



Energy Storage in Belgium

Guidelines to do business in the e-storage sector

E-Storage in Belgium

- Energy Market
- Grid Aspects
- Balancing the grid: markets and opportunities
- Permitting and Standardisation
- Business Support
- Financial support
- Best Practices

Energy market

Market designs, energy prices & capacity mechanisms

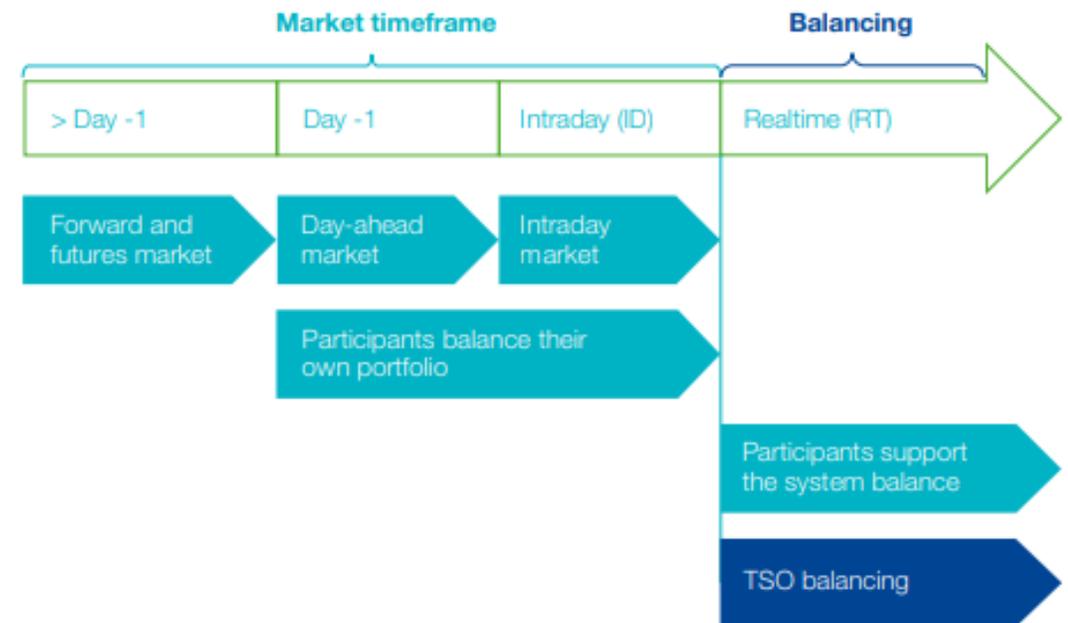
Structure of the Belgian energy market

The value chain of [the Belgian electricity market](#) consists of several parties:

- **The producers of electricity:** They generate electricity.
- **ELIA TSO:** The operator of the national high-voltage grid for voltages of 70 kV and higher. The TSO is responsible for the balance between injection and offtake on the grid. They also supply directly large industrial consumers.
- **The distribution grid operators (DSO):** They manage mid-voltage grids (10 to 70 kV) and the distribution grid.
- **The energy suppliers:** They supply power to customers, both private and business.
- **The balance responsible party (BRP):** They buy the electricity for the supplier and have an obligation to supply the agreed amount per time-unit. Any party that puts electricity on or takes electricity off the grid must contract a BRP.
- **The metering companies (MV-measuring responsible parties)**
- **Traders:** facilitate the markets, hedge risks or optimise energy portfolios
- **Consumer:** Uses electricity to power industrial processes, household appliances, etc., or to provide light and heat. Prosumers consume energy but also generate energy (with a local PV system)

Market design

- A **good description** of the market organization can be found at [Epexspot](#) and [Elia](#).
- **Forward & futures market:** In the forward market (OTC), sets of electricity are sold in advance, for a period varying in years, quarters or months. Market players can hedge against risks in future energy prices.
- **Day-ahead market:** Participators must submit their bids ([EPEX SPOT](#)) for the next day. Based on supply and demand orders, at 12:00 the hourly market prices for the following day are calculated.
- **Intraday market:** Allows continuous buying or selling of power (per block of 1 quarter) on a power exchange (EPEX SPOT) that takes place on the same day as the power supply (until 5 minutes before delivery). Intraday has a larger price-volatility. The trade volume of this market will probably grow with the increasing number of renewable energy sources.

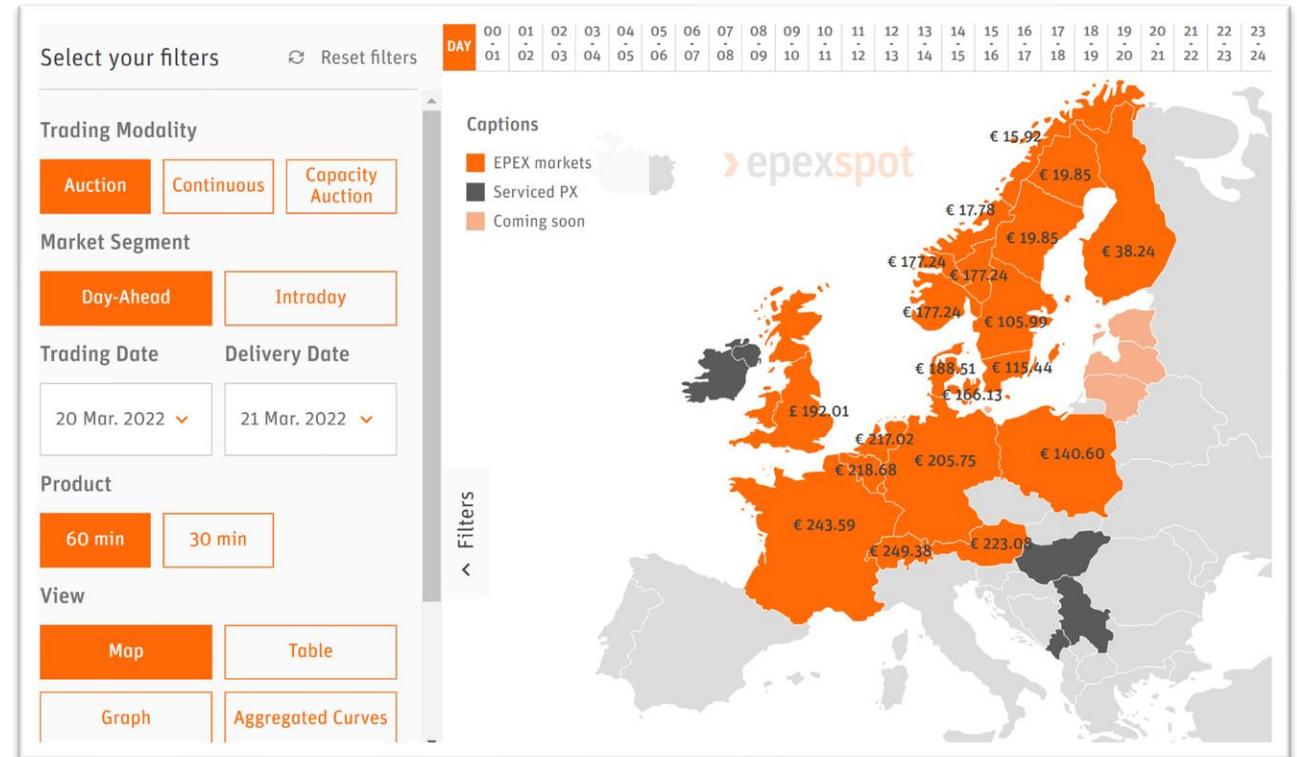


Energy market

- **Belpex:** In 2015, the Belpex (Belgian Power Exchange) and APX (Amsterdam Power Exchange) merged with the European Power Exchange (EPEX SPOT), to reduce barriers in international power trading. Today EPEX SPOT serves the North-West Europe region, the UK region and Scandinavia.
- **EPEX SPOT:** Today, energy is bought and sold via the online trading platform of the European Power Exchange. The main services are Day-ahead trading and intraday trading.
- **Participants:** Electricity producers, electricity suppliers, traders and industrial end-users can buy and sell electricity for tomorrow or for the day itself.

Balance energy flows

- **Balance portfolio:** Each transmission grid user needs to balance their demand and supply, to guarantee grid stability. To help reaching the balance, parties can buy or sell energy to cover expected changes (like solar or wind expectations). The real time deviations can still be anticipated on the intraday market or can be compensated with real time balancing services.
- **Forecasting:** To reduce risk or optimize value, operators have (AI-) algorithms to allow always more precise forecasting of imbalances and related real-time prices.
- **Imbalance charges:** each BRP is charged (+ or -) x€/MWh imbalance per settlement period. Battery storage could avoid these negative charges, if controlled right, to help the grid.



End user energy prices

- **Wholesale prices:** EPEX SPOT delivers the wholesale prices for energy. These prices are lower than the price for a final consumer. The margin for the energy supplier, grid tariffs and taxes need to be added.
- **End user Energy Prices:** The price for energy a consumer pays within a contract with the energy supplier, can be fixed for a year or can be variable, ex: based on a monthly average of the DA-price.
- **Dynamic prices:** Electricity suppliers can offer recently also dynamic prices, where the price can vary per hour, based on the DA-price. This allows to manage consumption to the cheapest hours. Large industrial consumers can use this system already for a long time. Since January 2021 this system is also open to households. Some suppliers offer this today (mid-2022); others are still in experiment mode.

End user power prices

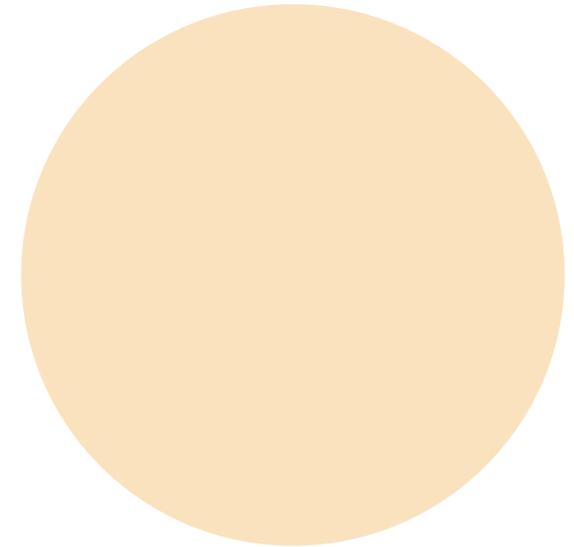
- **Peak power.** Large-scale energy consumers not only pay a price per kWh, but also a fee based on peak power (maximum power peak of the last month/year). Using battery systems or energy management systems to do peak shaving, allows to lower this peak power price component.
- **Capacity tariffs for smaller energy consumers.** It is expected that in January 2023 smaller consumers (residential homes) also pay for their peak power. Probably 80% of the distribution component of the invoice will be based on peak power (highest peak kW per month) and only 20% based on energy (kWh)

Grid Aspects

TSO's, DSO's and net codes

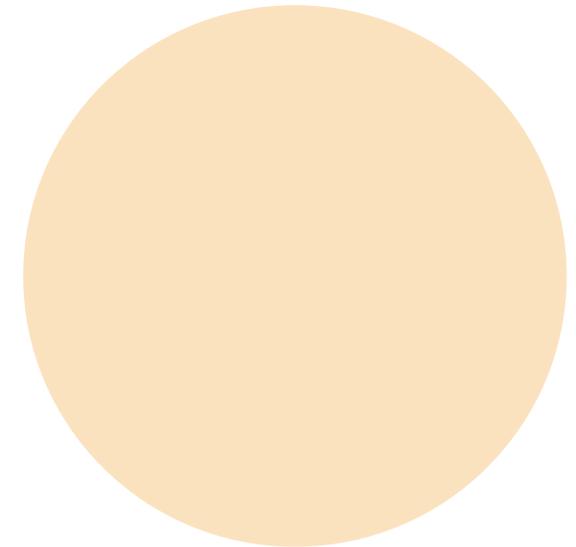
TSO & DSO Ecosystem

- **Transmission-System Operator (TSO):** [Elia](#) manages the entire national electricity grid of 70kV and higher. They are responsible for balancing the grid, frequency control, interconnections and security of supply, to keep the lights on.
- **Distribution System Operators (DSO's):** 4 regional organisations operate, maintain and develop the distribution grids and manage public service obligations:
 - Flanders: Fluvius
 - Brussels: Sibelga
 - Wallonia: Ores and Resa
- An overview of the **split responsibility** can be found at <https://www.elia.be/en/company/legal-framework>.



Regulators and government

- **Regulators** are responsible for the energy markets to function well. Some other elements are the responsibility of the respective **government agencies**.
- Federal Belgium:
 - Regulator: CREG (regulates the TSO Elia)
 - Transmission tariffs
 - Nuclear generation, Offshore generation, system adequacy
 - VAT
- Regional:
 - Regulators:
 - Flanders: VREG, regulates the Flemish DSO Fluvius
 - Brussels: Brugel
 - Wallonia: CWaPe
 - Distribution tariffs
 - Local production
 - Green certificates, Feed in tariffs, Prosumer levies
 - Rational energy use



Electricity laws and network codes

- **The European Network Code Requirements for Generators (NC RfG)** elaborates the connection requirements for generators at all voltage levels focusing on the cross-border electricity trade (European Commission, 2016).
- **The European Network Code on Demand Connection (NC DCC)** includes harmonized regulations for grid connection of consumption and distribution systems and focuses on the cross-border electricity trade (European Commission, 2016).
- **Belgium:** The main federal legislation or regulations can be found at <https://www.elia.be/en/company/legal-framework>.
- **Belgium:** On the federal level we have the [Electricity Law](#)

Network codes

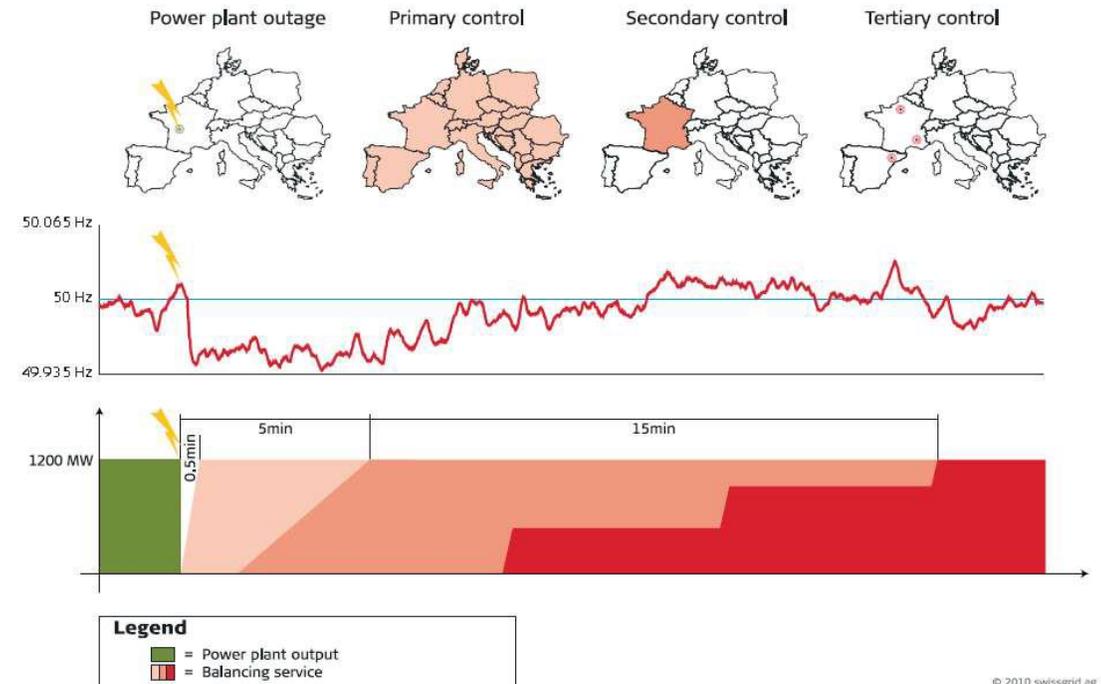
- **Belgium:** On the federal level we have the [Federal Grid Code](#)
- **Belgium:** Elia has created a document: '[Proposal for storage connection requirements -TSO proposal complementary to the EU Network Codes](#)'
- **Flanders:** VREG has created a document '[Technisch reglement](#)', when storage is connected to the DSO network. Such systems need to comply with the Synergrid [Technical regulations Electricity](#).
- **ENTSO-e** - the European Network of Transmission System Operators, is currently the main guidance for technical, market and policy issues relating to TSOs and the European network, including grid codes.

Balancing the grid: markets and opportunities

Balancing Markets

TSO: frequency control and restoration

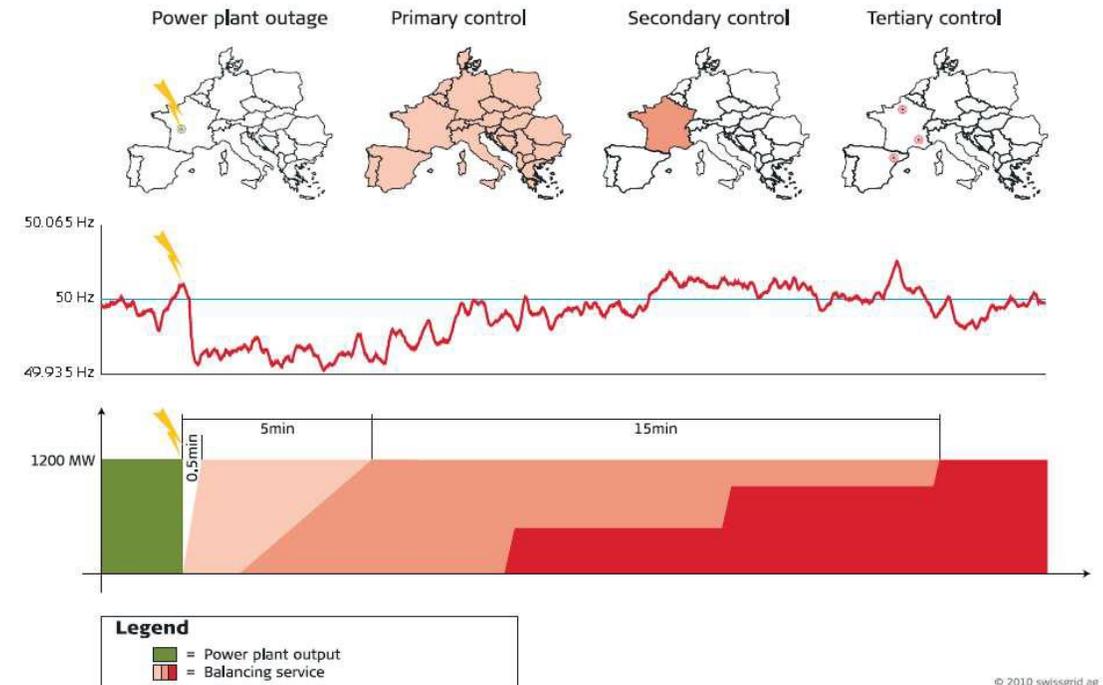
- **The TSO** is responsible for balancing the grid (supply versus demand) and to control the net frequency at 50Hz.
- **Imbalance** happens continuously because of inaccurate forecasting, intermittent RES generation or technical incidents.
 - Generation > demand: frequency goes up
 - Generation < demand: frequency goes down
 - Both deviations have to be countered by parties that have the flexibility to increase/decrease demand or generation: they provide balancing services
- **Restoring frequency deviations** is a 3 stages control process



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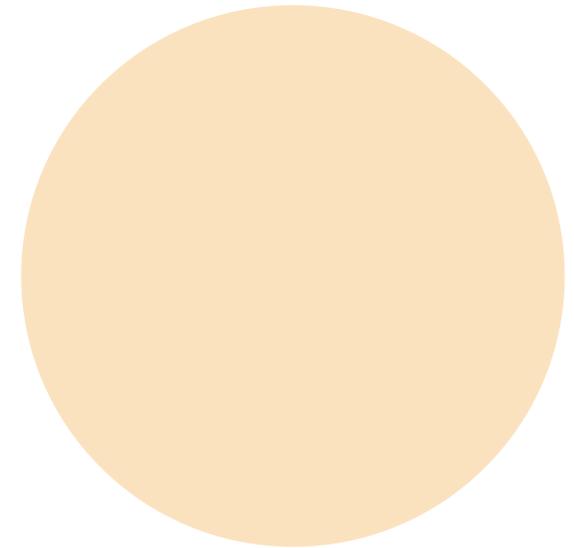
TSO: frequency control and reserve markets

- **Primary Control: Frequency Containment Reserves (FCR):**
 - Fast, decentralized, full automatic control
 - Response times: 0-30 seconds
 - Market size (2022): Continental Europe 3000MW; Belgium 80W
 - Opportunity for battery storage
- **Secondary Control: Automatic Frequency Restoration/Replacement (aFRR):**
 - Fast, central automatic control
 - Response times: 30 seconds – 15 minutes
 - Market size (2022): Belgium 117MW
 - Opportunity for battery storage
- **Tertiary Control: Manual Frequency Restoration/Replacement (mFRR):**
 - Slow, central manual control
 - Response times: > 15 minutes
 - Market size (2022): Belgium 665MW
 - Provided by power plants, industrial loads



TSO: flexibility markets and aggregators

- **Flex assets:** TSOs or DSOs are not allowed to own generation assets or storage assets. A market consultation is needed.
- **Balancing services markets:** The TSO organizes a market for each control, where flexibility service providers offer their services.
- **The market is complex,** risky and has thresholds, like minimum power of 1MW.
- **Aggregators:**
 - Gather flexibility from different consumers, producers and storage systems and pool this flex
 - Mediator between flexibility service providers and flexibility requesting parties, like Elia
 - Manage risks, maximize value of flex
 - Ex: Centrica (Restore), Flexcity (Activity), Next Kraftwerke,...



Security of supply – capacity mechanism

- **Strategic reserve:** Elia is responsible for organizing (auction), managing and, if necessary, activating a strategic reserve mechanism to offset any structural generation shortages during the winter months. Expected volumes:
 - winter 21-22: 0MW
 - winter 22-23: 800MW
- **Capacity Remuneration Mechanism (CRM):**
 - Compensate generation capacity with regards to the nuclear phase-out (starting in 2025).
 - Compensate electrical capacity holders for that portion of their relevant costs that are not compensated by their revenues, otherwise known as ‘missing money’, because of limited running hours.
 - Enable current and new capacities to be available on the market in order to avoid security of supply issues.
 - Auction based, in multiple phases
 - Technology neutral; opportunity for new Energy Storage systems

Permitting and Standardisation

Rules and regulations in the e-storage sector

European Regulations

- **EU Batteries Directive:** Energy storage solutions must comply with the European Batteries Directive, which:
 1. Prohibits the placing on the market of certain batteries manufactured with mercury or cadmium.
 2. Encourages the recycling of (parts of) batteries.
 3. Supports the improvement of batteries and environmental performance of all actors involved in the life cycle of batteries and accumulators.
- Currently, the EU is working on a proposal for a regulation concerning batteries and waste batteries, which would replace the Batteries Directive (2006). This 'new' regulation would govern the entire battery lifecycle.
- It would establish mandatory requirements for sustainability (such as carbon footprint rules, minimum recycled content, performance and durability criteria), safety and labelling for the marketing and putting into service of batteries, and requirements for end-of-life management. It would also introduce due diligence obligations for economic operators sourcing raw materials.

Environmental permits

- Flanders: For stationary batteries an environment notification is necessary if the installed capacity is higher than 10 kWh or if the power is higher than 10kW. ([Vlarem](#) regulation)
- Flanders: the Vlarem regulations [define conditions](#) for the room or cabinet that houses stationary batteries, specifying things like liquid-tight floors, fire resistant walls and doors, inertion to electrolytes, prevent water contamination and ventilation to avoid dangerous gas concentrations.
- Flanders: the Vlarem regulations also defines similar conditions for storing batteries in [waste processing facilities](#).
- Flanders: to comply with the [“European extended producer responsibility”](#), 2 options exist:
 - Organise end of life by yourself
 - Use the services of BEBAT to organise end of life of the battery systems

Business Support National energy and climate plan (NECP)

Policies and regulations regarding e-storage

NECP of Belgium

- Storage will be one of the solutions in addressing needs for flexibility in the internal energy market
- Different levels of government will ensure the continuous development of new centralised and decentralised storage systems
- The regions are working on a clear regulatory framework, intended to place storage behind-the-meter or at the neighbourhood level
- Objective to create energy storage potential as means to integrate intermittent, decentralised renewable energy into the grid
- Legal frameworks revised to different regional contexts to allow prosumers to choose whether generated energy should be fed back into the grid at peak times, or a battery storage system should be used

Source: https://energy.ec.europa.eu/system/files/2020-09/be_final_necp_parta_en_0.pdf

Policy instruments

As a facilitator for the energy transition, e-storage is stimulated by various policy measures (European, national & regional).

- **National Climate Goals:** interlinked with the international Climate Agreement. 50% less emission pertaining to 1995 in 2030



Financial support

European battery storage funding for R&D

Battery storage, among other important key technologies and innovations, is one of the funding priorities within the European Union.

European funds are an important means to connect our energy transition ecosystem with other important hotspots in the EU, for example through cross-border cooperation and knowledge transfer.

Examples of European subsidies that SMEs and knowledge institutions in NWE are eligible for are:

- **M-ERA.NET:** Aims to strengthen the contribution of R&D in materials to energy-related applications.
- **Horizon Europe:** EU's key funding programme for research and innovation. It tackles climate change, helps to achieve the Sustainable Development Goals and boosts the EU's competitiveness and growth.

Battery storage funding for R&D

Belgium: Energy Transition Fund. Support for R&I projects for energy. In this context, several publicly funded R&I projects which also include storage, are being performed by Belgian research centres. The funding for energy related R&I projects in 2022 amounts to 25 million €.

Flanders: VLAIO subsidies for research projects: Supports Companies with a subsidy of 25% to 60% for the implementation of certain research projects. Research projects mainly consist of activities in which new knowledge, insights and skills are built up in a critical and systematic manner and which, in the long term, form the basis for changes within the company

Flanders: VLAIO subsidies for Development projects: Supports Companies with a subsidy of 25% to 50% for the implementation of certain development projects. Development projects are intended for innovative ideas - new or improved product, process or service - that can change and strengthen the company in the short term. The development of a pilot installation or demonstrator is also eligible if it concerns supportable activities

Flux50

Spearhead cluster for energy: As a member-driven network organization representing more than 200 SMEs and industrial companies, Flux50 brings together players from industry, academia, and government to provide them with project support and networking opportunities. By organizing market development events, it facilitates cross-sector collaboration between energy, IT, and building companies to enhance the competitiveness of the Flemish smart energy industry.

Several instruments: It possesses many instruments, such as access to living labs, facilitating the setup of (R&D-) project consortia and facilitating project setup and funding. It provides network opportunities via events, dissemination of project results via seminars and access to international cooperation through intercluster activities and participation in European projects.

Examples:

- **European funding:** Funding that can be used to accelerate research, expand the knowledge base or cooperate with research institutions. Examples: INTERREG, EFRO, Horizon Europe.
- **Flemish funding:** Flux50 facilitates the request for funding to VLAIO, for project consortia.

Battery deployment funding

Belgium: tax discount: Investors in energy storage assets are eligible for a federal tax discount; for physical persons the deduction on the taxable income amounts to 20% of the eligible investment amount, versus 13.5% for companies.

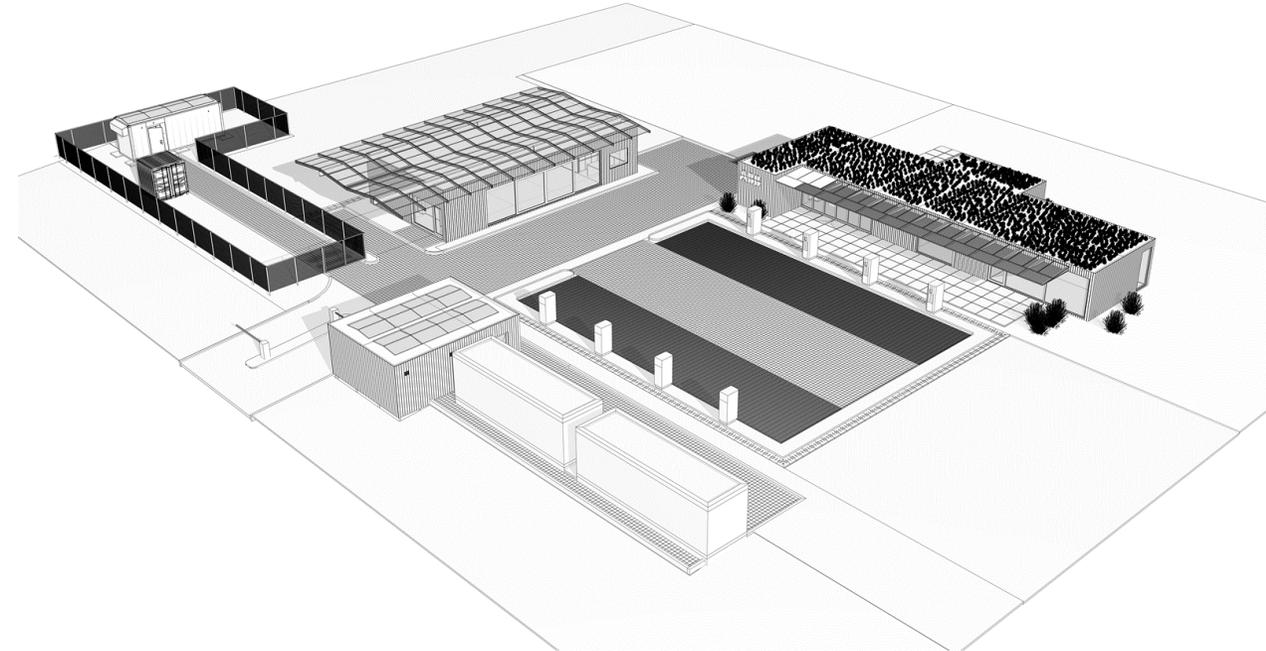
Best Practices

Best practices in Belgium

- The law contains a definition on 'Energy storage.
- Notification OR permitting requirement depends on storage capacity
- Storage is allowed in the Reserve markets; It is already common in the FCR market. The first systems are deployed in the aFFR market.
- CRM design allows the participation of storage directly or through aggregation
- Regulatory framework explicitly allows the regulator to provide specific tariffs to storage
- Storage is exempted from some electricity taxes

Green Energy Park - Zellik

- **Smart Village Lab:** living lab for energy and mobility
- **Smart homes in a smart neighborhood:** individual assets versus collective assets.
- **Smart Home Lab:** 6 houses with typical electrical installation (PV, inverter, digital meter, consumers/loads, home battery, EV-charger, EMS).
- **Collective charging station:** parking with 16 places for EV's; different types of charging stations; pre-cabled for charging stations; smart loading algorithms.
- **Collective batteries and PV:** 2*350kWh neighborhood battery/behind the meter battery; 60kWp PV
- **Welcome** for tests, demonstration, integration, training of your energy product or service.



Energyville - Genk

- [EnergyVille](#) is a collaboration between the Belgian research partners KU Leuven, VITO, imec and UHasselt in the fields of sustainable energy and intelligent energy systems.
- EnergyVille develops technology and knowledge to support public and private stakeholders in the transition to an energy efficient, decarbonised and sustainable urban environment.
- EnergyVille is located at [Thor Park](#), a business, technology and science park where research institutions, start-ups, growth companies and global players in the energy sector, manufacturing industry and smart city applications come together.
- **Welcome** for research, testing, validation of your energy product or service.



Lemcko lab - UGhent

- Lemcko is the Energy lab of the university of Ghent
- Detection of voltage dips, harmonics, imbalance, flicker, EMC problems in the lab; also on-site measurements.
- We have the measurement equipment and the knowledge!
- Engine and generator testing; EMC measurements and troubleshooting; power quality measurements and troubleshooting; decentralised generation and storage: analyses and troubleshooting; calculation tools for energy storage; mobile storage
- **Welcome** for low voltage measurements



Interreg North-West Europe STEPS

European Regional Development Fund

THANK YOU!