merit-order activation mechanism. It was also observed that balancing service providers (BSPs) do not always have abundant left-over capacity to form such bids; here we refer to the ECOFLEX deliverable "*D6.1 – Implementation of flexibility ecosystem*". Finally, administration costs could also cancel the gains from activations of these small size assets, since the value per asset is significantly lower compared to bigger volumes.

To conclude, several regulatory barriers were identified as described in deliverable *"D2.4 – Guidelines Legal Enabling Framework for Energy Management Service Providers"* and reported in [1]. To this end, mechanisms such as the Transfer of Energy (ToE) regime are established methods on the higher voltages. However, the introduction of ToE at low-voltage only started recently (March 2024) and solely in the framework of assets that participate to aFRR. Additionally, the participation is currently limited to the alternative cases within the ToE regime, i.e. the fall-back mechanisms: 'Opt-out agreement[2]' or the 'pass-through mechanism' (see Figure 2).

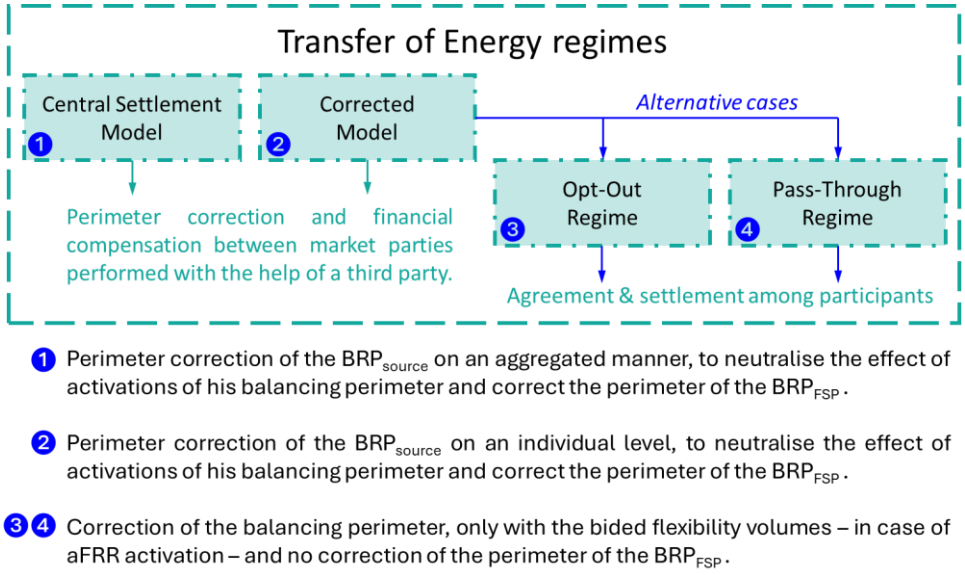


**Figure 2.** Different mechanisms with the Transfer of Energy (ToE) regimes.

Participation of low-voltage actors into the system flexibility markets can be obscured by contractual requirements. For instance, in the case of aFRR and imbalance, BSPs and balancing responsible parties (BRPs) are required to have a contractual agreement[3]. Nonetheless, if the independent flexibility service provider (FSP) or BSP, and the BRP do not agree on the requirements such as the Opt-out agreement, active participation in flexibility services can be blocked. However, these may also be subject to complexity as experienced in the course of this project at the Green Energy Park pilot. Active participation to aFRR was not realised since the site has two different BRPs. One for injection and the other for consumption. Since only one of the BRPs was willing to sign the opt-out agreement, the fall-back solution would be to go towards the pass-through mechanism according to the ToE regime. This would result in the

[2] An opt-out agreement ensures that the BRP transfers the activation renumeration to the BSP.
[3] According to the ToE regime models. Note that for aFRR on low-voltage (≤ 1kV), only the alternative cases (Opt-out regime and Pass-through mechanisms) are currently available. A proof-of-concept for the Central settlement Model is due for Q1 of 2026 while the timing for the corrected model has to be determined.

pilot site being exposed to imbalance, but this would be financially not interesting because the consumption pattern of the site is unpredictable. Therefore, activation could only be done in one direction. We believe that this situation is likely to occur more frequently, since small size assets (or pilot sites) do more frequently have different BRPs and omitting the later would undermine the role of independent FSPs. While imbalance steering proved to be adequate alternative, since (1) it is based on the deviation of the BRP nomination, thus no minimum volume is required for renumeration and (2) no prior commitment to the TSO is expected. Therefore, EMSs can decide in the last-minute whether to dispatch or not (i.e. deviate from the baseline or not), but it is also subject to challenges. First, the settlement may not be recognised. This is particularly the case for EVs, since they do not have a planned baseline (or they could deviate from the inputs provided in the user interface – cf. "*D4.2: Front-end application*"). Second, if the site has two different BRPs, the situation where one (or both) BRP is not willing to sign an opt-out agreement (as elaborated before) might occur.

## 1.1. Proposed solutions

In view of the aforementioned technical, market-based and regulatory challenges, we have provided three different solutions within the ECOFLEX project:

A. A novel algorithm for the scheduling of electric vehicles has been developed ("*D4.1 – Smart Charging Management*"). By proposing a model predictive control approach, the EV scheduler is capable of acting in real-time and dispatch last-minute (cf. imbalance steering).
B. An advanced energy management system, which compared to traditional EMSs, is capable of providing a baseline by using novel algorithms ("*D5.2 – Multi-energy community energy management*"). The latter allows dwellings or local energy communities to participate in the system flexibility markets.
C. The Universal Flexibility Platform (UFP), was developed to integrate different types of EMSs, hence, allowing small sized assets to participate in different markets. Whether via a BRP, BSP or aggregator.

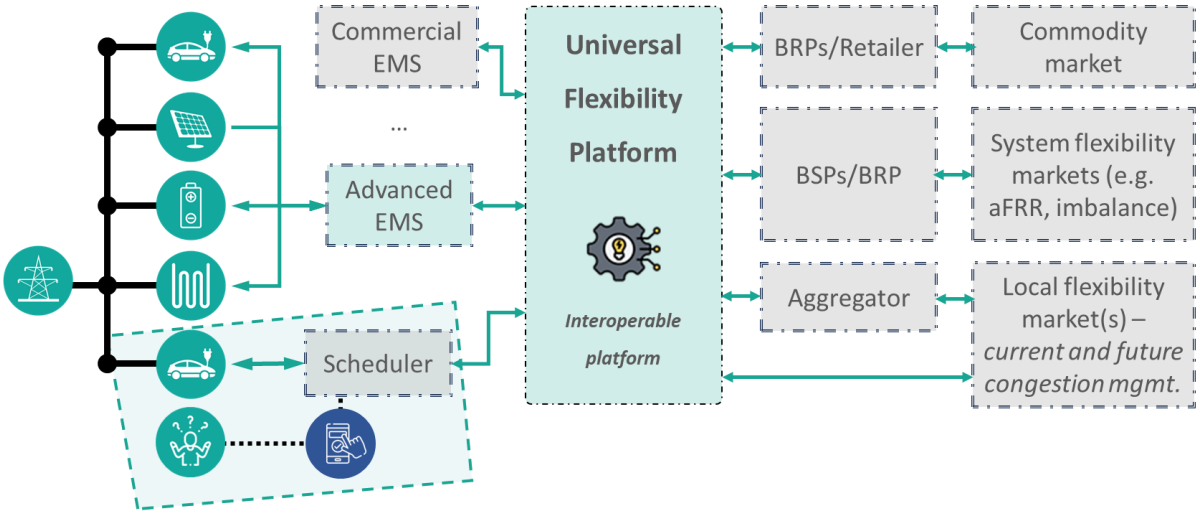


**Figure 3.** Overview of the proposed solution within ECOFLEX.

# 2. Scalability of the proposed solutions

The ECOFLEX project aims to develop and validate innovative solutions for optimizing energy flexibility across different types of sites and stakeholders. To ensure the long-term impact and large-scale deployment of these solutions, Task 7.4 focuses on assessing their replicability and feasibility across other relevant contexts and actors in Belgium.

## 2.1. Participation to events

Beyond the technical validation, replicability efforts have been supported through targeted communication and engagement activities — including workshops, webinars, and the final event — which gathered key stakeholders involved in large-scale energy management, renewable integration, and smart district operation. We refer to Table 1 for the summary of these events. In its early stage, ECOFLEX was presented at a workshop organized by the Royal Belgian Society for Electricians (SRBE/KBVE), which gathered the different stakeholders of the flexibility value chain. During that event valuable feedback was gathered which helped to better align with real-world needs. In its second year, the project was pitched during the Wall4Grid series organised by Tweed. The latter focuses on distribution level and the contemporary problems they encounter, as well as the solutions that various stakeholders propose. To this end, by presenting the scope of the project to a broader audience, we were able to engage with all stakeholders from the flexibility value chain where the needs for a universal flexibility platform were highlighted. Nonetheless, a relevant question arose: "*Who will operate the UFP?*" which has been studied extensively in deliverable "*D2.5 A Cost-benefit Analysis of the Energy Management Service Provider's Roles*". Accordingly, the UFP can be provided by the DSO, by invoking Article 31(10) of the Electricity Directive.

During the CIRED conference held in Geneva, ECOFLEX was presented during a poster session [2]. Being an international conference, various conversations sparked on the topic of low-voltage flexibility where a great interest in the EV scheduler was shown. Based on these discussions, we can conclude that the proposed solutions have a great potential not only in Belgium but also in other countries (e.g. Scandinavian countries for the EV scheduler).

On the 9$^{th}$ of September, we presented the overall outcomes from the project to a broader audience bringing together policy advisors, market players, system integrators and solution providers. Amongst the participants were also Elia and the different Belgian DSOs (Fluvius, ORES and RESA). By giving the floor to all the stakeholders of the value chain as well as organising a panel discussion, we were able to highlight the strengths and shortcomings of low-voltage flexibility. We refer to §1.1, where the barriers are being discussed. Notwithstanding aforementioned challenges, the DSOs have shown interest in the UFP as a tool to leverage flexibility. However, they don't see it as their role to operate it, but rather see the market include it.

Finally, during a working group session organised by Flux50 on the topic of data management and flexibility, the key outcomes of ECOFLEX were presented. Below is a summary of the Q&A:

- Fluvius was wondering if a time-of-use (ToU) component on top of the capacity tariffs could potentially benefit the use cases of the EV scheduler. However, the ToU has not been approved by the Flemish regulator (VNR), cf. RAPP-2025-18 [3]. We strongly believe that a ToU component could facilitate the participation of EVs in the flexibility

markets. Nowadays, the full potential of flexibility provisioning from EVs could be hindered by the maximum peak (monthly threshold) which could jeopardise the flexibility revenues. This is also part of future research within the Vrije Universiteit Brussel.

- Another point is the case of the two BRPs for one site. According to a system integrator, this is likely to not occur frequently as most sites will opt for a single BRP which is also the FSP. Nonetheless, the latter suggest that the role of independent FSPs would be overridden. Therefore, we believe that regulatory authorities should inspect this issue and take adequate measures to unlock this barrier.
- Finally, researchers from the University of Antwerp raised concerns on the emergent behaviour of EMSs. This topic was not part of the scope of this project, however deliverable "*D5.2 Multi-energy community energy management*" investigated this aspect.
- Although after the project ends, the key outcomes of ECOFLEX will be presented during the Smart Energy Academy (25-27 November 2025), a yearly 3-days (educational) event organised by Flux50 and bringing 3 times 90 people together.

**Table 1.** Summary of the events where ECOFLEX was presented.

| Dates | Organiser(s) | Event name | Actor(s) | #Attendees |
|---|---|---|---|---|
| 05/12/23 | SRBE/KBVE | Workshop on Electrical Load Flexibility in retail | SO; SP; AR, MP | 150 |
| 10/09/24 | TWEED | Wall4Grid series – Challenges DSOs & Walloon experience. | SO; SP; AR; SI; POL | 150 |
| 28/11/24 | TWEED | What's up in the Belgian Flexibility Market (webinar) | SO; SP; AR; SI; MP | 248 |
| 17/12/24 | TWEED | Blackout: understanding the risks and implications (webinar) | SO; SP; AR; SI; MP | 143 |
| 13/03/25 | TWEED | Energy storage and flexibility (webinar) | SO; SP; AR; SI; MP | 216 |
| 01/07/25 | TWEED | Working group on storage and flexibility | SO; SP; AR; SI; MP | 20 |
| 14/08/25 | BeClimate Hub | ECOFLEX presentation | SP | 10 |
| 09/11/25 | ECOFLEX partners | ECOFLEX closing event | SO; SP; AR; SI; MP; POL | 130 |
| 30/09/25 | Flux50 | Working Group on Data Management and Flexibility | SO; SP; AR; SI | 50 |
| 25-27/11/25 | Flux50 | Smart Energy Academy | SO; SP; AR; SI; MP; POL | 90/day |
| 28/11/25 | VITO/FOD | ETF-project presentations | SP; AR; SI | Upcoming |

***Legend*:** distribution and transmission system operator (**SO**); solution providers (**SP**); academic researchers (**AR**); system integrators (**SI**); market players, e.g. BRPs and BSPs (**MP**); Policy makers (**POL**)

These interactions allowed the identification of several actors and ecosystems with strong potential for replication and roll-out of ECOFLEX solutions. The following subsection presents these actors and describes the link between their activities and the energy flexibility approach promoted by ECOFLEX.

## 2.2. Key replication actors and potential links

***IDETA – Agence de Développement Territorial de Wallonie Picarde***

IDETA [4] was an active partner in the ECOFLEX project, where one of its business parks served as a living lab to test flexibility solutions. Beyond this pilot site, IDETA manages numerous industrial zones across Wallonie Picarde, which represent ideal contexts for replication.

**Link to flexibility potential:**

These industrial zones host diverse energy consumers and producers, making them suitable for collective flexibility strategies, local energy communities, and smart grid integration. The governance model of IDETA, which coordinates multiple stakeholders and infrastructures, provides a replicable framework for the deployment of ECOFLEX solutions at a regional scale.

***Raysun – Energy Community Developer and Operator***

Raysun [5] develops, operates, and manages renewable energy communities across Belgium. Currently, the company is involved in 15 energy communities — either operational or in the validation phase — covering a wide range of residential, tertiary, and industrial users.

**Link to flexibility potential:**

The decentralized structure of energy communities makes them ideal candidates for ECOFLEX's flexibility optimization tools. Integrating such solutions could help Raysun enhance the smart coordination of distributed assets, increase self-consumption, and improve grid stability. The large number of communities under Raysun's management offers an immediate replication opportunity with measurable impact potential.

***KARNO – Heating and Cooling Network Developer***

Karno [6] designs and builds district heating and cooling networks, integrating renewable and fatal energy sources into local energy systems.

**Link to flexibility potential:**

ECOFLEX's smart management concepts can be transposed to thermal energy networks, allowing for a coordinated use of assets (pumps, buffers, CHP (Combined Heat and Power) units) in response to energy price or grid signals. This would enhance both energy efficiency and system flexibility, extending the project's applicability beyond electrical systems.

***IDEA – Intercommunale de Développement Économique et d'Aménagement du Cœur du Hainaut***

IDEA [7] is the territorial development agency for 27 municipalities in the *Cœur du Hainaut* region, representing over 540,000 inhabitants across 1,000 km². With more than 350 staff members, IDEA manages industrial zones, water, energy, and urban development services.

**Link to flexibility potential:**

Given its comprehensive role in energy and territorial planning, IDEA can replicate ECOFLEX models within its managed industrial parks and renewable projects. Its integrated approach and local authority connections create an enabling environment for multi-site flexibility

management and collective self-consumption frameworks, similar to those piloted within ECOFLEX.

### *Transfo site - Zwevegem*

The Transfo site in Zwevegem [8] is an industrial heritage site that has been redeveloped recently. It has a modern circular and self-sufficient energy system with PV, a neighbourhood battery, a charging plaza with 17 connection points and an Energy Management System. It has a unique element in the energy system: a distribution net based on DC instead of AC. Fluvius, the local DSO as partner, wants to learn what this means in a real environment.

**Link to flexibility potential:**
The charging station with 16 AC-chargers and 1 fast charger will be managed in a flexible way. The site EMS system will control the site's energy flow. One of the goals is that the power-level for the charging station is variable, and dependent on the amount of PV energy and the state of charge of the neighbourhood battery, to optimise the self-sufficiency of the site. This is a potential deployment candidate of the smart charging scheduler and the advanced EMS system, both developed in the EOFLEX project.

## 2.3. List of related projects

There are multiple research and development projects that work on related topics in Belgium. Some of them are still active and can work further with the lessons learned in ECOFLEX. During the most recent events (closing event and the workgroup on data and flex) multiple attendees work on these projects.

**Table 2.** Examples of related projects

| Abbreviation | Title | Website |
|---|---|---|
| **ALEXANDER** | Accelerating low voltage flexibility participation in a grid safe manner | https://alexander-project.vito.be/en |
| **R-E-FLEX** | Renewable energy and E-mobility as a FLEXibility service | https://www.zuidtrant.be/reflex |
| **EM&EM's** | Electric Mobility & Energy Mix Solutions | https://eiffageenergiesystemes.be/nl/emems-wanneer-elektrische-mobiliteit-samengaat-met-elektrische-flexibiliteit/ |
| **InterFlex** | Unlocking the barriers to accelerate and scale up residential flexibility in Belgium | https://epes.ugent.be/research/InterFlex/ |
| **GEMS** | Green Energy management Systems for Business Parks | https://gems.nweurope.eu/ |
| **SE-MoRE** | Smart Charging - E-Mobility meets Renewable Energy | https://www.howest.be/nl/blog/onderzoek-en-dienstverlening/se-more-focust-op-slim-laden |
| **InstaFlex** | Exploitation of deferrable loads in industries for transmission system flexibility through demand side management.at LV. | https://instaflex.be/ |
| **IMPROCAP** | Improving Grid Hosting Capacity in the Electrification Process by combining Smart EV Applications and Interactive Building Management systems | https://research.ugent.be/web/result/project/474cf0de-f86a-4162-bb1d-2201b3551009/details/en |

# 3. Conclusions

Several actors collectively represent a diverse portfolio of sites and contexts — from industrial parks and energy communities to district heating networks — that can benefit from ECOFLEX's flexibility-oriented tools and methodologies. Through continued collaboration, yearly brainstorm meetings, and alignment with other regional initiatives, the project sets the foundation for a massive roll-out of flexible, smart energy systems across Belgium.

# 4. References


[1] T. Chen and F. Vandendriessche, "Enabling independent flexibility service providers to participate in electricity markets: A legal analysis of the Belgium case," *Utilities Policy,* vol. 81, p. 101496, 2023.

[2] R. Cleenwerck, J. Ruddick, G. Van Kriekinge, S. Naghdizadegan Jahromi, M. A. Putratama, T. Coosemans and J. Desmet, "ECOFLEX project: leveraging flexibility from low-voltage assets," in *28th International Conference and Exhibition on Electricity Distribution (CIRED)*, Geneva, Switzerland, 2025.

[3] Vlaamse Nutsregulator, "Reactie op het vervolgonderzoek naar tijdsafhankelijke tarieven en injectie van de distributienetbeheerds (RAPP-2025-18)," 13 oktober, 2025.

[4] "IDETA - Agence de développement territorial de Wallonie Picarde," [Online]. Available: https://ideta.be/parcs-activites/. [Accessed 21 10 2025].

[5] Raysun, "Energy Community Developer and Operator," [Online]. Available: https://www.raysun.solar/. [Accessed 21 10 2025].

[6] KARNO - Heating and cooling network developer, [Online]. Available: https://www.karno.energy/. [Accessed 21 10 2025].

[7] IDEA - Intercommunale de développement économique et d'aménagement du Coeur du Hainait, [Online]. Available: https://idea.be/. [Accessed 21 10 2025].

[8] Transfo site Zwevegem, [Online]. Available: https://www.transfozwevegem.be/energie. [Accessed 21 10 2025].