Legal Requirements for Automated Coordination Mechanisms for the Sharing of Energy Through Proxies: A Precautionary Approach

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COOMEP

Coordination mechanisms for the sharing of energy through proxies, from the user to general guidelines

WP4

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EXECUTIVE SUMMARY

This report analyzes how EU regulations impact automation tools for renewable energy sharing, focusing on Work Package 4 Tasks 4.1 and 4.3 of the project. It assesses three key regulatory frameworks: the recently adopted EU Artificial Intelligence Act (AI Act), the General Data Protection Regulation (GDPR), and the EU legal framework for peer-to-peer energy trading, specifically the Renewable Energy Directive (RED) and the Internal Market for Electricity Directive (IMED). The analysis also addresses the Brussels legal landscape for energy sharing.

The report clarifies the distinct uses of AI Proxy concepts across different work packages and develops a precautionary approach to ensure the coordination mechanism respects fundamental rights. It examines its broader implications, unpacking the assumptions and politics involved in designing the mechanism and its potential use in other contexts. It also provides COOMEP partners with key legal concepts regarding privacy, data protection, and AI to assess potential impacts on users' privacy and personal data.

The report provides a state-of-the-art analysis of legal conceptualizations of privacy, data protection, and artificial intelligence (AI) within the context of energy sharing through proxies. The analysis is organized around three legislative domains: data protection, artificial intelligence, and energy market regulations. Each section explores specific requirements and implications for the project's coordination mechanism.

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1. INTRODUCTION

This report offers a cutting-edge analysis of legal conceptualizations of privacy, data protection, and AI, within the context of energy sharing through proxies. The goal is to provide COOMEP partners with a set of key concepts that will serve as a reference for later assessing the impacts of the project's work on the privacy and personal data of users involved in the coordination mechanism.

The foundation of this report consists of legal and regulatory provisions. These provisions are categorized into three distinct legislative domains: data protection legislation, artificial intelligence legislation, and energy legislation. Accordingly, the main section of the report is organized into three parts based on the primary legal frameworks examined. The first part addresses the relevant requirements outlined in the General Data Protection Regulation (GDPR). The second part assesses the legal requirements for AI systems as specified in the AI Act. The third part examines the legal framework pertaining to the energy market, specifically focusing on two EU Directives, known as the Renewable Energy Directive (RED) and the Internal Market for Electricity Directive (IMED).

The concept of an AI proxy in the context of developing a coordination mechanism for sharing (exchanging) renewable energy is utilized in two distinct ways in the COOMEP project:

1. **In the context of WP1 and WP2, it is used to refer to an AI agent or digital assistant that takes specified automated decisions on behalf of the energy consumers.**

2. **In the context of WP4, tasks 1 and 3, it is used to refer to computational tools that stand for real-world interactions, events, or states of affairs, such as training data, labels in supervised ML, loss functions in unsupervised ML, goals in reinforcement learning (RL), prompts in RL with human feedback, agent-instructions in multi-agent systems, models, etc.**

To prevent confusion, we have renamed the AI proxy in WP1 and WP2 as AI Agent or Digital Assistant. This is also the term we will use in this report when referring to the AI proxies of WP1 and WP2.

Below, we will explain how we will deploy the concept of AI proxy in the context of WP4, specifically tasks 1 and 3, as well as how the term is utilized in WP1 and WP2 (section 2). Following this, we will describe our use of the concept of 'choice architecture,' which refers to the constraints that enable and/or limit the design choices of those who develop and provide the WP1-2 AI agents (section 3). Finally, we will outline the relevant legal framework (section 4) concerning the AI proxies as defined in section 2.

2. THE DEFINITION OF AI PROXIES (AS USED IN WP4, TASKS 1&3)

AI proxies, as defined in WP4 tasks 1 and 3, encompass the training data, labels, models, rules, prompts, and goals that represent real-world actions, objectives, events, states of affairs, issues, or problems that shape the input, learning model, and output of the WP1-2 AI Agents. Therefore, the AI proxies in WP4 tasks 1 and 3 serve as methodological tools that symbolize real-world actions, objectives, events, states of affairs, issues, or problems informing the design of the WP1-2 Agents. It is crucial to emphasize that these methodological tools are not equivalent to real-world objects, states, or actions.

2.1. AI Proxy in WP4, task 1&3

The WP4, tasks 1 and 3 AI proxy refers to, for example:

- **Training, validation, and test data sets** (e.g. energy usage data that stand for future energy consumption habits of the users and/or of other users or groups of users). Note that it is crucial for these three types of data sets to be different so that the model does not see the validation and test data during the training phase and does not see the test data during the validation phase. The division between them is important because while the training data set enables the model to learn, the validation data set helps fine-tune and optimize the model. And then the test data set provides an unbiased evaluation of the model's performance on previously unseen examples. This separation helps to avoid overfitting, where a model performs well on the training data but fails to generalize to new data.
- **Labels in the case of supervised learning or simulations in MAS**, e.g., fine-grained device data that stand for the needs of users to enable a fair distribution, for instance when specific energy usage data is labeled as less necessary than others;
- **Objectives of modeling energy usage data**, e.g., specific energy usage data that stand for energy efficiency of one household, of shared resources, of other users, or financial gain of individual users, sustainability and/or fairness;
- **Inferred preferences of energy users** that stand for real-world preferences of current and/or future energy users, e.g. which kind of users tend to go with the default settings/parameters (i.e., households with children or elderly), which kind of users tend to play with the settings and under what conditions, what inferences are made, based on this data, about their intentions, desires, needs);
- **Rules constructed for the simulation exercises by the WP2** (instructions created within a simulation game to model real-world interactions and decisions) that stand for how current and/or other users supposedly behave in real-world settings
- **Behavioral data used to test the behavior of multi-agent systems**, where the behavioral data stand for the future behavior of current or other energy users

The choice architecture that informs the design of the WP1 and WP2 AI agent will consist of, first, the software, hardware, and methodology deployed. Additionally, it will include the applicable legal framework (GDPR, AI Act, and other relevant EU laws) (WP4) and the output of a citizen jury from WP3, which should help balance the shared public interest—defined by all participants—with individual interests in access to energy. The concept of choice architecture is derived from behavioral economics, where it pertains to the design of an environment that offers specific choices while eliminating others. Without endorsing the assumptions of behavioral economics, this concept aids in understanding that choice architecture, such as law, is not merely about constraining choices but also about enabling specific choices. We employ the concept of affordances to emphasize this, noting that affordances may be obscured (as in the case of dark patterns). As indicated, the concept of choice architecture as applied in WP4 will be further detailed in section 3, prior to presenting the choice architecture defined by the legal framework.

2.2. AI Proxy in WP1 and WP2

WP1 refers to a proxy as an artificial intelligent "delegate" that can act on behalf of users (households), to make specific "autonomous decisions" on behalf of energy consumers, ensuring their interests and needs met.

Similarly, WP2 refers to a proxy as a "smart agent", an AI delegate that handles the energy requirements of households.

An AI agent/assistant (smart agent) is an automated decision-maker (ADM) that can be configured by its users to act on the users' behalf. The AI agent contains a set of settings that have been decided at the design stage, which are customizable within the boundaries afforded by the technology, allowing users to change the default setting/parameters[1] at any given moment. The system is informed by proxies at two phases: design phase and use phase, allowing for the AI agent to draw inferences from behavioral data that it collects and input explicitly provided by end-users concerning their preferences (parameterizable).

<u>Questions:</u>

- <u>Which settings are decided by the developers of the system?</u>

The developers decide on the tool's functionality and how the resource functions. This includes:

- Determining the default objective function/goal
- Choice of algorithm (rule-based system/deep learning system)
- The granularity of the energy consumption data

[1] The concept of 'parameters' is used by WP2 to refer to the preferences or inputs that users can set for the AI agents. These parameters allow users to customize the agent's behavior to match their goals (e.g., Financial gain)

- Used dataset

The tool's default objective, determined by COOMEP researchers, is to maximize efficiency in coordinating renewable energy distribution and sharing among households. The selected algorithm is a deep learning system trained to manage energy sharing. The goal is to distill this deep learning system into a set of executable rules (e.g., if 'battery is lower than 20%' and 'no sun for one hour' then charge). In this process, the price mechanism acts as a proxy for users' actual preferences.

While this goal is neutral, the actors deploying the system in the real world and the users might have different objectives. The kind of efficiency is thus decided by the actor(s) deploying the system in the real world, not the developers of the system.

- Is it the case that users can configure the AI agent?

The user would be able to configure the AI agent to a certain extent. The configurability, in this case, would be related to the ability to choose an objective function or goal that matches the user's personal preference and objectives. This will depend, however, on the level at which this configurability option is implemented. For instance, if the actor installing the system will be Sibelga, they might only consider a single objective (eg. stabilizing the grid). Whereas, if a group of end-users decide to implement the system by themselves, they could have different goals.

- If so, which choices do they have?

The following choices can be provided to the users:

  - **Optimizing for financial gain**: Configuring the agent to prioritize cost savings and financial efficiency.
  - **Optimizing for social welfare**: Setting the agent to prioritize actions that benefit the community or society as a whole.
  - **Optimizing for sustainability**: Directing the agent to focus on environmentally friendly and sustainable practices.

To illustrate this with an example, one of the scenarios where users would have to make a choice could be the case when there is a shortage. The user would have to decide how they want to react in such a situation based on the above variables (options) provided by the AI agent.

- Are the users free to change their preferences (at any time)?

In principle, users will be free to change their preferences at any time.

It is the choice architectures, the set of architectural design choices available, that enables or limits the choices that the deployer or user of a technology can make.[2] In the case of AI agents used for sharing of renewable energy, the choice architectures made at the upstream level, thus the qualitative decisions that include technical design decisions, together with the choice architectures created at the design and deployment phases of the system, determine the affordances of the system downstream, that the end-user, the household, will interact with. The choice architectures are not made in a vacuum. The law, in this case, the AI Act[3], imposes certain constraints, which contribute to shaping a dedicated choice architecture for the developers and providers of AI.[4]

The types of options the end-user has, or the ADM AI agent has, are determined by the affordances of the AI agent. The concept of affordance situates agents (a plant, an animal, a human animal and even an artificial agent) as dependent on what their environment 'affords' them in terms of both action and perception, thus highlighting the ecological nature of agency.[5]

These affordances constrain the kind of options an end-user would get from the tool, or the kind of actions an ADM would be able to take. The settings among which an end-user would be able to choose are also constrained by these choice architectures. As these choice architectures should be such that they serve the needs of households by outputting relevant and reliable recommendations or automatic decisions, the technical decisions made while developing the system must be made with an eye to what end-users agreed on.

In more detail, the techniques that underlie an AI agent are be based on design choices that determine the output of the AI agent. The start point is to specify the purpose that the AI agent is supposed to achieve as a task computable by the machine. In this case, the real-world purpose may consist of balancing different individual interests with public/community interests in the sharing of renewable energy while remaining within the bandwidth of the applicable law, and thus preventing fundamental rights violations. For this purpose to be translated into a computable task, the purpose must be formalised and this formalization will serve as a "proxy" for the real world purpose.[7] Formalization will have to take into account three types of input: (1) the preferences of the end-user (e.g. based on their willingness to engage in their energy community (2) recommendations from the citizen jury (e.g. about fairness) and (3) articulations of the general interest (e.g. energy efficiency to mitigate climate change).

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[2] See: Hildebrandt M (2022) The Issue of Proxies and Choice Architectures. Why EU Law Matters for Recommender Systems. *Front. Artif. Intell.* 5:789076. doi: 10.3389/frai.2022.789076

[3] Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts COM/2021/206 final

[4] Hildebrandt M (2022) The Issue of Proxies and Choice Architectures. Why EU Law Matters for Recommender Systems. *Front. Artif. Intell.* 5:789076. doi: 10.3389/frai.2022.789076

[5] For a more detailed description of the concept of "affordance" see: L. Diver, T. Duarte, G. Gori, E. van den Hoven and M. Hildebrandt, Research Study on Text-Driven Law (Brussels 2023), funded by the ERC Advanced Grant 'Counting as a Human Being in the Era of Computational Law' (COHUBICOL) by the European Research Council (ERC) under the HORIZON2020 Excellence of Science program ERC-2017-ADG No 788734 (2019-2024)

Questions:

- What is the purpose of the COOMEP coordination mechanism?

The purpose of the coordination mechanism is the coordination of renewable energy distribution/sharing among households while maximizing efficiency.

- What design decisions define the contribution of WP1?

The design decisions that define the contribution of WP1 consist of the granularity of the energy consumption and production data.

- What design decisions define the contribution of WP2?

The design decisions that define the contribution of WP2 consist of the choice of algorithm and the used data set.

- How will the preferences and/or agreement of the end-users feed into the coordination mechanism?

The preferences of end-users, as reflected in their system configuration, will directly affect the efficiency of energy sharing by the coordination mechanism.

- How will the recommendations of the citizen jury feed into the coordination mechanism?

The recommendations provided by the city jury will be considered by the WP2 researchers when determining their design decisions.

- How will the legal choice architecture inform the design of the coordination mechanism?

Section 5 of this report aims to answer this question.

3. THE CONCEPT OF CHOICE ARCHITECTURE

The concept of choice architecture was created within nudge theory to describe a deliberately created environment that determines the available choices for the members of that environment. The objective of creating certain choice architectures was to nudge people towards making certain choices.[6]

In this report, we liberate the concept of choice architecture from any attempts to influence or manipulate people's behavior. We rather have them participate in the design of their environment. Hildebrandt connects 'choice architecture' with the concepts of 'affordance' and 'capability' to "understand agents in terms of what an environment "affords" them and of what affordances they are "capable" of acting upon.[7]

Hence, in the context of WP4 tasks 1 & 3, the concept of choice architecture refers to the affordances provided to specific types of agents by a particular environment in terms of choices they can and cannot make, depending on their capabilities.

Individuals, and particularly those responsible for making certain decisions, do not make those decisions in a void. For example, judges do not have infinitive alternatives for deciding upon a case. Many features of the environment could influence their decision (i.e. an argument with their partner that morning, a momentous headache, etc.) But judges should not allow these features to impact their professional decision-making. By requiring them to decide within the boundaries of the law, their decisional space is restricted to what is relevant from a legal perspective. The entity that designs the environment within the boundaries of which a certain group of individuals must act is considered a choice architect. **When speaking of legal choice architecture, this report foregrounds the legislature and the courts as the main choice architects**. As will be explained in the following section, legal frameworks create a choice architecture for those to whom they apply, affording them a dedicated set of choices for their actions.

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[6] Refer to: Thaler, Richard H., Sunstein, Cass R. and Balz, John P., (2010). Choice Architecture. Available at http://dx.doi.org/10.2139/ssrn.1583509

[7] See: Hildebrandt M (2022) The Issue of Proxies and Choice Architectures. Why EU Law Matters for Recommender Systems. *Front. Artif. Intell.* 5:789076. doi: 10.3389/frai.2022.789076

4. PROJECT DESCRIPTION

Many households are currently facing challenges with energy production and consumption. These households have to spend excessive attention on monitoring changes with regard to their electricity consumption, production and fluctuation prices on the market. Autonomous decision-makers (ADM proxies) can be a force for good here, providing a way for users to have their interests and needs met. Yet given the importance of energy for everyone in a society and the need to have a leveled playing field, co-designing these systems with legal and social science experts is recommended as it ensures that human rights are not violated and that citizens understand and support the systems put in place to ensure their activities. The overall goal of this project is to co-create a socio-technical distributed coordination mechanism based on proxies that are fair towards its users and the community, while not being manipulative, enhancing rather than diminishing the agency of those concerned.

To realize this project we did a mapping of the global consumption and production data, thus requiring the use of smart meters (Flukso meters) in two of the energy communities already collaborating with the Voisin d'Energie project.[8] The data is collected in a Big Data infrastructure in the computing center at the ULB. The WP1 addresses the disaggregation and the analysis of this data, as well as the creation of user activity models, which can be provided to the user community for their knowledge and are used in WP2 to design what-if scenarios to explore potential community configurations.

The latter requires us to define a sandbox model wherein the collective dynamic of such energy communities can be explored, and outcomes can be analyzed in terms of effectiveness and also their implications from a human rights perspective (e.g., when some have more means than others but require equivalent resources). We explore the effect of multiple stakeholders on the collective dynamic and co-design with first the legal experts and later the Brussels Capital Region (BCR) citizens on how to manage such an ecosystem and what role (automated decision-making) ADM proxies are allowed to play (or not).

Additionally, data are collected through behavioral experiments to examine people's choices in ADM proxies and their willingness to use them. This requires online experiments through platforms like Prolific, where people are invited to participate. The goal is to explore the agents used in consuming from a limited energy source (e.g., a common-pool resource game).

To gauge BCR citizens about their willingness to participate in a system to share energy through the use of ADM proxies, this project also has an important citizen science component. The idea was to collect feedback about the coordination solutions produced from the data and the simulations. To achieve this, a citizen jury process was added, whose aim was to let citizens decide on the guiding principles of how and when an AI should decide on the distribution of energy when

[8] For information regarding the Voisin D'Energie project refer to: https://energy4commons.org/voisins-denergie/

the resources are limited. This is then translated into the work of the technical partners. Citizens will thus act as partners, allowing for the design of guidelines at the end of this project on when and how such systems can be designed in BCR, considering the context of the different communities in the BCR.

Interwoven through all these steps is the legal expertise and research that ensured alignment with human rights is part of the design and research process. To achieve its goal, COOMEP has a technology, legal, and social angle, reflected in four Work Packages (WPs).

4.1. WP1 overall objective

The expected outcome of WP1 is a model of energy demand that utilizes socio-economic metadata and incorporates the effect of social practices. This model will predict consumption patterns at the granularity of individual homes and appliances, as well as at the neighborhood scale, while considering their interactions. Such a model can facilitate what-if analyses and test the impact of external triggers or awareness campaigns on electricity consumers' behavior, thereby enabling the design of more effective energy policies. This WP primarily focuses on storing high-throughput **electrical consumption data** in the ULB Big Data Infrastructure, understanding this data's nature in relation to the knowledge acquired regarding residents' electrical consumption habits, and validating this data with household inhabitants to ensure its coherence with their reported consumption behavior.

What data are collected?

WP1 collects energy consumption and production data by using Flukso meters. Models are then developed to identify specific appliances and have a better understanding of the load curve of citizens. Surveys are then conducted to understand what appliances have been used by the energy consumers and, therefore, test the developed model's ability to identify specific appliances. This data is then used to define social practices. Despite the interest that this line of research can entail for research purposes, such data are not necessary for the real-world applicability of the coordination mechanism.

Data are collected from two energy communities: Coin do Balai and L'Échappée. The communities were selected based on their neighborhoods' existing social dynamics and a diversity of socio-economic levels and urban configurations. Currently, the analysis has focused on daily energy sharing in a normal situation, which might be different in different seasons (winter/summer). No analysis has been performed on crisis situations.

Le Coin du Balai is a neighbourhood in Watermael-Boitsfort on the edge of the Foret de Soignes. It has around 800 small houses and 3000 residents. The community is a registered energy community with around fifty photovoltaic panels installed.

L'Échappée is an 18-family grouped housing project (cohousing) set up in 2016 near Tour & Taxies, in a socially mixed neighbourhood. It has three photovoltaic panels connected to three individual meters. L'Échappée is in the process of determining their legal status for energy sharing purposes under Belgian law.[9]

The tasks of WP1 include:

- Data collection and storage of the high throughput electrical consumption
- Train electricity disaggregation models on open datasets and apply them to the data to gain further behavioral insights.
- Develop a UML activity-based modeling of the electricity demand and photovoltaic production that will allow to carry out what-if analyses using the electricity demand model to help design energy policies by changing social practices.

The above-listed tasks are translated into the following deliverables:

- A Big Data solution for storing and managing the high throughput electrical consumption data of participating houses.
- A deep-learning algorithm to disaggregate the electrical consumption data and the results for each of the participants of the Voisin d'Energie project
- A UML activity-based modeling to simulate in a clear, realistic and understandable way the behavioral patterns of the participants in terms of electricity consumption.

4.2. WP2 overall objective

As a main objective, this WP will deploy expertise in AI and agent-based modeling to study the question of which mechanisms may improve (or harm) coordination when sharing resources through AI proxies in a Common-Pool Resource (CPR) games, of which the energy use-case of WP1 is just one example. This WP is composed of two parts. One part investigates how to define and design commitment-based agents for the CPR delegation work, and ultimately for the energy sharing use-case, so that fair resource sharing is achieved, while ensuring that individual and collective needs are met and results are legally acceptable.

Furthermore, this part investigates how delegation to intelligent artificial agents changes choices in the context of CPR games, focusing specifically on the role of (costly) commitment in driving coordination. To achieve this goal, a series of experiments with human participants will be performed to gauge the effect of working with AI proxies and commitment strategies in socially complicated situations (like the energy use case). In the next step of the project, the web platform will be implemented for the experiment and the collection of data from participants.

While the first part examines the interaction between humans and agents, the second part of this WP explores the interaction among agents. It focuses on creating formal models that explain the observations and enable researchers to predict how changes in these models will positively impact

[9] For further details refer to section 5.4 of this report.

behavior, i.e., to produce balanced resource consumption while ensuring that needs are met and no fundamental rights are violated. In this part, a multi-agent sandbox is being developed in which various regulatory solutions, both with and without enforcement, may induce fair resource sharing in the CPR and the energy use case as defined in WP1.

This environment is essential for testing different coordination mechanisms, such as the commitment strategies identified earlier, under lifelike conditions. Realistic production and consumption profiles utilizing data from the City Learn challenge[10] are used, in order to establish a realistic testbed for the coordination mechanisms. It should be noted that the multi-agent sandbox has a modular design which allows it to incorporate insights gained from WP1 for the creation of energy consumption and production profiles so that it more closely captures the energy dynamics of Brussels. Furthermore, our goal is to improve the simulator's capabilities to accommodate a variety of agents, reflecting the diverse designs and architectures that real-world multi-agent systems would exhibit. This WP intends to investigate the dynamics that arise from the interactions of diverse heterogeneous agents,[11] each with distinct goals or architectures, within the system. In addition, this WP intends to track the effects of agents as they enter and exit the system in order to comprehend how this affects the stability of the coordination mechanisms. These investigations are crucial for developing robust and adaptable coordination mechanisms ensuring their relevance in real-world applications.

Concerning the simulator's functionality, it currently features a double auction market as its coordination mechanism, allowing agents to anonymously trade surplus energy in a market system. In the subsequent phases, the aim is to support more coordination mechanisms, including the commitment strategies that WP2's behavioral experiments explore. This WP also plans to integrate an automated incentive design, enabling an adaptive agent to generate collaborative incentives, thereby enhancing cooperation under challenging conditions when standard coordination mechanisms fall short. The focus is on distributed coordination via incentive mechanisms, where agents communicate energy consumption and production among each other. The ultimate aim is to build a flexible and powerful approach to automated incentive design using reinforcement

[10] A commonly used dataset for the development of energy management technology. See: https://www.citylearn.net/citylearn_challenge/index.html

[11] In the real-life scenario, agents can be provided by different companies, hence, also their predetermined architectures/levels of sophistication might be different. Possible examples include scenarios consisting of agents with different objectives/preferences (for e.g., some agents have sustainability as their default objective, some profit), or scenarios with energy sharing between more powerful agents and less powerful or less sophisticated ones. In the latter scenario, WP2 would investigate whether the coordination mechanism can be abused by more powerful agents to exploit less advanced agents. Investigating the dynamics arising from the interactions of these heterogeneous agents aims to guarantee fairness in energy sharing between agents from different providers. It is important to note that in analyzing these interactions, WP2 assumes that users stick to their predetermined objectives/preferences. No consideration is given to cases when users change their behavioral preferences and how this impacts the whole chain of interactions.

learning, where an adaptive agent learns to create cooperative incentives when other cooperation mechanisms are insufficient.

What data are collected and/or used?

A. As part of the behavioural experiment, around 500 participants are expected to be recruited from the Prolific platform (www.prolific.com), where they are filtered based on their English fluency. In this experiment, collected data consists solely of the decisions participants make in the designated task.

   Following standard Experimental Economics methodology, this experiment provides participants with all necessary information, including the task, potential earnings based on behavior, and the influence of others. Conducted via a web platform, participants will make decisions after consenting to the information provided. They cannot communicate directly with one another, and all personal data and decisions will be anonymized and unlinked from their identities.

   Besides the information about their actions in the experiment, data such as gender, age and country of origin, are also collected for the purpose of checking the gender balance and sample representativeness. This data is not linked to any identifiable information regarding the participants. For the behavioural experiment part, no data from the other WPs are used.

B. As part of the regulatory sandbox, publicly accessible data from three data sources are used.[12] These consist of consumption and production data. The mentioned data sources for the regulatory sandbox are the following:

   1. **CityLearn**: Open source and publicly available energy consumption and production data for the period of 2020-2023 from various regions of the United States. This data consists of four datasets:

      - 2023 Dataset:[13] energy consumption and production data, such as energy needed for temperature control appliances (heat pumps, domestic hot water pumps, etc.), but not exactly appliance-level information. For COOMEP research purposes, WP2 uses only the aggregated consumption (one reading for the whole household at regular intervals) and production data.
      - 2022 Dataset:[14] This dataset contains the same variables as the 2023 dataset (energy consumption of heaters and other electric devices)
      - 2020 and 2021 datasets: Simulated energy consumption and production data.

[12] WP2 does not at this stage have access to data collected from WP1, due to data sharing restrictions. Due to such limitations, WP2 team had to resort to publicly accessible data, which mainly represents the US energy consumer, not the European one.
[13] For more information on the dataseet see: https://www.aicrowd.com/challenges/neurips-2023-citylearn-challenge
[14] For more information on the dataseet see: https://www.aicrowd.com/challenges/neurips-2022-citylearn-challenge

2. **ANTgen library**: Next to CityLearn, which has predefined datasets, WP2 also wants to be able to generate their own scenarios to test the energy exchange mechanism. For this, they use the ANTgen library,[15] a tool used to generate electricity desegregation datasets. It provides realistic energy consumption signatures for many commonly used devices (fridges, computers, etc.). It additionally also allows for the planning of the usage of these devices to create realistic energy consumption patterns (for e.g., it is possible to simulate a user who runs his dryer every day or someone who only consumes energy after working hours).[16] This data is synthetically generated using a dataset from a 2012 paper ("On the Accuracy of Appliance Identification Based on Distributed Load Metering Data") where more than 1000 real-world power consumption traces of different electrical devices were collected. Again, for COOMEP research purposes WP2 only uses the aggregate electricity consumption data (one measure for each household following a fixed interval) and only uses ANTgen to generate different profiles of users in their scenarios to measure the performance of the energy exchange mechanisms.
3. **PVlib**: Additionally, when ANTgen is used to generate energy consumption data, WP2 still needs a tool to generate electricity production data. For this, they use PVlib,[17] a community-developed toolbox that provides methods to simulate photovoltaic panels. This is synthetic data that is generated using scientific models and, therefore, does not use any personal information.
4. Additionally, this research section also uses **pricing data** and **weather information** for the purpose of analyzing the coordination of energy sharing.
5. No data from the other WPs are used.

Finally, because of the limited availability of high-quality energy datasets and the geographical limitations of datasets WP2 does not limit the toolbox to the above listed datasets. They allow for additional data sources to be used as long as they fit their format.

The tasks of WP2 include:

- Designing agents with commitment behavior for CPR.
- Experimental exploration of fairness through AI proxies in common-pool resource games.
- Designing and implementing the regulatory sandbox for the energy use-case.
- Mechanism design and how to support stakeholders in deciding on the solution concepts.

The above-listed tasks are translated into the following deliverables:

[15] ANTgen Library: https://github.com/areinhardt/antgen
[16] For more technical details regarding datasets provided from ANTgen Library refer to: https://dl.acm.org/doi/pdf/10.1145/3396851.3397691
[17] PVLib: https://pvlib-python.readthedocs.io/en/stable/index.html

- Experimental design and power analysis to explore the commitment strategies relevant for the extraction of common, finite resources and specific energy-sharing scenarios.
- PoC for the ABS sandbox in which fairness and sharing mechanisms can be studied with the framework of current and future law.
- Approach for automated incentive design.

4.3. WP3 overall objective

WP3 focuses on actively involving users in the design of the AI proxy so that they develop an understanding of the most important choices. Where possible, users are involved not only in choices but as a constructive conversation partner for AI designers, voicing their concerns that risk being unaccounted for when only a selection of data-sources or socio-technical coordination mechanisms are taken into consideration. This WP3 activity deals with the societal aspects of building AI agents (proxies) for energy sharing. As such, it needs to ensure that technology will be developed with and for the people. That means actively engaging citizens in the conception and the design of the AI proxies. The aim is to develop ethically guided AI systems for managing citizen-defined fair energy distribution in crisis scenarios in Brussels. Using a citizen jury approach, this work package aims to create a deliberate process to define ethical guidelines for general principles concerning energy distribution and for AI design that will govern energy distribution on behalf of different Brussels actors. The aim of the citizen jury is to investigate the initial ethical guidelines and redlines when introducing an automated decision-making system in the distribution of energy among Brussels' households. The project activities within this WP thus encompass two phases: first, a Citizen Jury to understand general rules toward energy decisions, and second, the translation of these insights into practical AI and data proxy design. The Citizen Jury has provided the guidelines and redlines of the energy-sharing scenarios using AI for decision-making. The ultimate aim is to translate these citizen-developed principles in technology design.

The tasks of WP3 include:

- Citizen jury on ethical guidelines for employing AI in energy-sharing context
- Co-design processes with citizens/energy communities on translating citizen requirements into technology design

The above-listed tasks are translated into the following deliverables:

- Boundary objects
- Citizen jury cookbook

4.4. WP4 Overall objective

WP4 focuses on developing a precautionary approach to potential fundamental rights infringement by eliciting a set of relevant design decisions that may trigger such infringements. The focus is on the following fundamental rights: data protection, privacy, non-discrimination and the right to an effective remedy. Though this involves research into relevant positive law, the main goal is to test to what extent the output of the research (the coordination mechanism) incorporates the checks and balances that are key to the rule of law. This involved an in-depth cross-WP discussion on the AI proxies that are chosen to develop systems/methods/workshops [as well as on how diverse actors (such as users, AI proxies or researchers) interact in shaping the design and use of the perspective system(s)]. Part of the AI proxies consists of tests that aim to provide evidence of the functionality/efficiency/effectiveness (WP 1,2,4) and/or seek to establish the preferences of energy users (WP 1,2,3). These tests are investigated as to their real-world impact based on a 'sociology of testing' through interviews and a critical-making workshop. In practice, this means to identify what the diverse actors involved believe that the testing includes or excludes. For example, what counts as a good proxy and what the proxy stands for, what and whose concerns are reflected in a given testing exercise and what and whose concerns are not tested, etc. Finally, a series of checks and balances are suggested to be built into the system that should help to mitigate potential fundamental rights infringement and ensure the contestability of systems/methods that impact fundamental rights.

The tasks of WP4 include:

- Developing the concept of AI proxy
- Developing a preliminary assessment of the potential impact of upstream design decisions and AI proxies in terms of downstream fundamental rights infringements
- Conducting interviews on the impact of testing on the real-world environment
- Organizing a critical making workshop with actors in the field (researchers, energy communities, Brussels' institutions in the energy landscape)
- Detect and develop, together with the developers of the system/methods in WP1 and 2, alternative design decisions that contribute to a reduced risk of fundamental rights infringements, focused on data protection, privacy, non-discrimination, and the right to an effective remedy (Legal Protection by Design)

The above-listed tasks are translated into the following deliverables:

- Report on potential fundamental rights infringements and legal protection by design
- Report on real-world impact of the chosen testing mechanisms

5. LEGAL REQUIREMENTS AS A CHOICE ARCHITECTURE

In this chapter, we discuss the choice architecture concerning those affected by the GDPR of 2016, the AI Act of 2024, the Renewable Energy Directive of 2018, and the Electricity Directive of 2019.

We emphasize that the legislation restricts the options available to (1) data controllers and (2) processors (GDPR), to (3) providers and (4) deployers of AI systems (AI Act), and to energy suppliers and energy consumers. It is important to note that data controllers (under the GDPR) often serve as the deployers (under the AI Act). By framing the legal framework as a choice architecture, we can illustrate how the available choices should influence the development of the coordination mechanism that should result from COOMEP.

5.1. 5.1. The General Data Protection Regulation

The EU General Data Protection Regulation (GDPR) governs how personal data of individuals in the EU may be processed and transferred. Adopted in 2016, it entered into force on May 25, 2018. The GDPR defines individuals' fundamental rights in the digital age, outlines the obligations of those processing data, establishes methods for ensuring compliance, and specifies sanctions for those in breach of the rules. Under the GDPR, data controllers, processors, and joint controllers are subject to specific requirements. Individual users whose personal data is processed, known as data subjects, have several rights, including the right to judicial remedy and compensation against both data controllers and processors. Sanctions are imposed on controllers or processors who violate data protection rules.

5.1.1. Who is the controller?

Article 4(7) defines a 'controller' as

- *a natural or legal person, public authority, agency or other body*
- *which, alone or jointly with others,*
- *determines the purposes and means of the processing of personal data*.

In other words, the data controller determines the how and why of a data processing operation.[18] The data controller can be a natural person or a legal entity, such as, a company, a public authority, or an agency. It is not necessary for the controller to have actual access to the data being processed to be qualified as a controller.[19]

In practice, it is typically the organization, rather than the individual, that acts as the controller.[20] "Even if a specific natural person is appointed to ensure compliance with data protection rules, this person will not be the controller but will act on behalf of the legal entity (company or public body) will be ultimately responsible in case of infringement of the rules in its capacity as controller."[21]

[18] Often the how is de facto decided by the processor, for which the data controller, however, remains responsible. The contract between the controller and the processor must be in writing and stipulate the purpose of the processing and compliance with the GDPR.
[19] EDPB Guidelines 07/2020 on the concepts of controller and processor in the GDPR. 07 July 2021. Pg.3.
[20] Ibid. pg.10.
[21] Ibid.

When deciding the purposes and means of processing personal data, the controller must **put in place appropriate and effective measures to protect personal data** and enable **individuals to exercise their rights**.[22]

Article 26(1) of the GDPR states that data controllers can determine the purposes and means of data processing either individually or jointly with another party as joint data controllers. This situation occurs when joint controllers have a shared purpose and agree on the purpose and means of processing data together through an arrangement between them. They will be jointly liable for the processing. This does not apply if the same data is used by different controllers for different reasons, in which case each is liable for their own processing.

The GDPR demands data controllers comply with the following obligations: principles related to the processing of personal data (accountability) (art. 5), lawful grounds for processing (art. 6), guarantee the rights of data subjects regarding transparency, information and access (art 12-14), data protection by design and by default (art. 25), keep records of the processing activities (art. 30), data security (art. 32), personal data breach notification (art. 33), conduct Data Protection Impact Assessments (art. 35)[23], and adherence to approved codes of conduct (art. 40). This role and related obligations do not apply in the case of processing anonymized data, as this is not considered personal data.[24]

By exemption, Article 2 of the GDPR states that the GDPR does not apply to the processing of personal data by a natural person engaging in purely personal or household activities. This includes situations where personal data is held by an individual and is solely related to the management of their personal, family, or household affairs, or is kept for recreational purposes. This provision is commonly known as the household or domestic exemption. This exemption remains valid as long as the personal data is not utilized in connection with any professional or commercial activity or made publicly available.

This means that if an internal energy management system is used exclusively for the energy user's personal or household activities, then they will not be subject to the same obligations as a data controller would be under data protection law. However, it's important to note that the energy user may become a data controller for data protection law purposes, depending on how they handle the collected data. For example, if the energy user publishes the data online or shares it with COOMEP partners, they may become subject to the obligations of a data controller. The household exemption wouldn't apply if the devices installed in each household can interact with each other, thus sharing personal data (i.e., energy consumption/production) to optimize load balance. It wouldn't apply even if the personal data is only shared with the grid, making it accessible to the grid owner.

[22] Article 24, GDPR and Recital 74 and 75, GDPR.

[23] A Data Protection Impact Assessments has to be conducted only if certain conditions are met, where a type of processing in particular using new technologies, and taking into account the nature, scope, context and purposes of the processing, is likely to result in a high risk to the rights and freedoms of natural persons" (Article 35(1) GDPR) in particular in the cases referred to in section 4.2.9.

[24] GDPR, Recital 26.

Questions:

- Who decides on the purposes of processing?

For research purposes data collection and processing purposes are determined by VUB-ULB, as they are the only ones involved in **the design** of the coordination mechanism. This is done in cooperation with the citizens participating in the research which consist of **one association registered as an energy community and one group of citizens in a co-ownership (one apartment building).**[25]

WP1 has received permission from Sibelga to install Flukso sensors in the low-voltage cabins of the respective energy communities and in each participating household. Data collected from Flukso are directly communicated to WP1 researchers (ULB), not to Sibelga. Hence, for GDPR compliance purposes, the company providing Flukso would, in this case, be the processor, and ULB would be the controller. Sibelga does not seem to have a controller role in this case.

Regarding future considerations, if the system is deployed in the real world, data processing would need to be managed by Sibelga and/or the energy communities, depending on the level of implementation.

5.1.2. Who is the processor?

A data processor can be either a legal entity or an individual. Although data processors make their own operational decisions, they operate **on behalf of and under the authority and instructions of the relevant data controller**. Therefore, there are two conditions for qualifying as a processor:

a) being a separate entity in relation to the controller, and
b) processing personal data on the controller's behalf.[26]

In practical terms, being a separate entity means that, for example, a department within a company cannot act as a processor for another department within the same entity.[27] According to Article 29 of the GDPR, a data processor may only process personal data according to the instructions of the data controller unless required to do so otherwise by Union or Member State law. Thus, acting "on behalf of" also entails serving someone else's interests, in this case, adhering to the instructions given by the controller regarding the purpose of the processing and the essential elements of the means of processing.[28] The GDPR requires a written contract between the controller and the processor. The processor may not carry out processing for its own purpose(s), if it does, it will be qualified as controller.[29]

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[25] As per Brussels rules regarding energy communities, co-ownerships do not need to be registered as a legal energy community to be able to perform energy sharing.
[26] EDPB Guidelines 07/2020 on the concepts of controller and processor in the GDPR. 07 July 2021. Pg.3 and 25.
[27] Ibid. pg.26
[28] Ibid.
[29] Ibid.

If a data processor violates the data controller's instructions, they will be liable for any data breaches. Processors have a responsibility to ensure that the data subject's rights are protected,[30] so they should implement their own technical and organizational measures. Additionally, processors should also keep records of the processing activities (art. 30(2)) and notify the controller in instances of personal data breaches (art. 33(2)).

Questions:

- Which entity or entities will be doing the actual processing of the energy usage data?

WP1 (ULB) is the entity processing the energy usage data in the capacity of the controller. Flukso is also involved in the processing by collecting global consumption data from low-voltage cabins and also directly from householdes.

- Is that entity or are those entities the same as the controller?

Flukso is not the controller.

- If not, is there a written contract where the controller instructs the processor how to process what data?

ULB has a formal contract with Flukso.

- Does the processor keep the data to process them for its own purposes?

It is unclear whether Flukso continues to store the data after forwarding it to the ULB.

5.1.3. Who is the data subject?

Article 4(1) of GDPR defines a data subject as an "**identified or identifiable natural person**" **whose personal data are being processed**.

The GDPR includes a long list of activities within the definition of processing, including storing and making publicly available.[31]

"processing" means

- **any operation or set of operations**
- **which is performed on personal data or on sets of personal data,**

[30] Article 32(1), GDPR
[31] Article 4(2), GDPR

- **whether or not by automated means,** - **such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction;**

A natural person is a human being, encompassing both adults and children. Therefore, the definition excludes legal persons, such as companies or any other non-human entities with legal rights. A natural person is considered "identified" if, within a group of individuals, he or she is "distinguished" from all other members, meaning singled out. Article 4(1) of the GDPR defines

"An identifiable natural person" as

- one who can be identified, directly (such as by their name)
- or indirectly, by all sorts of information, such as an identification number, location data, an online identifier (such as an IP address, cookie data, etc.) or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity.[32] **Any such information that can identify a data subject is considered personal data**.[33]

Data subjects can exercise several rights,[34] such as the need for an individual's clear consent to the processing of his or her personal data, the right to access, the right to be forgotten, the right to rectification, the right to limit the processing, the right to data portability, the right to object, the right to withdraw consent, and the right not to be subject to a decision based solely on to automated processing and profiling. Data subjects can exercise their rights directly against any data controller that processes personal data about them.

5.1.4. Personal data involved

The European Commission's Smart Grid Task Force has developed a non-exhaustive list of energy sector-specific personal data in the context of smart metering as including the following:[35]

• Consumer registration data: names and addresses of data subjects, etc;
• Usage data (energy consumption, in particular household consumption, demand information and time stamps), as these provide insight in the daily life of the data subject;

[32] Article 4(1), GDPR
[33] Ibid.
[34] Articles 7, and 12-23, GDPR
[35] Smart Grid Task Force 2012-14, Data Protection Impact Assessment Template for Smart Grid and Smart Metering systems, 13 September 2018. Pg. 25. Available at: https://energy.ec.europa.eu/system/files/2018-09/dpia_for_publication_2018_0.pdf

• Amount of energy and power (e.g. kW) provided to grid (energy production), as they provide insight in the amount of available sustainable energy resources of the Data Subject;
• Profile of types of consumers, as they might influence how the consumer is approached;
• Data and function of individual consumers/loads;
• Facility operations profile data (e.g. hours of use, how many occupants at what time and type of occupants);
• Frequency of transmission of data (if bound to certain thresholds), as these might provide insight in the daily life of the data subject;
• Billing data and consumer's payment method

If any of the mentioned personal data are processed, a Data Protection Impact Assessment (DPIA) must be conducted. This non-exhaustive list of personal data involved in the smart grid poses a significant relevance for the COOMEP coordination mechanism and the developers of the mechanism should pay careful attention when deciding what types of data are necessary to be collected in the realm of this project. The GDPR allows the processing of personal data if and to the extent that it is necessary for the purpose, as defined by the controller.[36] **For the processing of personal data to be considered necessary, it is insufficient for their processing to be relevant or potentially useful; the purpose of the processing must not be achievable by other means**.[37] By default, the controller shall not collect more data than is necessary; they shall not process the collected data more than is necessary for their purposes, nor shall they store the data for longer than necessary.[38]

5.1.5. Special Categories of Data: Sensitive Data

Sensitive data refers to information that reveals racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, and health and sexual orientation.[39] The processing of such data is permitted only under very specific conditions, such as explicit consent by the data subject.[40]

In terms of COOMEP, this is relevant where the collected data can provide insights into these particularly sensitive aspects of the data subject. For instance, energy consumption can reveal a data subject's religious beliefs by observing Ramadan eating times or preparing for morning prayers.[41] The Court of Justice of the EU (CJEU) has determined that 'revealing' such data includes indirect disclosure,[33] which would in turn include inferences that could be derived from

[36] EDPB Guidelines 4/2019 on Article 25 Data Protection by Design and by Default Version 2.0. 20 October 2020. pg.20
[37] Ibid, pg.21. See also Recital 39 GDPR.
[38] Article 6(1), GDPR. EDPB Guidelines 4/2019, pg.11.
[39] Article 9.1 GDPR
[40] See Article 9.2 GDPR
[41] See also: Colette Cuijpers and Bert Jaap Koops, (2013) Smart Metering and Privacy in Europe: Lessons from the Dutch Case, European Data Protection: Coming of Age. Springer.

based on inferences that could be made based on data that has been provided or observed (such as the energy usage behaviours in the context of COOMEP).

5.1.6. General data protection principles

The general principles outlined in Article 5 of the GDPR encompass lawfulness, fairness and transparency in the processing of personal data; purpose limitation of the processing; the permissible amount of personal data processing for achieving the intended purpose (data minimization), the accuracy at all stages of the data processing, the fairness of the involved data processing, storage limitation, and data must be processed in a manner that ensures appropriate security of the personal data (integrity and confidentiality).[42] The controller is responsible for upholding these principles and should be able to demonstrate compliance accordingly (the accountability principle).

Purpose limitation safeguards data subjects by establishing boundaries on how controllers can utilize their data, while still providing some flexibility for those controllers. Additional processing, such as profiling, may involve using personal data that was initially collected for a different purpose. Further processing for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes is not considered incompatible with the initial purposes of data collection.[43] In order to ascertain whether processing for another purpose is compatible with the purpose for which the personal data are initially collected, the controller should take into account, on a case-by-case basis,[44] inter alia:

- the relationship between the purposes for which the personal data have been collected and the purposes of further processing;
- the context in which the personal data have been collected and the reasonable expectations of the data subjects as to their further use;
- the nature of the personal data in particular whether special categories of personal data are processed, pursuant to Article 9 GDPR, or whether personal data related to criminal convictions and offences are processed, pursuant to Article 10 GDPR;
- the impact of the further processing on the data subjects;
- the safeguards adopted by the controller to ensure fair processing and to prevent any undue impact on the data subjects; which may include encryption or pseudonymisation.

<u>Questions:</u>

[42] Article 5, GDPR

[43] Article 5(1)(b), GDPR

[44] Article 6(4), GDPR. Article 29 Data Protection Working Party. Opinion 03/2013 on purpose limitation. 2 April 2013. http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2013/wp203_en.pdf ; EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018, p.11

- What are the concrete (specific) purposes for the processing of the personal data of the members of the energy communities?

Data collected from Flukso (global consumption and production) are obtained directly from households through fluksometers installed in each household. This data is collected for research purposes. The specific research objectives include creating realistic and diverse energy behavior profiles that enable WP1 and WP2 researchers to test the effectiveness of the coordination mechanism under realistic conditions.

On the contrary, data from low-voltage cabins are not collected for research purposes. Instead, data from these cabins are collected solely to be made available to energy users upon their request.

Global consumption and production data will need to continue being collected also during the deployment stage of the coordination mechanism for the purpose of predicting future energy consumption behavior and energy production to properly ration energy and increase the efficiency of the coordination mechanism.

- Would it be possible to achieve this purpose using methods that involve little to no processing of personal data (keeping in mind that processing includes collection, storage, and any other manipulation of data, so 'select before you collect' and reducing the storage period will aid compliance)?

At the development stage, the system can be developed using only high-level energy consumption data. However, this would hinder researchers from accurately reflecting on the system's efficacy under real-world conditions. Disaggregation would be necessary to test and optimize the model. In contrast, the only data necessary for the deployment phase are high-level energy consumption and production data.

- What further processing is foreseen and by whom?

No further processing is foreseen.

- Which of the data should be qualified as sensitive data?

Data regarding energy usage behavior can reveal sensitive information about energy users. When this data is linked with information about the use of particular electronic devices at certain timeframes, it can be used to derive inferences that reveal racial or ethnic origin, religious beliefs (e.g., if someone turns up the light for morning prayer), health (e.g., if someone uses a specific medical device or a baby monitor), and sexual orientation.

5.1.7. Automated Decision-Making, Art 22

Article 22

Automated individual decision-making, including profiling

1. The data subject shall have the right
   - not to be subject to a decision
   - based solely on automated processing, including profiling,
   - which produces legal effects concerning him or her or similarly significantly affects him or her.

2. Paragraph 1 shall not apply if the decision:
   a. is necessary for entering into, or performance of, a contract between the data subject and a data controller;
   b. is authorised by Union or Member State law to which the controller is subject and which also lays down suitable measures to safeguard the data subject's rights and freedoms and legitimate interests; or
   c. is based on the data subject's explicit consent.

3. In the cases referred to in points (a) and (c) of paragraph 2, the data controller shall implement
   - suitable measures to safeguard the data subject's rights and freedoms and legitimate interests,
   - at least the right to obtain human intervention on the part of the controller, to express his or her point of view and to contest the decision.

4. Decisions referred to in paragraph 2 shall not be based on special categories of personal data referred to in Article 9(1),
   - unless point (a) or (g) of Article 9(2) applies
   - and suitable measures to safeguard the data subject's rights and freedoms and legitimate interests are in place.

According to the EDPB, Art. 22(1) establishes a general prohibition against decision-making based solely on automated processing, instead of being a right that is applied only when invoked by the data subject.[45] Thus, controllers must abstain *a priori* from engaging in qualifying automated decision-making (ADM) unless one of the exceptions applies.

In the case of automated decision-making addressed in Article 22(1) of the GDPR, the controller must provide additional information as specified under Article 13(2)(f) and Article 14(2)(g) of GDPR. Next to that, the data subject enjoys the right to obtain from the controller, in particular,

[45] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p.19. See also: The Schufa case: Case C-634/21, ECLI:EU:C:2023:957

'meaningful information about the logic involved, as well as the significance and the envisaged consequences of such processing for the data subject'.[46]

Automated decision-making can be based on three types of data:[47]

- data provided directly by the individuals concerned;
- data observed about the individuals;
- derived or inferred data, such as from a profile of the individual that has already been created

When automated individual decision-making is permitted, safeguards must be established, including enabling individuals to seek human intervention, express their views, and contest decisions made regarding them.

Decisions that are solely automated may also include profiling. Recital 71 explains that profiling concerns:

"*any form of automated processing of personal data*

- *evaluating the personal aspects relating to a natural person,*
- *in particular to analyse or predict aspects concerning the data subject's performance*
- *at work, economic situation, health, personal preferences or interests, reliability or behaviour, location or movements,*
- *where it produces legal effects concerning him or her or similarly significantly affects him or her*".

To the extent that COOMEP's processing of personal data provides insights into the personal preferences or interests of energy users that can produce legal effects concerning them or similarly significantly affect them, this processing will fall within the definition of profiling as provided in Article 4(4) of the GDPR.

Article 22 of GDPR is specifically applicable to "decisions based **solely** on automated processing" of personal data, including profiling, which produce legal effects concerning an individual or similarly significantly affect that individual. This provision establishes the right not to be subject to a decision based solely on automated processing, one of the rights of the data subject, which is authoritatively interpreted as a prohibition.

In the Schufa case, the CJEU explained in more detail the **three cumulative conditions** that must be met for a data controller to be considered engaged in automated decision-making:[48]

1. a decision must be made;

[46] Article 15(1)(h), GDPR.
[47] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018 p.8
[48] Case C-634/21, ECLI:EU:C:2023:957, para 43.

2. it must be based solely on automated processing, including profiling; and
3. it must produce 'legal effects concerning [the interested party]' or 'similarly significantly [affect] him or her'.

The CJEU states that the concept of 'decision' within the meaning of Article 22(1) of the GDPR is broad and includes several acts that may affect the data subject in many ways since that concept can "encompass the result of calculating a person's creditworthiness in the form of a probability value concerning that person's ability to meet payment commitments in the future."[49] It also noted the calculation of the creditworthiness score would have significant effects.

The EDPB has clarified that a decision is based 'solely' on automated processing if there is no **meaningful** human involvement in the decision-making process.[50] To be meaningful, human oversight should be carried out by someone who has the authority and competence to change the decision.[51] **A decision has legal effects on individuals if it affects their legal status or rights,** such as a decision to cancel a contract or deny a social benefit.

Based on the Schufa case, if a credit reference agency or other similar provider issues a score that is relied on heavily, by those taking the final decision where the score is "playing a determining role" without paying significant weight to other factors, then the issuing of that score "must be qualified in itself as a decision producing vis-à-vis a data subject 'legal effects concerning him or her or similarly significantly [affecting] him or her' within the meaning of Article 22(1) of the GDPR."[52]

The EDPB explains the phrase "similarly significantly affects the data subject", referring to decisions that potentially (i) significantly affect the circumstances, behavior or choices of the individuals concerned, (ii) have a prolonged or permanent impact on the data subject, or (iii) lead to the exclusion or discrimination of individuals.[53] To illustrate, the EDPB gives the example of decisions that affect one's access to education, such as university admissions.[54] In the process of sharing of renewable energy, an example that potentially affects a data subject might be an automated decision that puts someone at a serious disadvantage.

The second paragraph of Art. 22 lists three exceptions, or permissible uses of ADM:

(1) ADM which is necessary for entering into or performing a contract with the data subject;

(2) ADM which is authorized by Union or Member State law; and

(3) ADM for which the data subject has given explicit consent.

[49] Ibid. para 44.
[50] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p.21
[51] Ibid.
[52] Case C-634/21, ECLI:EU:C:2023:957. Para 50.
[53] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p.21
[54] Ibid.

Hereunder we provide a brief analysis of each of these conditions.

5.1.7.1. Conditions that justify the use of ADM

Art. 22(2) provides exceptions to the rule set out in Art 22(1). This means that the controller can undertake processing based solely on automated decision-making if one of these exceptions applies.

(1) **Contractual necessity**: The controller can resort to solely automated decision-making processes for contractual purposes if it is able to show that this type of processing is **necessary**, as the least privacy-intrusive effective method.[55] The controller should be able to show that other less intrusive methods are not effective.[56] 'Effective' in this case means, not just 'useful' but essential to achieve the objective. Not everything that "proves to be useful" for a certain purpose is "desirable or can be considered as a necessary measure in a democratic society".[57]

(2) **Specific justifications under European Union or member state law:** Automated decision-making including profiling can take place **if Union or Member State law authorize it.** Where this is the case, all safeguards must be put in place anyway. Recital 71 mentions the examples of monitoring and preventing fraud and tax-evasion, or ensuring the security and reliability of a service provided by the controller, to illustrate potential cases under this exception.

(3) **Explicit consent:** The third exception relies on the **explicit consent of the data subject**. Explicit consent is required in situations of serious data protection risks, thus where a high level of individual control of personal data is deemed appropriate.[58]

GDPR does not define 'explicit consent'. Consent is defined by GDPR as "any freely given, specific, informed and unambiguous indication of the data subject's wishes.[59] For 'regular' consent, GDPR requires a clear affirmative act. The request for consent must be clearly distinguishable from the other matters, in an intelligible and easily accessible form, using clear and plain language.[60] The right to withdraw their consent should be guaranteed for all data subjects. Withdrawing consent should be as easy as it was to give it.[61]

For 'explicit consent', the bar is raised even higher by requiring an express statement of consent by the data subject, such as in a written statement or with a two-stage verification method.[62]

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[55] Buttarelli, Giovanni. Assessing the necessity of measures that limit the fundamental right to the protection of personal data. A Toolkit European Data Protection Supervisor, 11 April 2017; EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p.23

[56] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p.23

[57] European Data Protection Supervisor. Assessing the necessity of measures that limit the fundamental right to the protection of personal data: A Toolkit. 11 April 2017. P.17

[58] EDPB Guidelines 05/2020 on consent under Regulation 2016/679. 4 May 2020. Para 91. Pg.20.

[59] Article 4(11) GDPR

[60] Article 7(2) GDPR.

[61] Article 7(3) GDPR.

[62] EDPB Guidelines 05/2020 on consent under Regulation 2016/679. 4 May 2020. P.20

Explicit consent can also be provided by oral statements,[63] but for evidentiary reasons, controllers would better opt for a written statement. Additionally, to remove all possible doubts, the controller may ask the data subject to sign the written statement, offering an extra layer of proof.[64]

5.1.7.2. Human intervention, the right to be heard, and contestability in the light of Art 22

Recital 71 stipulates that in all three cases, personal data processing based solely on automated decision-making, including profiling, should be subject to suitable safeguards. These safeguards should include specific information for the data subject and the right to human intervention, to express his or her point of view (right to be heard), to obtain an explanation of the decision reached after such assessment, and to challenge the decision (right to contestability).

In an opinion of the Belgian DPA on a draft law proposal regulating the remote reading of electricity consumption through smart meters the DPA considered that the relevant legislation allowing "the automated authorization or refusal of collective self-consumption operations by the competent energy authority, based on citizens' consumption patterns" could provide the exception of art. 22(2)(b) GDPR thus constituting legally-authorized ADM. [65] Though this requires 'suitable measures to safeguard the data subject's rights and freedoms and legitimate interests' and it does not absolve from identifying and communicating a legal ground for the processing, including for instance compliance with the principles of data minimization and storage limitation. Therefore, the Belgian DPO required the Wallonian government to include certain data subject safeguards in the law, such as allowing data subjects to demonstrate that a specific consumption pattern was due to a transitory situation.[66]

5.1.8. Data Protection Impact Assessments (DPIAs)

The Data Protection Impact Assessment (DPIA) is a key accountability tool under the GDPR.[67] It is a way of demonstrating compliance with GDPR, by showing that suitable measures have been put in place to address, the risk involved in decisions that are based in automated processing, including profiling.[68] When personal data processing is likely to result in a high risk to the rights and freedoms of natural persons the controller should carry out a DPIA prior to such processing.[69]

This incentivizes the building of protection into the design of the devices or infrastructure, lowering risks and costs at a later stage.[70]

In particular, Article 35(3) lists three cases in which the controller is required to carry out a DPIA:

[63] Ibid.
[64] Ibid.
[65] APD, Avis n° 44/2019 of 6 February 2019, available at https://www.autoriteprotectiondonnees.be/publications/avis-n-44-2019.pdf.
[66] Ibid.
[67] Accountability is required under Article 5(2) GDPR.
[68] Article 35(3)(a) GDPR.
[69] Article 35(1), GDPR.
[70] Hildebrandt, M. (2013) Legal Protection by Design in the Smart Grid: Privacy, Data Protection & Profile Transparency. Smart Energy Collective. p.40.

a)	*"**a systematic and extensive evaluation of personal aspects** relating to natural persons which is **based on automated processing, including profiling**, and on which decisions are based **that produce legal effects concerning the natural person or similarly significantly affect the natural person**;"*
b)	**processing on a large scale of special categories of data referred to in Article 9(1)** GDPR, or of Personal Data relating to criminal convictions and offences referred to in Article 10 GDPR; or
c)	**a systematic monitoring of a publicly accessible area on a large scale**.

Only the first case appears relevant for the processing that is conducted in the realm of COOMEP. As for the second case, it is important to note that special categories of personal data as covered by Articles 9 and 10 GDPR, typically do not fall within grid processing activities.[71]

The EDPB notes that Article 35(3)(a) refers to "*evaluations including profiling and decisions that are **'based' on automated processing, rather than 'solely' automated processing**. We take this to mean that Article 35(3) (a) will apply in the case of decision-making including profiling with legal or similarly significant effects that is not wholly automated, as well as solely automated decision-making defined in Article 22(1).*"[72]

As part of their DPIA, the controller should identify and record the degree of human involvement in the decision-making process and at what stage this occurs.

To illustrate the importance of DPIAs in the energy market technologies, let us have a look at the EDPB's opinion on the European Commission's Recommendation on preparations for the rollout of smart metering systems,[73] noting that those patterns can be used for energy conservation, but also for many other purposes.[74] The EDPB expressed concerns about the need for "best available techniques" to safeguard personal data and guarantee data security when data are processed in smart metering systems and smart grids, observing that:

> "*by analyzing detailed electricity usage data it may be possible in the future to infer or predict – also on a basis of deductions about the way in which electronic tools work - when members of a household are away on holidays or at work, when they sleep and awake, whether they watch television or use certain tolls or devices, or entertain guests in their free-time, how often they do their laundry, if someone uses a specific medical*

[71] Smart Grid Task Force 2012-14, Data Protection Impact Assessment Template for Smart Grid and Smart Metering systems, 13 September 2018. Pg. 22. Available at: https://energy.ec.europa.eu/system/files/2018-09/dpia_for_publication_2018_0.pdf

[72] EDPB/WP29, Guidelines on Automated individual decision-making and Profiling for the purposes of Regulation 2016/679. February 2018. p. 29.

[73] 2012/148/EU: Commission Recommendation of 9 March 2012 on preparations for the roll-out of smart metering systems

[74] Hildebrandt, M. (2013) Legal Protection by Design in the Smart Grid: Privacy, Data Protection & Profile Transparency. Smart Energy Collective. p.40.

device or a baby-monitor, whether a kidney problem has suddenly appeared or developed over time, if anyone suffers from insomnia, or indeed whether individuals sleep in the same room."[75]

When developing a new application or system, in compliance with the principle of Data Protection by Design, a DPIA should be executed from the start of the idea throughout the design and implementation.[76] This enables guaranteeing that potential risks are identified and that appropriate controls can then be built into the systems.[77]

The execution of a DPIA in required if any of the personal data listed in section 4.2.4. is processed. Additionally, for further guidance, the Smart Grid Task Force 2012-14 provides a list of Smart Grid processes that typically require processing personal data, thus, demanding the execution of a DPIA:

Remote readings for billing purposes
Frequent remote readings for network planning
Dynamic and advanced tariffing
Provide information to consumer online (e.g., Website, mobile App)
Remote switching

The Smart Grid Task Force has also provided some illustrative examples, such as:[78]

1. Smart meters register consumption data every 15 minutes (configurable). The data concentrator collects this 15-minutes reading once a day and sends it back to the backend systems. These readings might be considered personal data in such a way that they can be illegitimately used to assess sensitive information regarding the behaviour of each client.
2. The advanced load balancing functionality of the Smart Grid requires data collectors to have near real-time access to the mapped meter readings to efficiently manage energy production and consumption, including micro and distributed generation. The Smart Meter readings are critical for processing the Smart Grid response for a load balancing event using the described strategy of near real-time data collection on the meter level.

[75] Opinion of the European Data Protection Supervisor on the Commission Recommendation on preparations for the roll-out of smart metering systems. 8 June 2012. Point 19.
[76] Smart Grid Task Force 2012-14, Data Protection Impact Assessment Template for Smart Grid and Smart Metering systems, 13 September 2018. Pg.24
[77] Ibid.
[78] Ibid. pg. 25-26.

The Smart Grid Task Force has also developed a list of examples of non-Personal Data used in Smart Grid or Smart Metering processes, which do not trigger the execution of a DPIA:[79]

Locally produced weather forecast – consumption prediction / forecasts;
Demand forecast of building, campus and organisation;
At non-private feeder, transformer or network level (no link to individual consumers and their behavior. Consumption, frequency, voltage etc.).
An energy supplier maintains a list of systems and versions provided (e.g. leased) to a micro grid operator. This data will not be considered as Personal Data.
Technical data and commercial information are stored and processed in different systems. The common key (also called primary key) that is used to link the two types of data is location (the address). This way, client's Personal Data is better protected as it is not directly available when accessing technical data only.

5.1.9. Data Protection by Design and by Default (DPbDD)

Article 25
Data protection by design and by default

1. Taking into account the state of the art, the cost of implementation and the nature, scope, context and purposes of processing as well as the risks of varying likelihood and severity for rights and freedoms of natural persons posed by the processing, **the controller shall,**
   - **both at the time of the determination of the means for processing**
   - **and at the time of the processing itself,**
   - **implement appropriate technical and organisational measures**, such as pseudonymisation,
   - which are designed to implement data-protection principles, such as data minimisation, in an effective manner
   - and to integrate the necessary safeguards into the processing in order to meet the requirements of this Regulation and protect the rights of data subjects.

2. The controller shall implement appropriate technical and organisational measures for **ensuring that,**
   - **by default,**
   - **only personal data which are necessary for each specific purpose of the processing are processed**.
   - That obligation applies to the amount of personal data collected, the extent of their processing, the period of their storage and their accessibility.
   - In particular, such measures shall ensure that by default

[79] Ibid. pg.26.

- personal data are not made accessible without the individual's intervention to an indefinite number of natural persons.

3. An approved certification mechanism pursuant to Article 42 may be used as an element to demonstrate compliance with the requirements set out in paragraphs 1 and 2 of this Article.

DPbDD is an obligation for all controllers, irrespective of size and complexity of processing.[80] These upstream requirements ensure compliance with the rights and obligations of the GDPR. The essence of the obligation is that data controllers must implement technical and organizational measures as early as possible in the design of processing operations to safeguard privacy and data protection principles, thereby ensuring data subject rights right from the start ('data protection by design').

Controllers must adhere to the implementation of DPbDD both prior to processing and throughout the processing phase.[81] This entails regularly assessing the effectiveness of the chosen measures and safeguards. EDPB notes that "technical and organizational measures and necessary safeguards" should be understood in a broad sense as any method or means that the controller employs in the processing, including i.e. internal policies, or even training of the personnel.

Implementing technical and organizational safeguards 'appropriately' means that each measure and safeguard should be suited to achieve the intended purpose and produce the intended results, while ensuring effective implementation of the GDPR principles.[82] This means that no specific measures required by the GDPR, but the chosen measures should guarantee the implementation of the data protection principles into the particular processing in question.[83] To be able to demonstrate that the data protection principles have been guaranteed, the controller should document the implemented technical and organizational measures.[84] This can be done by determining Key Performance Indicators (KPI) to demonstrate effectiveness.[85]

Controllers should ensure that personal data is processed with the highest data protection (in conformity with Art. 5(1) GDPR, as analyzed in section 5.1.6 of this report) so that by default, personal data isn't made accessible to an indefinite number of persons ('data protection by default').[86] The term 'by default' in the context of processing personal data pertains to decisions made regarding configuration values or processing options established or recommended within a processing system, which can be a software application, service, device, or a manual processing

[80] EDPB Guidelines 4/2019 on Article 25 Data Protection by Design and by Default Version 2.0. 20 October 2020. p.4
[81] Ibid.
[82] Ibid. p.7
[83] Ibid.
[84] Ibid.
[85] Ibid.
[86] Article 25(2), GDPR

procedure.[87] These decisions impact the quantity of personal data collected, the scope of their processing, the duration of storage, and their accessibility.[88] As the EDPB notes: "*this means that by default, the controller shall not collect more data than is necessary, they shall not process the data collected more than is necessary for their purposes, nor shall they store the data for longer than necessary. The basic requirement is that data protection is built into the processing by default.*"[89] Hence, the controller should pre-determine the specific, explicit, and legitimate purposes for the collection and processing of personal data, ensuring by default that only data that are necessary for a specific purpose are processed, thus implementing the data minimization principle.

5.1.10. The choice architecture for data controllers and processors of energy usage data as applied to the COOMEP Coordination Mechanism

In this section, we analyze the main elements of the choice architecture under the GDPR relevant for data controllers and processors of energy usage data. The analysis of choice architecture presented in this report holds significance for COOMEP due to its impact on the upstream design decisions of the coordination mechanism. The elements examined in section 4.1.4 influence the design decisions made in configuring the backend system of the coordination mechanism, constraining controllers and processors in the right direction.

In the context of COOMEP, the controller is the partner who determines the purpose of the processing, regardless of whether they process personal data pseudonymously.

Since energy users play a relatively active role in the COOMEP project, it is necessary to determine whether they can be considered controllers under GDPR. In making this determination, it is important to assess the degree of influence each entity has in deciding the purposes and means of the processing. If the coordination mechanism is developed without any input from the energy users, and VUB and ULB (project partners) independently decide the categories of data to be collected and the duration of their retention, the energy users do not have enough control to qualify as controllers. However, if the VUB and ULB researchers decide the purpose of the processing while considering the interests of the energy communities (through regular meetings with community members), then ULB and VUB may be regarded as joint controllers alongside the energy communities. Nonetheless, the responsibilities of energy communities as joint controllers will need to be assessed based on their role and the extent of their control in determining the categories of data to be collected and the purpose of that processing.

A contentious role in determining joint controllership belongs to Sibelga. Sibelga's role appears to be limited to granting permission for ULB researchers to install Flukso in low voltage cabins associated with the energy communities. It does not seem that Sibelga plays any part in defining

[87] EDPB Guidelines 4/2019 on Article 25 Data Protection by Design and by Default Version 2.0. 20 October 2020. p.11
[88] Ibid.
[89] Ibid.

the purpose of processing personal data. Furthermore, data from Flukso are transmitted directly to ULB researchers, with Sibelga having no access to this information. This situation raises the question of who acts as the processor, which will be addressed in the next section.

It should be noted that collected energy usage data are considered personal data if the related person can be reasonably identified, or singled out. Remember, identification isn't just about whether a person's name is processed, but rather about whether they can be isolated. When this is the case— as it often is due to the linkability of energy usage data with other data—GDPR applies. Once GDPR is applicable, those who determine the purpose and means of processing, known as the controllers as explained in the sections above, become liable for GDPR compliance. The controller has to ensure that they have a legal basis for the processing, such as consent, contract, legal obligation, for the protection of the vital interests of the data subject or of another natural person, for the performance of a task carried out in the public interest or in the exercise of official authority, and legitimate interest.[90]

The processing of personal data of energy users in the COOMEP project is based on their consent. Consent is one of six lawful bases to process personal data, as listed in Article 6 of the GDPR. Consent is defined by Article 4(11) of GDPR as "any freely given, specific, informed and unambiguous indication of the data subject's wishes.[91] Hence Article 4(11) requires four elements for obtaining a valid consent:

- Freely given
- Specific
- Informed

Unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her.

"Free" consent means data subjects must have real choice and control over their choice. If the data subject has no real choice, feels compelled to consent or will endure negative consequences if they do not consent, then consent will not be valid.[92]

GDPR provides strict requirements for acquiring informed consent of the data subjects,[93] and data subjects must be able to withdraw their consent at any time.[94] Consent can be expressed by a clear affirmative act from the data subject. The request for consent must be clearly distinguishable from the other matters, in an intelligible and easily accessible form, using clear and plain language.[95]

[90] Article 6, GDPR
[91] Article 4(11) GDPR
[92] Opinion 15/2011 on the definition of consent (WP187), p. 12.; EDPB (2020) Guidelines 05/2020 on consent under Regulation 2016/679. p.7
[93] Article 4(11) GDPR
[94] Article 7(3), GDPR
[95] Article 7(2) GDPR.

Data subjects must have the possibility to withdraw their consent. Withdrawing consent should be as easy as it was to give it.[96]

Compliance with the stringent requirements of informed consent under GDPR is imperative. This involves providing data subjects with clear, intelligible information, particularly concerning the specific purpose of the processing of personal data.

This means that the controller has to:

- Obtain consent from end-users to use their personal data as described in article 6.1(a) of GDPR and by providing end-users information listed in article 13 of GDPR;
- Comply with all other duties on controllership deriving from GDPR, including those ensuring the exercise of rights of the data subjects concerning the processing of their data.[97]

Articles 12-14 impose transparency obligations on controllers reconfiguring their choice architectures. Controllers should be open and provide data subjects with clear, intelligible information, including the specific purpose of the processing of personal data and the legal basis for the processing, guaranteeing individuals' right to know what happens with their data.

It is crucial to ensure that before developing the coordination mechanisms data subjects are explicitly informed about the proposed automated processing to be made by the AI assistant, leading to automated decision-making on behalf of the energy users/producers. They should receive comprehensive details about the logic of the processing, as well as envisaged consequences of such processing for the data subject, again, before the mechanism is put in place. Once deployed, the right to human intervention and the right to contestation should be guaranteed to all users with regard to the automated decision.

As regards the purpose limitation principle, it aims to restrict data collection and processing to specific, legitimate purposes, directly influencing how systems are designed. The purpose limitation principle restricts processing to what is necessary for the specified, explicit purpose.[98] Controllers are obliged to define the purpose of processing personal data and make it explicit. Consent is only valid if provided for this specific purpose, and if the processing is necessary for that specific purpose.[99] Controllers are obliged to choose processing operations that are not just appropriate but necessary for the intended purpose. This relates with the data minimization and storage limitation principles.[100] **For the processing of personal data to be necessary, it is not enough that their processing is relevant or potentially useful but that the purpose of the processing cannot be fulfilled by other means**.[101] By default, the controller shall not collect more

[96] Article 7(3) GDPR.
[97] Exceptions may apply based on art. 89 GDPR for research purposes.
[98] Article 5(1)(b), GDPR
[99] Article 6(1)(a), GDPR. See also: Hildebrandt M (2022) The Issue of Proxies and Choice Architectures. Why EU Law Matters for Recommender Systems. *Front. Artif. Intell.* 5:789076. p.14. doi: 10.3389/frai.2022.789076
[100] Art. 6(1)(c) and (e), GDPR
[101] Ibid, pg.21. See also Recital 39 GDPR.

data than is necessary; they shall not process the collected data more than is necessary for their purposes, nor shall they store the data for longer than necessary.[102]

Purpose limitation is tightly linked to the principle of data minimization, requiring organizations to collect only the data necessary for the specified purpose. This principle has led to an emphasis on minimizing data fields during the design of collection forms, ensuring all collected data directly contributes to the processing goal. This limits the choice architecture of controllers regarding their data fields during the data collection process to those strictly necessary for the processing purpose, ensuring compliance through carefully structured interfaces that clearly justify each data element's necessity.

Ensuring that data is processed only for its intended purpose influences how access is structured within data systems. In terms of design choices, this can be translated into implementing access controls based on purpose limitation, restricting data access to individuals whose roles are relevant to the data's intended purpose. Such restrictions not only reduce unauthorized access but also make organizations more resilient to insider threats and privacy breaches.

Another element that dictates the choice architecture of controllers is the prohibition of fully automated decisions that have a legal or similarly significant effect on the user.[103] As is more extensively explained in sections 4.1.6 and 4.1.6.1, there are three exceptions to this prohibition: consent, a legal obligation, or a contract. If one of these exceptions applies, the controller should ensure that users are provided with meaningful information about the logic of the processing, as well as envisaged consequences of such processing for the data subject,[104] or what is currently widely known as "explainable AI".

The choice architecture of processors is constrained by the controller's instructions. The controller's instructions may still be broad enough to allow some discretion to the processor for choosing the most suitable technical and organisational means in best serving the controller's interests.[105]

Questions:

To the extent that the processing of personal data by COOMEP researchers provides insights regarding personal preferences or interests of energy users that can produce legal effects concerning them or similarly significantly affect them, the processing will fall within the definition of profiling provided in Article 4(4) of GDPR.

- What processing operations are taking place?

Energy consumption and production data are used to predict the future energy behavior of data subjects or users.

[102] Article 6(1), GDPR. EDPB Guidelines 4/2019, pg.11.
[103] Art. 22(1)
[104] Art. 15(1)(h), GDPR
[105] EDPB Guidelines 07/2020 on the concepts of controller and processor in the GDPR. 07 July 2021. Pg.3.

- What is the nature of personal data that are being collected and processed and by whom?

Two types of data are being collected and processed by ULB:

a. Total energy consumption of households per hour/15 minutes
b. Total energy production of households

WP1 also collects information about the appliances available and used in various households through direct surveys. VUB does not collect any data from the citizen energy communities. WP2 researchers use open access energy consumption and production data for developing the toolbox.[106]

- What aspects concerning data subjects are analyzed from the automatic processing of personal data?

The energy consumption patterns and behaviors of data subjects are analyzed through automatic processing. of personal data.

- Is this automatic processing used for making decisions that may anyhow affect the energy users?

Yes, automatic processing will be used to make decisions about the energy produced. If, for example, the AI agent decides to share the produced energy, this energy is effectively no longer available to the user, and the user would, therefore, need to resort to the underlying electricity grid in case the energy left at their disposal is insufficient.

- Is there any human involvement in the decision process?

There is no human involvement in the decision-making process.

5.2. The Artificial Intelligence Act

In April 2021, the European Commission proposed the first EU legislative framework explicitly addressing AI, namely the Artificial Intelligence Act (hereafter the AI Act). The final text of the AI Act was adopted by the European Parliament in March 2024. It entered into force on 1 August 2024, 20 days after being published in the Official Journal.[107] The new rules establish obligations for providers and deployers depending on the level of risk that the AI systems pose to the users. The different risk levels mean more or less legal obligations to protect against risks to safety, health, and fundamental rights.

[106] For detailed information of data collected and/or used by each WP refer to section 4 of this report.

[107] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance) PE/24/2024/REV/1, *OJ L, 2024/1689, 12.7.2024, ELI:* http://data.europa.eu/eli/reg/2024/1689/oj

5.2.1. Who is the provider?

The AI Act defines a 'provider' as:

- *a natural or legal person, public authority, agency or other body*
- *that **develops** an AI system or a general-purpose AI model*
- ***or** that **has** an AI system or a general-purpose AI model **developed***
- ***and** places them on the market **or** puts the system into service under its own name or trademark,*
- *whether for payment or free of charge*.[108]

Predominantly, obligations set by the AI Act are directed towards the providers. Edwards considers the provider, as defined by the AI Act, as the analogue of the manufacturer of a product.[109]

An AI system is defined by the AI Act as:

- *a **machine-based system***
- *designed to operate with **varying levels of autonomy***
- ***and** that **may exhibit adaptiveness after deployment***
- ***and** that, for explicit or implicit objectives, **infers**, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions*
- *that **can influence physical or virtual environments***.[110]

5.2.2. Who is the deployer?

The AI Act defines a 'deployer' as:

- *any natural or legal person, public authority, agency or other body*
- *using an AI system under its authority,*
- *except where the AI system is used in the course of a personal non-professional activity*.[111]

Deployers are not the same as and should not be confused with end-users. They are also not necessarily the same person as 'data subjects' in the GDPR (note that a data subject is a natural person, while a deployer can be a legal person). An example of a deployer could be an employer using an automated hiring system; the deployer will probably also be a controller in terms of GDPR, but not a data subject.

5.2.3. High-risk AI systems

The AI Act divides AI systems into three risk groups based on their intended use.

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[108] Article 3(3), AI Act
[109] Edwards, L. (2022) The EU AI Act: a summary of its significance and scope. Ada Lovelace Institute
[110] Article 3(1), AI Act
[111] Article 3(4), AI Act

- Unacceptable AI practices are practices prohibited (with some exceptions) by the AI Act, due to an unacceptably high risk of adverse effects on individuals or society.
- AI systems that create a high but not unacceptable risk of adverse impacts on people's safety, health, or their fundamental rights are considered high-risk. Such systems are authorized, but subject to a set of requirements and obligations to gain access to the EU market, such as documented evidence of the robustness, resilience, reliability, and the responsible design and deployment of these systems.
- A third set of legal obligations applies to AI systems (i.e. chatbots) that are not high risk, but should nevertheless comply with key transparency requirements that allow users to make informed decisions. For instance, there is a legal obligation to make sure that natural persons are informed when they interact with an AI system (Article 50(1)).

Lastly, the AI Act introduces transparency obligations for all general-purpose AI Models (foundation models) and additional risk management obligations for very capable and impactful models that carry systemic risks.

The AI Act is mainly focused on high-risk AI systems, imposing detailed legal obligations on providers and sometimes also on deployers. The providers of high-risk AI systems must comply with the following requirements[112]:

- ✓ Establish a **risk management system** throughout the entire lifecycle of the high-risk AI system by particularly taking into consideration the likelihood of the high-risk AI system adversely impacting persons under the age of 18 and other vulnerable groups of people.[113]
- ✓ Conduct **data governance** and management practices regarding Training, validation and testing datasets.[114]
- ✓ Draw up **technical documentation** before placing the system on the market to demonstrate compliance and provide authorities with the information to assess that compliance.[115]
- ✓ Design their high-risk AI system so as to allow for **record-keeping** to enable it to automatically record events (logs) relevant for identifying national-level risks and substantial modifications throughout the system's lifecycle.[116]
- ✓ Ensure that the operation of the high-risk AI system is sufficiently **transparent** to enable deployers to interpret the system's output and use it appropriately. Provide **instructions for use** to downstream deployers to enable the latter's compliance.[117]
- ✓ Design their high-risk AI system in such a way as to allow deployers to implement **human oversight**.[118]

[112] Chapter 2 of the AI Act
[113] Article 9, AI Act
[114] Article 10(3), AI Act
[115] Article 11, AI Act
[116] Article 12, AI Act
[117] Article 13, AI Act
[118] Article 14, AI Act

- ✓ Design their high-risk AI system to achieve appropriate levels of **accuracy, robustness, and cybersecurity**.[119]
- ✓ Establish a **quality management system** to ensure compliance.[120]

5.2.4. Fundamental rights impact assessment for high-risk AI systems (FRIAs)

The Fundamental Rights Impact Assessment (FRIA) was introduced into the AI Act in the preliminary agreement phase. The FRIA is an obligation to conduct a fundamental rights impact assessment for certain entities that employ high-risk AI systems. This requirement extends to deployers of high-risk AI systems that are bodies governed by public law, or private entities providing public services and deployers of certain high-risk AI systems listed in Annex III point 5 (b) and (c). It is limited to the deployment of high-risk systems. [121] These entities, when deploying a specific type of high-risk AI system, must undertake a FRIA and report the findings to the market surveillance authority.

High-risk AI systems intended to be used in the area listed in point 2 of Annex III, thus AI systems used as safety components in the management and operation of critical infrastructure, are specifically exempt from the requirement of conducting a FRIA.[122] Hence, even if the COOMEP coordination mechanism would classify as high-risk under point 2 of Annex III, the FRIA will not apply.[123]

5.2.5. The choice architecture for providers and deployers of high-risk AI systems

Legislation on AI came as a need to present providers and deployers of AI systems with a choice architecture that constrains them in the right direction and safeguards human capabilities.[124] The AI Act has a direct effect in all EU Member States. It addresses the impact of AI systems on safety, health and fundamental rights and imposes a set of requirements on providers of high-risk AI systems. In the initial text, besides the definition of the AI system in art. 3(1), the definition was further limited to a list of techniques and approaches in Annex I. In the final text, that Annex has been removed.

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[119] Article 15, AI Act
[120] Article 16(b) and 17, AI Act
[121] This applies only to operators deploying high-risk systems referred to in Annex III, point 5, b) and c) which comprises two categories of the AI systems for: "Access to and enjoyment of essential private services and essential public services and benefits.": AI systems intended to be used to evaluate creditworthiness of natural persons or establish their credit score, and AI systems intended to be used for risk assessment and pricing in relation to natural persons in the case of life and health insurance; Article 27, AI Act.
[122] Article 27, AI Act
[123] For a detailed analysis of whether the COOMEP coordination mechanism classifies as a high-risk AI system refer to section 4.2.1.
[124] Hildebrandt M (2022) The Issue of Proxies and Choice Architectures. Why EU Law Matters for Recommender Systems. *Front. Artif. Intell.* 5:789076. p.14. doi: 10.3389/frai.2022.789076

The final text defines AI systems in terms of the following conditions:

(1) it must be a machine-based system;
(2) it can have varying levels of autonomy, which will depend on the type and intended purpose of each system and the underlying technology;
(3) it may exhibit adaptiveness after deployment. This is not a necessary condition for considering it an AI system, but is an option the negotiators of the final text decided to incorporate in the definition.
(4) it can have explicit or implicit objectives. The word "human-defined" objectives has been removed from the final text.
(5) the output the AI system generates has the potential of influencing physical or virtual environments.

The AI Act distinguishes between two categories of high-risk AI systems.

1. Systems used as a safety component of a product or falling under EU health and safety harmonisation legislation (e.g. toys, aviation, cars, medical devices, lifts).
2. Systems deployed in eight specific contexts identified in Annex III:
   a. Biometric identification and categorization of natural persons;
   b. Safety components in the management and operation of critical infrastructure;
   c. Education and vocational training;
   d. Employment, worker management and access to self-employment;
   e. Access to and enjoyment of essential private services and public services and benefits;
   f. Law enforcement;
   g. Migration, asylum and border control management;
   h. Administration of justice and democratic processes.

High-risk AI systems will be subject to the set of legal obligations for high-risk systems discussed in 4.1.12, except if Article 6(3) of the AI Act applies. An AI system, otherwise considered high-risk under Annex III, shall not be classified as high-risk if it fulfills one or more of the following conditions provided under Article 6(3):

(a) the AI system is **intended to perform a narrow procedural task**;

(b) the AI system is **intended to improve the result of a previously completed human activity**;

(c) the AI system is **intended to detect decision-making patterns or deviations** from prior decision-making patterns **and is not meant to replace or influence the previously completed human assessment, without proper human review**; or

(d) the AI system is **intended to perform a preparatory task** to an assessment relevant for the purposes of the use cases listed in Annex III.

It should be noted however that the last paragraph of the same provision provides an exception to the exception, stating that "notwithstanding the first subparagraph, an AI system referred to in Annex III **shall always be considered to be high-risk where the AI system performs profiling of natural persons**."[125] Hence, the derogation provided in Article 6(3) will not apply to high-risk AI systems that perform profiling of natural persons even if those AI systems fulfill one or more of the conditions listed in Article 6(3).

5.2.6. Application to the COOMEP coordination mechanism

To understand the AI Act's applicability to the COOMEP coordination mechanism, the primary question is whether the AI agent being developed by the COOMEP team of researchers qualifies as a high-risk AI system, and if it does not, under what conditions it could be classified as such.

To the extent that the COOMEP AI Agent is an AI System that falls within the scope of 'AI systems intended to be used as safety components in the management and operation of critical digital infrastructure, road traffic, or in the supply of water, gas, heating or electricity', the providers of the system need to comply with the requirements for high-risk AI systems taking into account the intended purpose of the AI Agent as well as the generally acknowledged state of the art on AI and AI-related technologies.

Directive 2008/114/EC for European Critical Infrastructure defines critical infrastructure as "*an* ***asset, system or part thereof*** *located in Member States which is* ***essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people****, and the* ***disruption or destruction of which would have a significant impact*** *in a Member State as a result of the failure to maintain those functions*".[126] Examples would include energy, distribution, communications, health care, and financial services. The COOMEP AI Agent is designed and intended to be used for energy-sharing purposes, hence in an area categorized by Directive 2008/114/EC as critical infrastructure. However, this does not automatically categorize the AI Agent as a high-risk system under the AI Act.

'Safety component' is defined in the AI Act as:

"- a component of a product or of a system which

- ***fulfills a safety function*** *for that product or system****,***
- ***or the failure or malfunctioning of which endangers the health and safety of persons or property***"[127]

Recital 55 of the AI Act further clarifies that:

"Safety components of critical infrastructure, including critical digital infrastructure, are

[125] Article 6(3), AI Act
[126] Article 2(a), Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection
[127] Article 3(14), AI Act

- *systems used to directly protect the physical integrity of critical infrastructure*
- *or the health and safety of persons and property*
- ***but which are not necessary in order for the system to function***.
- *The failure or malfunctioning of such components might directly lead to risks to the physical integrity of critical infrastructure and thus to risks to health and safety of persons and property."*

Hence, the primary step in understanding whether or not the COOMEP coordination mechanism could be considered as a high-risk AI system under the AI Act, is determining whether and under which conditions it can be regarded as a safety component. Two elements must be considered:

1. Whether the coordination mechanism fulfills a safety function; or
2. Whether its failure or malfunctioning endangers the health and safety of energy users or their property.

If any of the above conditions apply, the coordination mechanism will be classified as high-risk under the AI Act. To assess whether the AI Agent could be deemed a high-risk AI system under the AI Act, we perform the following analysis:

- Does the coordination mechanism fulfil a safety function?

After consulting with researchers from WP1 and WP2 who were directly involved in developing the coordination mechanism, it was concluded that the mechanism does not fulfill any safety function.

- Is the coordination mechanism used to protect the physical integrity of critical infrastructure or health and safety of persons and property?

The coordination mechanism does not serve any function related to protecting the physical integrity of critical infrastructure or the health and safety of energy users and their property. However, it can have the side effect of safeguarding the infrastructure by avoiding peak energy consumption, though this is not the primary purpose of the coordination mechanism.

- Does its failure or malfunctioning endanger the health and safety of persons or property?

The coordination mechanism is envisaged to operate on top of the existing energy grid as a type of microgrid. This means the energy community remains connected to the grid while utilizing the coordination mechanism. This ensures that in the event of a failure or malfunction in the coordination mechanism, the system will automatically revert to the grid as a backup energy source, thereby eliminating the risk of a complete blackout. While this type of switch poses no risks to the health and safety of the energy community and its members, it could lead to financial losses due to fluctuations in energy prices. Nevertheless, we cannot completely dismiss the possibility that a failure or malfunction of the coordination mechanism could threaten the health and safety of individuals or property.

- Is the coordination mechanism necessary for the system to function?

According to the vision of the COOMEP researchers, a coordination mechanism is not required for the system to operate. This coordination mechanism would function as a micro-grid, layered on top of the existing electricity grid. Therefore, if there is no coordination mechanism, users rely solely on the current electricity grid.

However, the coordination mechanism would be necessary for the system to function if a community has made itself independent from the grid and relies solely on it. If the coordination mechanism fails to function or malfunctions, the energy community may experience a total blackout.

The coordination mechanism does not seem to classify as a high-risk AI system, but it will still have to comply with a set of transparency obligations as provided in Article 50 of the AI Act. These obligations include informing the natural person in a clear and distinguishable manner at the latest at the time of the first interaction or exposure,[128] that they are interacting with an AI system unless this is obvious from the point of view of the natural person.[129] As noticed, the AI Act does not appear to restrict the choice architecture of the providers of the coordination mechanism for as long as the coordination mechanism does not qualify as a high-risk system.

5.3. The EU Legal Framework for peer-to-peer energy trading

The supply of energy to end-users (consumers) by an energy supplier (a professional party) is strictly regulated by EU energy legal framework and consumer contract law, both relying on the traditional vertical relationship of the energy supply transactions.[130] Whereas the situation regarding peer-to-peer trading/sharing of energy is not that clear. As of 2018, the Renewable Energy Directive (RED)[131], introduced the innovative horizontal trading relationship, allowing for energy trading between end-users (peer-to-peer or p2p) trading, regardless whether a third party is involved as an intermediary in the transaction.

It is important to note here that, unlike a regulation that is directly applicable to all Member States, a directive needs to be transposed into the national laws of each Member State. The RED is a directive; thus, it must be transposed into the national legal frameworks of Member States.

5.3.1. The Renewable Energy Directive 2018/2001 as revised in 2023

The Renewable Energy Directive (2018/2001/EU) entered into force in December 2018, as part of the Clean Energy for All Europeans package.[132]

[128] Article 50(5), AI Act
[129] Article 50(1), AI Act
[130] Kalisvaart, S. (2023). Contractual positions in peer-to-peer electricity trading. SEW: Journal of European and Economic Law, 2023(6), 258-268.
[131] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (OJ 2018, L 328/82) (Renewable Energy Directive).
[132] The Clean Energy Package (CEP) is a set of four directives and four regulations: https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en. It introduced a set of new rights for energy consumers, empowering them by enabling them full market participation. Some have

Among the novelties of this Directive are its provisions that allow citizens to play an active role in the development of renewables by enabling the formation of **renewable energy communities** and self-consumption of renewable energy. As such, the Renewable Energy Directive requires Member States to provide a legal framework that facilitates p2p trading, without subjecting 'active consumers'[133] to discriminatory or disproportionate procedures and tariffs in the process.

In 2021, the EU published The Fifth Energy Package or 'Fit For 55' with the aim of aligning the EU's energy targets with the new European climate ambitions for 2030 and 2050.[134]To reach the 2030 target, the updated Renewable Energy Directive (RED) increased the overall binding target from 32% to a new level of 40% of renewables in the EU energy mix.[135]

After Russia invaded Ukraine in February 2022 and cut off of the gas supply to Europe, the Union adopted the REPowerEU plan intending to rapidly phase out all Russian fossil energy imports, by introducing energy-saving measures, diversifying its energy sources, adopting exceptional and structural measures in electricity and gas markets and accelerating the introduction of renewables.[136]

In the REPowerEU, the 2030 target of renewable energy production was increased to 45%.[137]

5.3.1.1. Who is a 'renewables self-consumer'?

Article 2(14) of the Renewable Energy Directive defines a 'renewables self-consumer' as follows:

"*a final customer*

- *operating within its premises located within confined boundaries or,*
- *where permitted by a Member State, within other premises,*
- *who **generates renewable electricity for its own consumption**,*
- *and who **may store or sell self-generated renewable electricity**,*

considered the Clean Energy Package as a Magna Carta of Energy Prosumer Rights. See: H. Schneidewindt, (21 February 2019) Clean Energy Package: Magna Charta of Prosumer Rights https://energy-democracy.org/clean-energy-package-magna-charta-of-prosumer-rights/

[133] The term active consumer was introduced in the Electricity Directive, referring to a consumer that is involved in a range of activities involving: production and self-consumption of energy, energy storage, participation in energy services, flexibility or aggregation, peer-to-peer trading, sale and sharing of energy.

[134] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality. COM/2021/550 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0550

[135] Section 2.2.3. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality. COM/2021/550 final.

[136] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions REPowerEU Plan COM/2022/230 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:230:FIN

[137] Ibid.

- *provided that, for a non-household renewables self-consumer, those activities **do not constitute its primary commercial or professional activity***"

Article 2(14) of the RED regards the final customer as an active participant who can generate renewable energy for personal use, store it, or sell any excess energy produced. When purchasing energy for their own consumption, customers receive the legal protections provided by law to small customers. Article 21(2)(c) emphasizes that member states must ensure that renewable self-customers retain their rights and obligations as final consumers, even when selling energy to another final customer, indicating that they will not be classified as energy suppliers concerning rights and obligations.

5.3.1.2. What is a 'renewable energy community'?

The RED introduces the concept of 'renewable energy community' as:

"*a **legal entity**:*

*(a) which, in accordance with the applicable national law, is based on **open and voluntary participation**,*
*- is **autonomous**, and*
*- is effectively **controlled by shareholders or members** that are located in the proximity of the renewable energy projects that are owned and developed by the legal entity;*

*(b) the shareholders or members are **natural persons, SMEs or local authorities including municipalities;***

*(c) the **primary purpose** of which is **to provide environmental, economic or social community benefits** for its shareholders or members or for the local area where it operates, rather than financial profits*.

For the purposes of RED, a renewable energy community must be a legal entity, with members joining on an open and voluntary basis. Members of the energy community can be natural persons, as well as SMEs and local authorities, such as municipalities. A fundamental element of the renewable energy community is its non-commercial purpose, which is driven by environmental, economic, and social community benefits rather than personal financial gains.

5.3.1.3. What is peer-to-peer trading?

In Article 2(18), 'peer-to-peer trading of renewable energy' is defined as:

"***the sale of renewable energy between market participants***

- ***by means of a contract***

- *with **pre-determined conditions governing the automated execution and settlement of the transaction**,*
- *either directly between market participants*
- *or indirectly through a certified third-party market participant, such as an aggregator.*
- *The right to conduct peer-to-peer trading shall be without prejudice to the rights and obligations of the parties involved as final customers, producers, suppliers or aggregators*".[138]

The aim of peer-to-peer (P2P) trading is to provide final customers with energy supply at more favorable prices and active customers with more autonomy over the sale of self-generated electricity.[139] In practice this should be achieved by national legal frameworks that facilitate P2P trading without subjecting active customers to disproportionate procedures and charges.[140] Based on this definition, P2P traders are considered market actors, and the actors of P2P trading can be any market participant, thus *final customers, producers, suppliers or aggregators,* as long as they **interact on the same market level**. What sets P2P apart from other market relationships is the absence of a professional-level business relationship, such as those found in business-to-consumer (B2C) and business-to-business (B2B) contexts. RED specifies that trading must occur through a contract with predetermined conditions that govern the automated execution and settlement of the transaction.

It is important to note that the P2P trading scheme involves constant switches between different suppliers. In this case, it consists of P2P trading of renewable energy with a backup supplier (the grid) that ensures energy supply when local production is insufficient. This dual supply arrangement would only be discontinued if and when local production consistently provides an ample and reliable supply. RED does not restrict P2P trading within members of the same renewable energy community; thus, it is also possible among members of different energy communities or even among energy communities themselves.

In general, P2P trading is only possible if the parties have access to the electricity grid.[141] Challenges in this regard might include getting access to the network (grid), attribution of responsibilities in cases of imbalances that might arise in the energy grid, access to telecommunication networks, such as smart energy services, and lastly the role of Distribution System Operators in enabling P2P trading.[142]

P2P trading primarily impacts the role of consumers, who have traditionally been viewed as passive participants in the market. With technological innovation, consumers are empowered to

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138 Directive (EU) 2018/2001 (Renewable Energy Directive), Art 2(18).
139 See recitals 68-72, Renewable Energy Directive
140 Article 21(2)(a) Renewable Energy Directive.
141 L. de Almeida, et al. (2021) Peer-to-Peer Trading and Energy Community in the Electricity Market: Analysing the Literature on Law and Regulation and Looking Ahead to Future Challenges. p. 10, available at: https://library.wur.nl/WebQuery/wurpubs/fulltext/5587ç1.
142 L. de Almeida, et al. (2021)

take an active role in energy sharing. It is important to note that in this transformation, an active consumer who sells energy to another active consumer in P2P trading remains a consumer regarding their rights and obligations related to consumer protection in the energy market, rather than a supplier. This distinction is clearly outlined in Article 2(14) of the RED, which defines renewable self-consumers as final customers.

Certainly, if we view active consumers as suppliers, there would be no incentive for them to participate in P2P energy trading. While there appears to be some economic advantage in the P2P trading of energy, this does not manifest as financial profit but rather as an economic benefit where excess produced and stored energy is shared among peers at more favorable prices, granting the peers greater autonomy in distributing their surplus energy. Indeed, RED seems to ensure that they continue to enjoy consumer law protection through Article 21(2)(c), as discussed in the previous sections.

Similarly, Art. 2(18) states that the right to conduct P2P energy trading shall be without prejudice to the rights and obligations of the parties involved as final customers. This is reasonable considering that active consumers in P2P energy trading are acting in a non-professional capacity and that the generation, storage, and sale of renewable energy do not constitute the primary commercial or professional activity of the active consumer. Thus, despite the fact that they act as producers and suppliers of energy to other consumers, they would not be in the position of ensuring consumer protection or handling complaints.[143]

5.3.1.4. The choice architecture for self-consumers and renewable energy communities in peer-to-peer trading

An essential precondition for consumers to engage in new energy services and become market participants is having a smart meter installed. Thus, the choice architecture for self-consumers and renewable energy communities is in this sense limited. The smart metering data must be granular, so self-consumers must consent to having their energy usage data collected by a smart meter. Here, GDPR comes into play, with all the preconditions and principles analyzed in section 4.1 of this report.

Article 21 RED entitles renewable consumers, individually or through aggregators:

- to generate renewable energy, including for their own consumption,
- store,
- sell their excess production of renewable electricity, including through power purchase agreements, electricity suppliers and peer-to-peer trading arrangement.

[143] For a more detailed analysis also from the perspective of European consumer protection laws refer to: L. de Almeida, et al. (2021) p.13-18

Discriminatory or disproportionate procedures and fees are prohibited. Consumers have the right to install and operate storage systems combined with renewable installations for self-consumption without being liable for any additional charges, including grid fees for stored electricity.

Consumers who decide to become active consumers can do so via aggregators, a new term introduced by the RED. Aggregators function as intermediaries to enable consumers and communities to access the energy market and trade their self-generated electricity.

The RED applies only to energy from renewable sources; thus, the self-consumers and renewable energy communities are constrained by the RED to *renewable* energy production. The choice architecture for the self-consumers and renewable energy communities regarding the sale of their renewable energy consists of agreements through peer-to-peer trading or via renewables power purchase agreements.[144]

Every self-consumer has the right to join or leave a renewable energy community while maintaining their rights and obligations as an individual customer. This freedom cannot be waived or restricted contractually.[145]

Self-consumers can choose between two types of organizing collectively: jointly acting or as part of a renewable energy community. Jointly acting renewables self-consumers are a group of at least two jointly acting renewables self-consumers in accordance located in the same building or multi-apartment block.[146] In this case, the jointly acting consumers enjoy the same rights as their individual components. Whereas in the case of the creation of a renewable energy community, the creation of a legal entity is mandatory.

The limited scope of the renewable energy community restricts the choice architecture of the technologies it can deploy. It can only engage in renewable energy projects, thereby limiting the sources to renewables. The Internal Market for Electricity Directive 2019/944 (IMED), analyzed in the following section, provides a broader choice architecture with its concept of 'citizen energy communities,' which are not restricted in terms of energy sources. While the renewable energy community should exclusively utilize technology for energy production from renewable sources, encompassing electricity, gas, and heat, citizen energy communities have the flexibility to employ both fossil-fuel and renewable-based technologies, but solely for electricity production.[147]

In terms of benefits, the choice architecture of renewable energy communities is limited to environmental, economic, or social community benefits for its members or the local area rather than financial profits as a primary objective. Similarly, the choice architecture of self-consumers

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144 Art. 2(17) RED defines a renewable power purchase agreement as: "'a contract under which a natural or legal person agrees to purchase renewable electricity directly from an electricity producer".

145 Vanhove, Simon (2023) The Electricity Distribution System Operator in a World of Active Customers; A legal laboratory analysis under EU, Belgian and Dutch law. KU Leuven. PhD Dissertation. p.201.

146 Art.2(15) RED.

147 For a more detailed overview of the IMED refer to section 4.3.2. of this report.

is limited to environmental, economic, or social community benefits for themselves or the local area rather than financial profits as a primary objective.

5.3.2. The Internal Market for Electricity Directive 2019/944: a decentralization initiative

The Internal Market for Electricity Directive (IMED)[148] established new rules governing the generation, transmission, distribution, energy storage, and supply of electricity and a new form of participation in the energy system. It also includes consumer protection measures aimed at establishing competitive, consumer-focused, flexible, fair, and transparent electricity markets within the EU. The main goals involve ensuring affordable and transparent energy prices, providing a high level of security in energy supply, and facilitating a smooth transition to a sustainable, low-carbon energy system.

5.3.2.1. Who is an active customer?

An active customer is defined in IMED as

"*a final customer, or a group of jointly acting final customers,*

- *who **consumes or stores electricity** generated within its premises located within confined boundaries or, where permitted by a Member State, within other premises,*
- ***or who sells self-generated electricity***
- ***or participates in flexibility or energy efficiency schemes**,*
- *provided that **those activities do not constitute its primary commercial or professional activity***"[149]

This definition is very similar to the RED's definition of the 'renewables self-consumer'; the main difference is that the active customer does not necessarily generate, store, and sell only renewable energy.

Article 2(3) defines a final customer as "a customer who purchases electricity for own use". If the final customer gets involved in the activities listed in Article 2(8) IMED, then he is considered as an active customer. Article 15(1) IMED urges Member States to ensure that final customers may act as active customers without being subject to disproportionate or discriminatory technical requirements, administrative requirements, procedures and charges, and to network charges that are not cost-reflective.

In addition to guaranteeing their rights as active customers as outlined in sections a-f of Article 15(2), Member States are also required to ensure through national laws that active customers are

[148] Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast) hereafter The Internal Market for Electricity Directive or IMED

[149] Article 2(8) Internal Market for Electricity Directive

financially responsible for the imbalances they create in the electricity system.[150] This sounds concerning, as it seems that active customers would have to prove they were not the cause of any imbalances in the electricity system. However, it does not seem to refer to power cuts but rather to situations where the active customer causes more electricity to be bought from the grid, leading to higher costs for the community.

Member States should also ensure that active consumers are subject to cost-reflective transparent and non-discriminatory network charges that account separately for the electricity fed into the grid and the electricity consumed from the grid.

For active customers that own an energy storage facility, Article 15 obliges Member States to ensure that they:[151]

a) have the right to a grid connection within a reasonable time,

b) are not subject to any double charge, including network charges, for stored electricity remaining within their premises and when providing flexibility services to system operators,

c) are not subject to disproportionate licensing requirements and fees,

d) are allowed to provide several services simultaneously.

5.3.2.2. What is a citizen energy community?

The definition of 'citizen energy community' provided by the ED closely resembles the definition of 'renewable energy community' as outlined by the RED, as analyzed in section 4.1.16.2 of this report. Thus, the ED defines 'citizen energy community' as:

> "*a **legal entity** that:*
>
> *(a) is based on a **voluntary and open participation** and*
> *- is effectively **controlled by members or shareholders** that are natural persons, local authorities, including municipalities, or small enterprises;*
>
> *(b) has for its **primary purpose to provide environmental, economic or social benefits** to its members or shareholders or to local areas where it operates rather than generate financial profits; and*
>
> *(c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide energy services to its members or shareholders'*."

[150] Article 15(2)(f) Internal Market for Electricity Directive
[151] Article 15(5) Internal Market for Electricity Directive

Similar to the elements of the RED in the renewable energy community, the IMED states that this citizen energy community must deliver environmental, economic, or social benefits to shareholders, members, or the local area of operation instead of focusing on generating financial profits. Nonetheless, EU law does not prevent energy communities from generating profits, as long as these profits are reinvested in the community, and it does not prevent them from offering returns on investment to their members.[152]

IMED allows members states to establish their own regulatory framework for citizen energy communities, provided that they make sure that: [153]

a) participation in a citizen energy community is **open and voluntary**;
b) members or shareholders of a citizen energy community are **entitled to leave** the community
c) members or shareholders of a citizen energy community do not lose their rights and obligations as household customers or active customers;
d) subject to **fair compensation** as assessed by the regulatory authority, relevant distribution system operators cooperate with citizen energy communities to facilitate electricity transfers within citizen energy communities;
e) citizen energy communities are subject to **non-discriminatory, fair, proportionate and transparent procedures and charges**, including with respect to registration and licensing, and to transparent, non-discriminatory and cost-reflective network charges in accordance with Article 18 of Regulation (EU) 2019/943, ensuring that they contribute in an adequate and balanced way to the overall cost sharing of the system.
f) are able to **access all electricity markets**, either directly or through aggregation, in a non-discriminatory manner;
g) are treated in a **non-discriminatory and proportionate manner** with regard to their activities, rights and obligations;
h) are **financially responsible for the imbalances they cause** in the electricity system;
i) with regard to consumption of self-generated electricity, **citizen energy communities should be treated like active customers and thus be subject to cost-reflective, transparent and non-discriminatory network charges** that account separately for the electricity fed into the grid and the electricity consumed from the grid;
j) are **entitled to arrange within the citizen energy community the sharing of electricit**y that is produced by the production units owned by the community.

5.3.2.3. The choice architecture for active customers, final customers and citizen energy communities

The choice architecture defining the governance model of citizen energy communities is characterized by criteria of openness and voluntary participation. Active customers and final customers are free to decide whether they want to become members or shareholders of a citizen

[152] L. de Almeida, et al. (2021) p.31
[153] Article 16 (1) and (3), Internal Market for Electricity Directive

energy community. Participation in a citizen energy community cannot be forced or imposed—for example, a household cannot be compelled to join simply because everyone else in the neighborhood has. As the term "voluntary participation" suggests, members can choose to leave the community whenever they see fit. Opt-outs must adhere to the standard rules concerning consumers' rights to switch suppliers.

IMED constrains the choice architecture of active customers to selling electricity for purposes other than primary commercial activities. Therefore, the sale of self-generated electricity should not be their main commercial or professional endeavor. Likewise, citizen energy communities cannot be established primarily for the purpose of generating financial profit. IMED limits their main objective to achieving environmental, economic, or social benefits. However, EU law does not seem to prevent energy communities from making profits as long as the profits are reinvested into the community, nor does it preclude them from providing a return on investment to members.[154]

Article 15 IMED entitles active consumers to:

- operate either directly or through aggregation,
- sell self-generated electricity including through power purchase agreements,
- participate in flexibility and energy efficiency schemes,
- be subject to cost reflective, transparent and non-discriminatory network charges.

Due to the wide scope of the citizen energy community in terms of energy sources, the choice architecture of citizen energy communities is not confined by any particular types of technologies, allowing the citizen energy community to engage in any electricity-related activities, regardless of the technology.[155]

5.3.3. Application of the discussed EU legal framework for p2p energy trading to the COOMEP coordination mechanism

For the purposes of COOMEP, the term 'energy community' refers to a group of citizens legally recognized to operate as an energy community under local laws, characterized by open and voluntary participation. This community owns and controls its operations in market activities such as generation, distribution, supply, consumption, aggregation, energy storage, energy efficiency, or charging services for electric vehicles, with the primary goal of providing environmental and social benefits (sustainable energy generation) to that specific community rather than financial gains. The coordination mechanism would aid the energy community in achieving its objectives through an automated process.

[154] L. de Almeida, et al. (2021) p.31
[155] Vanhove, Simon (2023) The Electricity Distribution System Operator in a World of Active Customers; A legal laboratory analysis under EU, Belgian and Dutch law. KU Leuven. PhD Dissertation. p.204

There is no definition of energy sharing in the analyzed regulatory framework, nor in any of the EU laws of the Clean Energy Package.[156] Recital 46 of IMED, refers to sharing electricity produced using generation assets within the citizen energy community by 'offsetting the energy component of members or shareholders using the generation available within the community, even over the public network, provided that both metering points belong to the community'.[157] The same recital refers to resorting to 'existing or future information and communications technologies' for the sharing of electricity.[158] REScoop notes that by using smart meters, an energy community, either by itself or through a third party, would virtually aggregate the load profile of members, and then allocate portions of produced energy between members according to an established distribution agreement between them.[159] In legal terms, sharing energy means allocating the generated electricity owned by the community to community members or shareholders instead of selling it in the market.[160] COOMEP envisages the use of an AI assistant for building a coordination mechanism for automating this process.

Active customers of citizen energy communities who choose to implement an AI assistant as a coordination mechanism cannot be disadvantaged by it. Therefore, the coordination mechanism must ensure that during the process of sharing (buying/selling) energy within the community, no member is placed in a disadvantaged position.

As a basic contractual right of the final customers, the supplier should provide the final customers with fair and transparent general terms and conditions in plain and unambiguous language and should not include non-contractual barriers to the exercise of customers' rights, such as excessive contractual documentation.[161]

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[156] https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en
[157] Recital 46, Internal Market for Electricity Directive
[158] Ibid.
[159] REScoop and ClientEarth, (2020) Energy Communities under the Clean Energy Package: Transposition Guidance https://www.managenergy.eu/node/980
[160] L. de Almeida, et al. (2021) p.32
[161] Article 10(8), Internal Market for Electricity Directive

5.4. The Brussels legal landscape regarding energy sharing

Belgium's energy policy focuses on transitioning to a low-carbon economy while ensuring energy security, lowering costs for consumers and increasing market competition. The RED and IMED were transposed into the Brussels Energy Decree by the Brussels Ordinance of 17 March 2022 (hereafter the Ordinance).[162]

There are three different energy sharing models in Brussels:

- energy communities,
- sharing in the same building,
- peer-to-peer exchange.

The main objective of energy communities is to provide environmental, social or economic benefits to their members and to the territory where they operate, rather than generating financial profits. Besides the renewable energy communities and citizen energy communities discussed in the previous section, there is a third type of energy community called the local energy community.[163] Each form of energy community is distinguished by the activities that the community can carry out, the categories of people who can participate in it, and the categories of members who can control it. In any case, these communities are distinguished from other actors

[162] Ordonnance modifiant l'ordonnance du 19 juillet 2001 relative à l'organisation du marché de l'électricité en Région de Bruxelles-Capitale, l'ordonnance du 1er avril 2004 relative à l'organisation du marché du gaz en Région de Bruxelles-Capitale, concernant des redevances de voiries en matière de gaz et d'électricité et portant modification de l'ordonnance du 19 juillet 2001 relative à l'organisation du marché de l'électricité en Région de Bruxelles-Capitale et l'ordonnance du 12 décembre 1991 créant des fonds budgétaires en vue de la transposition de la directive 2018/2001 et de la directive 2019/944

[163] Article 5 § 57°, Ordonnance modifiant l'ordonnance du 19 juillet 2001 relative à l'organisation du marché de l'électricité en Région de Bruxelles-Capitale, l'ordonnance du 1er avril 2004 relative à l'organisation du marché du gaz en Région de Bruxelles-Capitale, concernant des redevances de voiries en matière de gaz et d'électricité et portant modification de l'ordonnance du 19 juillet 2001 relative à l'organisation du marché de l'électricité en Région de Bruxelles-Capitale et l'ordonnance du 12 décembre 1991 créant des fonds budgétaires en vue de la transposition de la directive 2018/2001 et de la directive 2019/944, available at: https://etaamb.openjustice.be/fr/ordonnance-du-17-mars-2022_n2022020646.html

by the fact that they must pursue the main objective of providing environmental, social and economic benefits to their participants and to the Region. Hence, the energy community cannot pursue a purely profit-making goal. Furthermore, each energy community must be a legal entity, subject to the granting of an authorization issued by Brugel, the Brussels energy regulator.[164,165] Obtaining an authorisation to operate an energy community is mandatory. The authorization is valid for a period of 10 years, and is renewable.[166] The local energy community is a form of renewable energy community, which may produce, consume, store or share renewable electricity only internally.[167] The installations producing this electricity must be owned by the local energy community or one or more of its members.

Energy Communities in Brussels:

- renewable energy community (REC)
- citizen energy community (CEC)
- local energy community (LEC)

Legal Requirements for setting up an energy community:

- It must be a legal entity
- Bylaws must be set up
- Authorization by Brugel
- Smart meters must be installed (by Sibelga)

Since April 2022, with the implementation of the new ordinance, sharing electricity within the same building is now possible on a free and voluntary basis among active customers acting jointly. **In this case, registering the participants as an energy community is not required.**

Legal requirements for energy sharing in the same building:

- Electricity must come from renewable sources (e.g. via photovoltaic panels);
- The installation for the production of electricity from renewable energy sources must be located in or on the buiding;
- Sharing participants must be located in the building where the production facility is located;
- Each participant in the sharing must remain covered by a supply contract with an energy supplier.

[164] Ibid. Art. 28sexiesdecies. § 1st.
[165] See: https://energysharing.brugel.brussels/
[166] Ibid.
[167] Ibid. Art. 28septies. § 1st.

- Each participant must be equipped with a smart meter that can measure electricity flows (both consumption and injection) over a quarter-hourly period.
- An agreement on the rights and obligations of each party including, where applicable, electricity billing rules (including pricing or sharing free of charge) must be concluded prior to sharing.

Sibelga manages the metering data and calculates the distribution of shared volumes as per the terms set by the relevant network users within the same building. Energy sharing must be reported to the distribution network manager, Sibelga.

The ordinance distinguishes between ‘electricity sharing’ and ‘peer-to-peer exchange of electricity’.

Electricity sharing is defined as:

- consumption shared between active customers acting jointly
- or members of an energy community
- connected to the regional transport network or the distribution network,
- over the same quarter-hourly period,
- in whole or in part, of electricity produced by one or more production facilities connected to the regional transmission network or the distribution network and injected into the regional transmission network or the distribution network;

peer-to-peer exchange is defined as:

- exchange of electricity from renewable energy sources
- between active customers
- on the basis of a contract containing pre-established conditions governing the automatic execution and settlement of the transaction
- either directly between active customers,
- or through an intermediary;

As we can see, there are several differences between the two methods. P2P exchange can only occur between active customers as individuals, while electricity sharing can take place between active customers acting jointly or among members of an energy community. Therefore, for energy users to operate individually, membership in an energy community is required, a requirement that does not apply to the P2P exchange of electricity.

Electricity sharing has no restrictions on the energy source, while P2P exchange is confined to renewable energy sources. Another difference is the legal foundation; P2P exchange necessitates a contract with pre-established terms that govern the automatic execution and settlement of the transaction. The contract can be executed either directly between the active customers involved or through an intermediary. A contract is not needed for electricity sharing. Ultimately, there is a time limit for electricity sharing, which must occur within the same quarter-hour period. This limit does not apply to P2P exchange.

There's no requirement to be in the same municipality for P2P sharing, as long as it takes place within Brussels. Having a smart meter is essential. P2P exchange can take two forms:

1) **Peer-to-peer exchange with only one other active customer (one-to-one P2P):** The active customer engaging in purchasing activities through peer-to-peer exchange, without the involvement of an intermediary during the same quarter-hour period, is not required to meet the obligations of suppliers when the purchasing activity involves only one other active customer. This is contingent on both access points being covered by a supply contract with a supply license holder and being connected to the same network. Specifically, this means the active customer is exempt from the obligation to obtain an electricity supply license and does not need to adhere to the public service obligations of suppliers.

2) **Peer-to-peer exchange with multiple active customers (one to many P2P):** The active customer engaging in purchasing through a peer-to-peer exchange, without an intermediary, is subject to the obligations of suppliers when the purchasing activity involves several active customers.

The Ordinance led to changes to the Brussels Protocol on Energy Sharing. Art. 4.3.64, §1 of the Technical Regulation for the Distribution of Electricity in the Flemish Region (TRDE)[168] stipulates that the electricity distribution system operators and access holders, the parties engaged in energy sharing under art. 7.2.1, §1 Energy Decree, the active customers engaged in peer-to-peer trading of green electricity in accordance with art. 7.2.2, §2 Energy Decree, and the third parties that are mandated in the context of the aforementioned activities, communicate according to the mentioned protocol. The third version of this Protocol on Energy Sharing and Peer-to-Peer Trading of Green Electricity,[169] allows for multiple person-to-person trading. Now this protocol accommodates for energy sharing in a common building (apartment buildings, office complexes, etc), and as of July 2022 also energy sharing between own access points and peer-to-peer sharing of green electricity.

In the Brussels Energy Decree, "**energy sharing**" is defined as:

> "*the allocation* ***free of charge*** *over one imbalance settlement period*

[168] Technisch Reglement voor de Distributie van Elektriciteit in het Vlaamse Gewest of 25 June 2021
[169] Protocol on Energy Sharing and Peer-to-Peer Trading of Green Electricity, Third Version entered into force on 23 January 2023. Protocol Energiedelen en P2P-derde versie: https://www.vreg.be/sites/default/files/document/bijlage_1_-_protocol_energiedelen_en_p2p_-_derde_versie.pdf

- *of all or part of the self-generated energy*
- *injected into an electricity distribution system, the local electricity transmission system, a closed distribution system of electricity,*
- *between customers in the cases mentioned in Art. 7.2.1, §1,*
- *or the allocation free of charge of renewable thermal energy through a heat or cold network […].”*[170]
-

Whereas “**peer-to-peer sharing**” of green electricity is defined as:

*“**the sale**, per imbalance settlement period,*

- *by an active customer, if it does not constitute for him the main commercial or professional activity,*
- *of the self-generated green electricity,*
- *and where appropriate stored, and injected into the distribution network at his residence or establishment unit,*
- *to one other active customer,*
- *up to the amount of the offtake of that other active customer at his access point.*[171]

Multiple person-to-person sales as a form of peer-to-peer trading amounts to the situation in which one active customer buys from several other active customers the green electricity that the latter have each individually produced and input into the distribution network.[172] This means that one active buyer can conclude contracts with several active buyer-sellers in the context of peer-to-peer trading of green electricity.[173] Art. 7.2.2 of the Energy Decree forms the basis of peer-to-peer electricity sharing, including green electricity. While it does not oppose multiple person-to-person trading, it restricts the sales only to “one other active customer” and only to the extent of the offtake of that other active customer at its access point.[174] The sale should also be limited to the maximum offtake of the active customer-buyer at his access point in the timeframe of one quarter-hour.[175]

The requirement that energy sharers and active customers engaged in peer-to-peer energy trading all have the same access holder was removed in the third version of the protocol. Furthermore, the following forms of sharing or selling energy are allowed without additional preconditions: energy sharing within a common building, energy sharing in a citizens’ energy community or a renewable energy community, energy sharing between access points with the same holder, and peer-to-peer trading.

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[170] Decreet houdende algemene bepalingen betreffende het energiebeleid [hereafter " Energiedecreet"] Article 1.1.3. 38° /1
[171] Energiedecreet
[172] Beslissing van de VREG met betrekking tot de goedkeuring van het voorstel van de elektriciteitsdistributienetbeheerders betreffende het protocol inzake energiedelen en peer-to-peerhandel van groene stroom (derde protocolversie): https://www.vreg.be/sites/default/files/document/besl-2022-207.pdf
[173] Ibid.
[174] Art. 7.2.2, §2, Energiedecreet of 8 May 2009, as amended by Decree of 2 April 2021
[175] Ibid.

For the purposes of P2P energy sharing, each grid user of the access point or allocation point through which energy sharing or P2P sharing are made ("the participant") must have measurement regime 3 (quarterly data in the allocation) activated.[176] Each participant can only participate in 1 community.[177] Furthermore, deciding to participate in a community for energy sharing, means consenting to making available their entire injection.[178] Any surplus is then allocated back to the injection facility.[179]

The Belgian regions opted for a minimal transposition of peer-to-peer energy trading, allowing peer-to-peer transactions only in one-on-one exchanges. Intermediaries are not specifically mentioned in the legal framework, and there is no certification mechanism for them.

Energy sharing model	Energy communities	In the same building	P2P sharing
Requirements	Registered as a legal person	-	-
	Authorization by Brugel	-	-
	Smart meter installed	Smart meter installed	Smart meter installed
	No source restriction	Source must be renewable energy	Source must be renewable energy
	Participants are members of the energy community	Participants located in the same building	Participants located anywhere within Brussels

[176] Protocol on Energy Sharing and Peer-to-Peer Trading of Green Electricity.
[177] Ibid.
[178] Ibid.
[179] Ibid.