


# Role of the TSO: Responsibilities & challenges

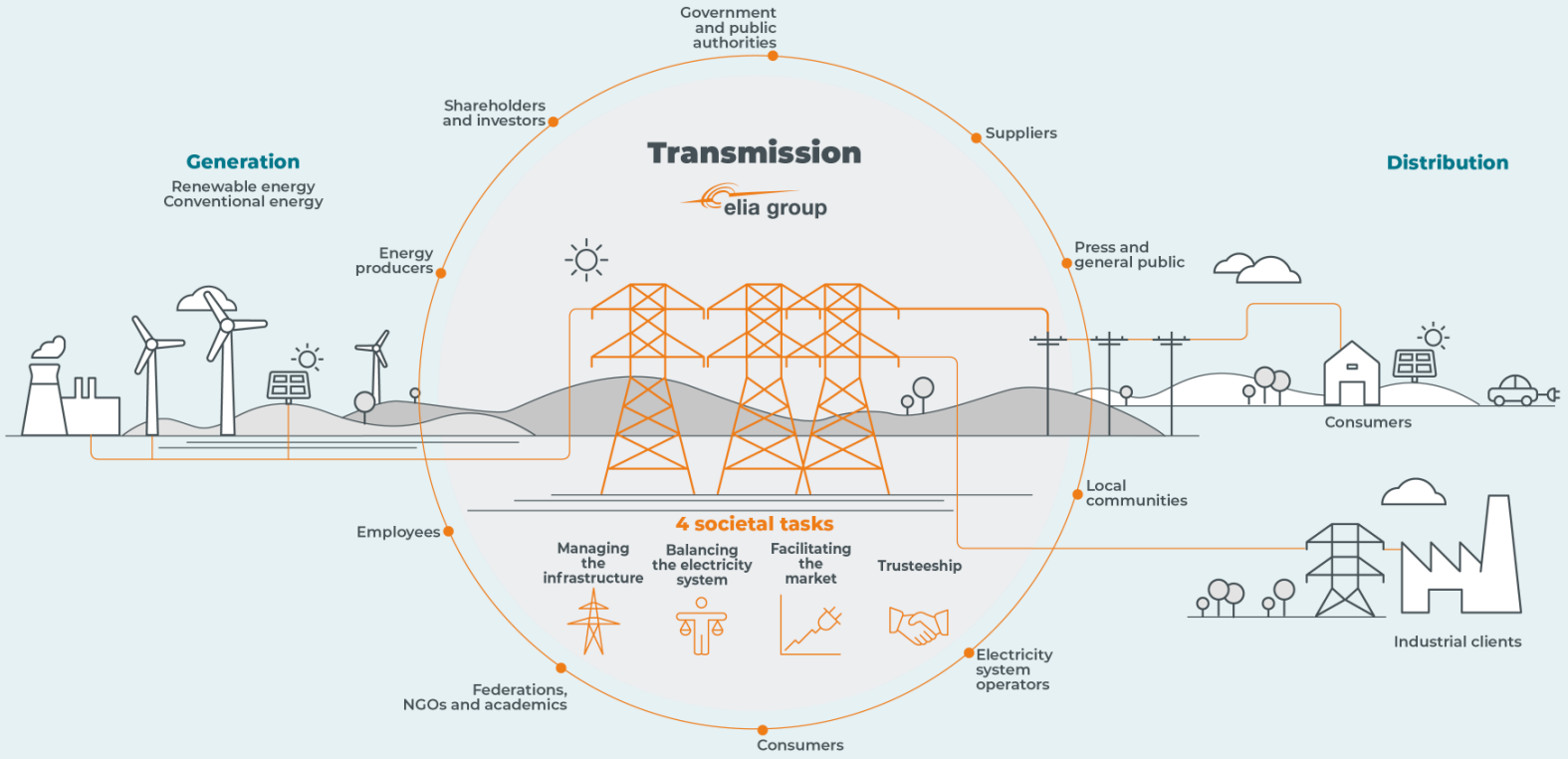
## Elia @ CoDE-masterclass

10th November 2026 | Sander Claeys

# Agenda

1. Role of TSO: Responsibilities & challenges
2. How does balancing work?
3. How can companies valorize their flexibility?
4. Use cases of flex valorization

# Elia connects distribution & generation, manages congestion in its network and balances entire system




## We highlight 4 responsibilities:

1. Keep the **balance**
2. **Manage congestion**
3. **Optimize infrastructure**
4. **Ensure adequacy**

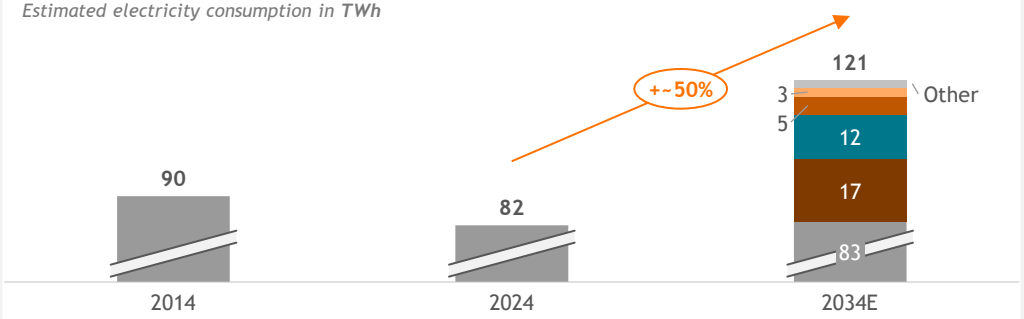
# Energy transition will drive major changes for both consumption and generation in next 10 years

**Consumption** to increase ~50% in 10y due to electr. & new uses

**Generation** capacity by renewables to double in 10y

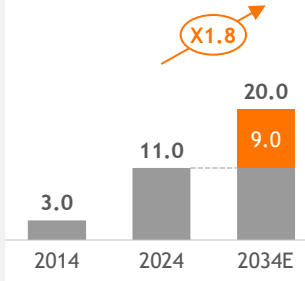
| Industrial electr. | Electric vehicles | Data centers | Heat pumps |
|---|---|---|---|
| +17 TWh | +12 TWh | +5 TWh | +3 TWh |

*Estimated electricity consumption in TWh*

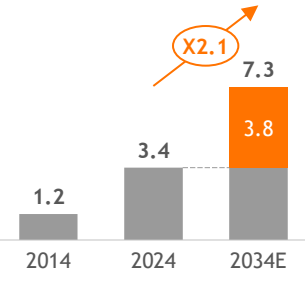



| Solar PV | Onshore wind | Offshore wind |
|---|---|---|
| X 1.8 | X 2.1 | X 1.9 |

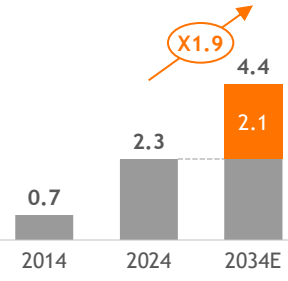
*Estimated capacity in GW*




*Estimated capacity in GW*




*Estimated capacity in GW*




Source: AdeqFlex 2025, Current Commitments scenario

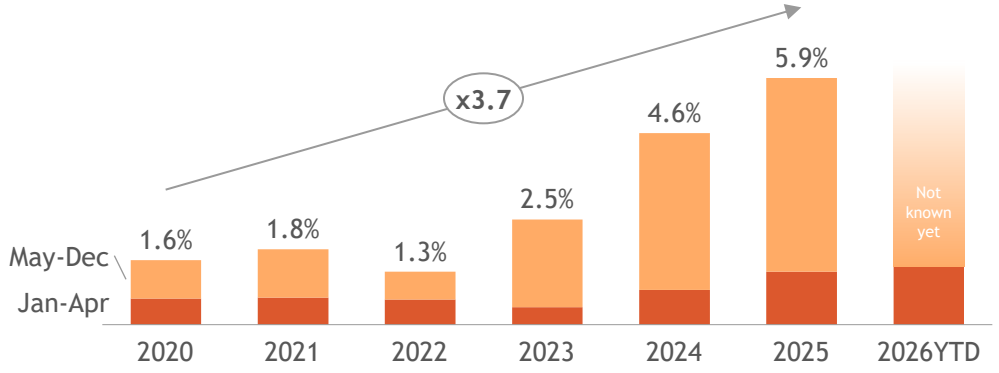
# This growth is unprecedented in recent history, and we start to see the challenges this poses for the grid

## Incompressibility poses risk for stability

Though more solar PV is good news for climate goals, it does often not (yet) react to market signals. This can lead to situations where there is more generation than the system can handle, and all existing means of flexibility to absorb it have been exhausted.

In 2025, ~6% of the time prices were negative in the DA wholesale market, about 4 times more often than in 2020, indicating increasing constraints on ramping down generation

*Share of QHs with negative prices in Belgian day-ahead market*

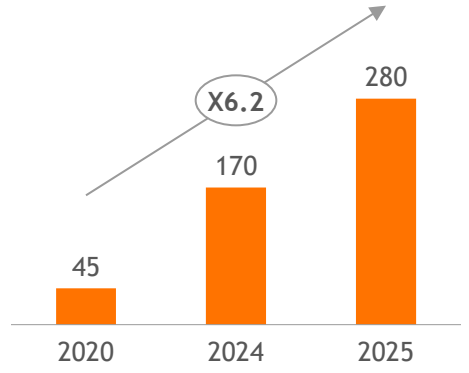



## Surge in connection requests

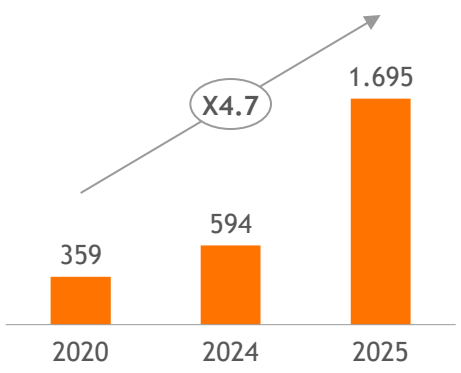
We are experiencing a surge in connection requests in recent years, driven by new assets (especially batteries & data centers) and electrification. This challenges the existing mechanisms for queue management and allocation of capacity.

In 2025, the connection requests had already increased by a factor of x4-6 compared to 2020

*Requests from TSO-connected users*



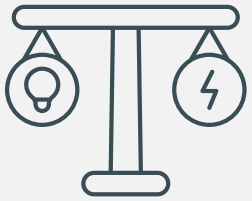

*Requests transferred from DSOs*



# Flexibility is key for managing efficiently most challenges in transforming our power system

## Keep the **balance**

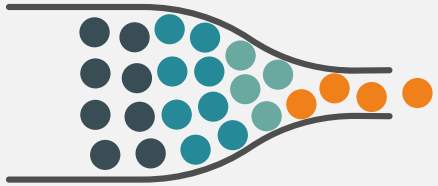
Supply = demand



**Flexibility absorb**
fast deviations and forecast errors

## Manage congestion

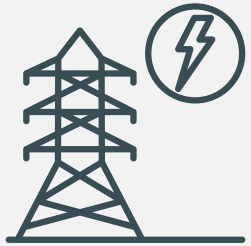
Network limits not to be exceeded



**Flexibility relieves**
local peaks where needed

## Optimize infrastructure

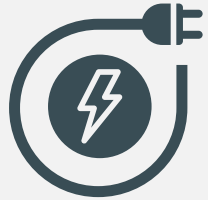
Grid sized for peaks, used only part of the time



**Flexibility optimizes**
costs via a TotEx approach

## Ensure adequacy

Enough capacity in critical



**Flexibility reduces**
peak capacity needs

# The FNA brings forward an integrated study on flexibility for Belgium, succeeding the Adeqflex framework

Elia traditionally **combined** its Adequacy and Flexibility needs study **in one report**

## FNA

The **European regulation** imposes now each country to adopt a **Flexibility assessment (FNA)** every two years




* The Cabinet confirmed that Elia will be proposed as Designated Entity
** Subject to revision of Article 7bis of the Federal Electricity Law (under development)

The FNA establishes **a new framework for assessing flexibility needs** in Belgium:

In line with **European legislation** and **methodologies**

**Developed by the Designated Entity** (Elia*) in cooperation with DSOs and subject to approval by CREG

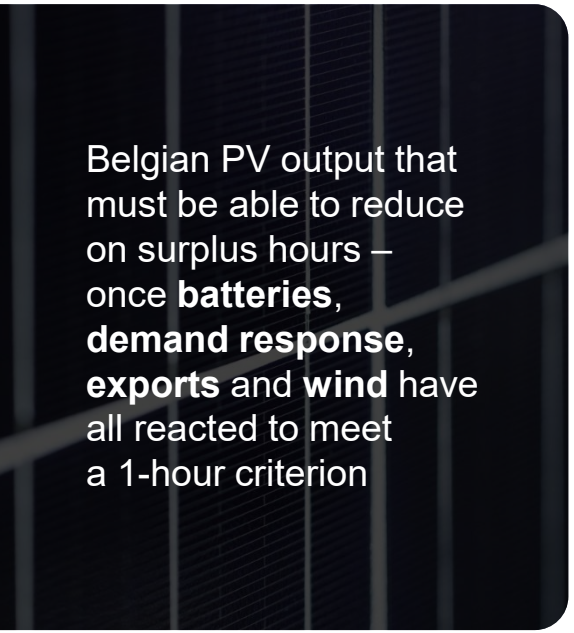
**Aligned** with scenarios & target years of the Adequacy study

## Planning

| | |
|---|---|
| JAN-JUN 2026 | Study calculations and report |
| JULY-AUG 2026 | Public consultation draft FNA |
| OCT. 2026 | **FNA approval by CREG** |
| SUMMER 2027 ** | New Belgian Adequacy assessment (then every 2 years) |
| Q2 2028 ** | Second FNA and iterated every 2 years |

# PV response required between 1–5 GW by 2030 & 2–7 GW by 2035

(today up to 0,65 GW market reaction)



Belgian PV output that must be able to reduce on surplus hours – once **batteries**, **demand response**, **exports** and **wind** have all reacted to meet a 1-hour criterion

**2030**

**1-5 GW**

of PV response needed
(derated)

**≈ 2–8 GWp**
of installed panels

**10-45%**
of the solar fleet

**2035**

**2-7 GW**

of PV response needed
(derated)

**≈ 4–11 GWp**
of installed panels

**15-50%**
of the solar fleet

## How to read these numbers

**A capability, not a forecast**
What must be able to reduce, not what will be curtailed

**Counted last**
Only what remains after all other flexibility has reacted

**Total need**
Can be delivered by the market (up to 5% observed in 2025) or required in last resort mechanism

**Range**
Spread across FNA scenarios & sensitivities

Today only up to **5% of solar fleet** (up to 650 MWp) **react to prices.**
**This gap must close** for sunny-day surpluses to stay manageable.

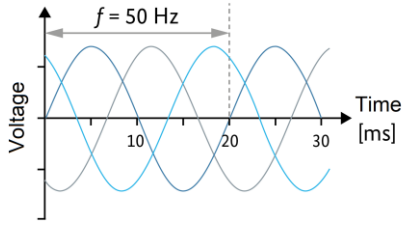
Source: Elia, Flexibility Needs Assessment (FNA) – "Beyond the FNA" analysis. Sized to a 1-hour reliability criterion (uncovered surplus limited to 1 hour per year on average).
Derated GW = 65% of installed peak capacity; installed = derated ÷ 65% (≈ ×1.5). Assumes full wind participation and storage/DSR flexibility as in the scenarios.

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# Why do we need to balance the grid?

- The power system is designed to operate at a very specific frequency (50 Hz)




- As soon as an imbalance occurs, the frequency starts to change
  - An oversupply will increase the frequency
  - An undersupply will reduce the frequency
- Such frequency deviations need to be managed very carefully; a deviation of 0.4% (200 mHz) is already considered as a major event!
- If frequency deviates too far or too long, automatic disconnections cascade, potentially leading to blackouts

# Balancing the grid is the joint responsibility of BRPs & Elia with the help of BSPs

## BRPs - Balancing Responsible Parties

- Every offtake/injection point on the grid is assigned to the portfolio of a BRP
- The BRP is responsible to balance offtake and injection within its portfolio. They can do this by
  - Steering generation assets in their portfolio
  - Steering consumption in their portfolio
  - Trading with other BRPs or on exchanges
- BRPs act without direct coordination by Elia (indirect coordination happens through real-time publications)

## Elia with the help of BSPs - Balancing Service Providers

- Elia relies on three 'explicit balancing' products to resolve any imbalances that remain after adding together all individual BRP portfolios
- Since Elia does not have any own generation or consumption assets, it contracts BSPs to implement these explicit balancing products
- The BSP is responsible to deliver these services correctly when they are selected by Elia

How does my supplier fit into this? You can see these as different 'roles', where the supplier role entails managing the retail relationship with the end customer. Most traditional 'suppliers' (E.g., ENGIE, Luminus) take up all these roles (supplier, BRP, BSP and more), whilst other suppliers might work with another BRP behind the scenes.

# Elia's balancing philosophy relies both on implicit reaction by BRP and explicit activation of BSPs

## Elia relies on two types of flexibility to always maintain the balance between supply and demand:

BRPs & Implicit flexibility: Balance Responsible Parties (BRPs) are responsible for maintaining the balance in their portfolio, **and are incentivized to help the system** under certain conditions (e.g., real-time balancing obligation)

+

BSPs & Explicit flexibility: Elia procures and activates frequency containment reserves (FCR) and frequency restoration reserves (aFRR & mFRR) to deal with the residual system imbalances

## Why a decentralized balancing model?

It has the potential to unlock broader system flexibility by leveraging implicit reactions, though care must be taken in how it is designed. For a more detailed discussion, see the report below:



# Elia relies on three distinct BSP products to tackle imbalances in real-time: FCR, aFRR, mFRR

## Imbalance makes frequency deviate

Imbalances occur in real-time for many different reasons:

- Forecasting errors for renewables
- Forecasting errors for consumption
- Unexpected outages
- Etc.

The net effect of all individual BRP imbalances (in the synchronous zone) will then affect the frequency

- Surplus will increase the frequency
- Shortage will decrease it

## FCR contains the freq. deviation

= Frequency Containment Reserves

- FCR will automatically react to changes in frequency, without an explicit activation by Elia
- This 'contains' the frequency i.e., it stops the deviation from becoming larger but does not restore it to 50 Hz
- Full activation needs to be reached within 30 seconds

## FRR (Frequency Restoration Reserves) restore frequency to 50 Hz

Two products exist to restore the frequency back to 50 Hertz. Their relative use depends on their relative characteristics but also cost

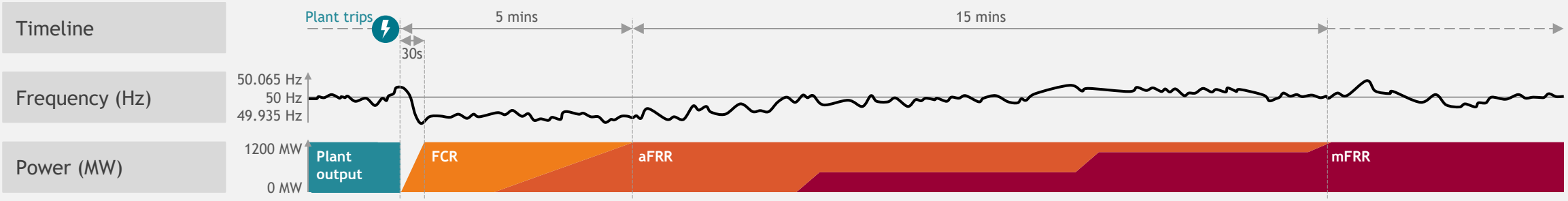
### aFRR – automatic FRR

- aFRR allows Elia to activate BSPs with a granular control signal (every 4 seconds)
- Full activation required in 5 mins

### mFRR – manual FRR

- mFRR allows Elia to activate BSPs for a full quarter hour at once
- Full activation required in 12.5 mins
- Especially useful for large deviations

*Illustrative example of how the balancing products contribute to restoring the frequency after a plant failure*



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# There are multiple ways to valorize your flex

*… some of which can conflict, so it is important to optimize across these (e.g., minimizing sourcing costs could increase grid tariffs)*

## Lower your electricity bill, consisting of two key components:

### Energy (sourcing cost)

The cost of energy varies based on how much ahead you buy it, and moment of delivery.

**Pick a suitable supplier contract**

**Fixed / variable** contracts: This does not allow you to valorize your flex, as the price you are exposed to is flat in the short-term

**Dynamic** contracts: This exposes you to the day-ahead market price in real-time

**Pass-through** contracts: You decide day-ahead what you buy at day-ahead prices, whilst real-time deviations are exposed to imbalance price (plus a premium for the supplier)

**Become your own BRP**

This gives you full flexibility to trade on all markets (DA, ID, IMB) but also comes with significant complexity. Only the very largest industrial players opt for this today.

### Grid tariffs

You also pay tariffs for your usage of the network. These tariffs are designed to incentivize behavior that lowers the need for network investments. Details vary by network operator, but roughly there are three components:

**Energy tariffs:**
proportional to the energy / MWh consumed, can be lowered by lowering consumption (e.g., with onsite generation)

**Capacity tariffs:**
proportional to the highest quarter-hour peak in a certain period, which can be lowered through peak shaving (e.g., with a BESS)

**PPAD (power-put-at-disposal) tariffs:**
an upper limit on your peak power agreed in advance, which helps the SO to plan the network. If you exceed the PPAD, this results in penalties

## Get additional revenues w. explicit flex

### Explicit balancing (FCR, aFRR, mFRR)

Help Elia manage imbalances in real-time and be rewarded for it. You can participate through an existing BSP, which can manage the significant complexity of participation for you (IT and comms towards Elia etc.). Be aware that if your BSP is not your supplier, they might only work with certain suppliers (as they need an agreement)

### Local flexibility markets

DSOs have launched initiatives and pilots to procure flexibility in a market-based way, to deal with local congestion on their networks. Under such a market, DSOs would buy and activate flexibility when certain regions within their network are congested (examples: ORES' Pic@u project, Fluvius through NODES)

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You can find uses cases and more on Watts.Happening, our dedicated website to promote flexibility and its valorization:

[wattshappening.be](wattshappening.be)

## Overview of use cases included today:

### Shurgard

Real estate | Solar energy | Battery



Shurgard is installing PV and batteries across 15 Belgian sites to cut emissions and unlock flexibility across multiple energy markets.

### Ranson

Food industry | Cooling | Solar energy



Ranson, active in the B2B food industry, valorizes the flexibility of its industrial cooling installation on the Day-Ahead market and imbalance market, and increases its solar self-consumption.

### VPK

Paper and pulp | Cogeneration



A major packaging company maximizes the value of its CHP in Belgium by combining Day-Ahead and ancillary markets optimization.

### How Much Can You Save on EV Charging?

Other | Electric vehicles



Unlock up to 25% in annual savings on EV charging by using smart charging and time-based electricity tariffs. Estimate your potential savings for home or office charging

### L'Arsenal in Etterbeek

Real estate | Solar energy



With solar installations facing increasing revenue challenges, the operator at l'Arsenal significantly increased profitability by implementing smart control of solar injections.

### Kwekerij Dirk Mermans

Agriculture | Cogeneration | E-boiler



Kwekerij Dirk Mermans, a leading European greenhouse, delivered 1.5MW of flexibility on DA and imbalance markets by decoupling heat production and demand.

### Aquafin

Wastewater treatment | Cogeneration | Heat pump



Aquafin leads wastewater treatment in Flanders, using biogas from sludge for power. With CHP engines, they harness day-ahead pricing, delivering flexibility and additional revenue.

### Alpro

Food industry | E-boiler | Cooling | +2



Alpro, a pioneer in plant-based alternatives to dairy products, built an advanced energy system with flexibility and sustainability at its center.

# Thank you.

