

UNPOLISHED DRAFT PAPER

Tentative of a coding algorithm for the leximetric analysis of the charters of renewable Energy Communities

1. Abstract (Title: Are Renewable Energy Communities actual Ostrom's institutions? – a leximetric analysis of the governance structures)

The EU recently formalized Renewable Energy Communities (RECs) by the RED II EU Directive 2018/2001, amended by Directive (EU) 2023/2413, after almost two decades of spontaneous initiatives. RECs represent forms of collective distributed generation and consumption of renewable energy resembling “commons” or common pool resources (hereinafter CPRs) in the economic meaning (Ostrom 1994). Our aim is primarily to understand whether RECs have a governance similar to that predicted by Elinor Ostrom for commons, basing on what is written in their charters.

For this scope, we collected and analyzed a sample (“preliminary sample”) of charters from France, Italy, and Switzerland (respectively 7, 5, and 4 documents) in order to create a leximetric analysis (Armour 2016, Adams 2017) coding template of the components of control rights and the design principles that characterize the governance structures à la Ostrom (Schlager and Ostrom 1992; Cole and Ostrom 2012; Ostrom 1998).

By employing this analysis, we aim to systematically evaluate the incorporation and representation of various governance mechanisms within the charters of RECs, also observing comparatively how these institutions develop across three different countries and trying to determine the reasons for these differences. The study, thereby, intends to offer valuable insights into the regulatory frameworks and operational dynamics of the phenomenon of RECs, which appears to be significantly propagating.

2. About the nature of Renewable Energy within the RECs

Distributed generation of renewable energy (RE) has significantly grown over the past few decades, building up on a variety of reasons, including the increasing power demand, concerns over climate change and the need to diversify the sources of energy production to enhance flexibility and reduce geopolitical dependence. While it was born in the form of independent power generation units, is now emerging the need to integrate these into the centralized power

system. Such integration incurs into both technical obstacles, involving flexibility and capacity of the existing system, as well as non-sufficient reliability of RE (Iweh et al. 2021, Akhtar et al. 2021), and socio-legal complexities, as involves a critical and extensive engagement with various “distributed actors”. Some of these assemble in the form of REC.

2.1. Analyzing subtractability and Excludability of RE in RECs to assess its Potential as Commons

Ostrom (1990) categorized goods basing on their conditions of subtractability and excludability in consumption. Subtractability, also known as rivalry, refers to the degree to which the appropriation of resource units by one person reduces the amount available for others. In particular, if the appropriation of resource units by an users does (not) impact the stock of units available to other users, then the good is characterized by high subtractability/low rivalry. The characteristic of excludability is, on the other hand, related to the *jointness* of the resource system, which implies the higher or lower costs of excluding one appropriator from the resource or from improvements made to the resource system (Ostrom 1990). A systems can therefore be described in terms of low jointness/high excludability, when mechanisms of ownership rights or pricing can easily restrict the access. can be restricted in their access. On the other hand, high jointness/low excludability of goods is described when it is difficult or impossible (or even undesirable, as in the case of national defence) to prevent individuals from using them.

Common-Pool Resources are goods characterized by high rivalry and low excludability. Appropriation by one individual reduces availability for others, but it is difficult to excluded potential appropriators from access to the system (e.g., fisheries, groundwater). These characteristics about consumption leads to free-riding behaviours and the “tragedy” (Hardin 1968). This concept described how CPRs are naturally subject to being depleted by individuals acting unavoidably in self-interest.

RE in RECs can be described through the lenses of subtractability and excludability.

Renewable energy sources are generally characterized by low subtractability/rivalry in their raw form. For instance, sunlight and wind are abundant and not diminished by individual appropriation. One person's use of sunlight to generate solar power does not reduce the availability of sunlight for others. Similarly, wind energy is non-subtractible as long as there is sufficient capacity and no impediment (e.g forms of shielding) for multiple users to harness the wind. However, when it comes to the infrastructure and technology required to convert these resources into usable energy (e.g., solar panels, wind turbines), to store it and distribute it, subtractability emerges (Jenny, A., Hechavarria Fuentes, F., & Mosler, H. J.,2007). The production capacity of a solar farm or wind farm is finite, and thus, withing the stock of electricity “units” generated by one system, when a unit is appropriated by one user, this is not subject to joint use, meaning it cannot be appropriated by another user. This introduces a degree of subtractability/rivalry in the utilization of renewable energy, determined by the ratio of

produced resource units per number of appropriators and replenishment rate of the stock generated by the technical infrastructure.

The excludability of renewable energy also varies depending on the stage of the resource's use. In their natural state, sunlight and wind are non-excludable as they are freely available and cannot be easily restricted. However, the conversion of these resources into electricity introduces excludability. Access to the energy produced can be controlled through technological and/or regulatory means, such as grid connections, metering systems, and electricity pricing.

While the raw resources such as sunlight and wind are non-rivalrous and non-excludable (as public goods), the infrastructure required for their conversion introduces elements of rivalry and excludability. For instance, while solar energy is environmentally friendly and sustainable, the efficiency of the DES depends on various factors including the size and quality of photovoltaic panels, as well as the storage capacity of batteries. These elements determine the amount of electricity produced and stored, thereby imposing limits on consumption. Users should consider the needs of others. Moreover, inverters, which convert AC to DC current for household appliances, restrict the amount of energy that can be used simultaneously. Excessive usage can deplete stored energy, leading to system failures like inverter disconnections, leaving all users without power. Access to electricity generated by a community solar project can be restricted to members who have invested in the project and are part of the collectivity/community of reference. Therefore, establishing energy management rules is vital for communities using shared solar energy systems. Individual compliance with these regulations is crucial, as misconduct by one person can affect the entire community.

According to Wolsink, DES should not just be considered in their technical dimension, but as social-technical systems. This definition gives the size of the embeddedness of the social dimension of prosumers and of the community, which generate, as in the case of RECs, a socio-legal institution for the coproduction and co-consumption of energy by operating a decentralization of the energy systems as well as a switch from hierarchy to polycentric structures of governance, which constitute the basis of power distribution among users, could be regarded as common goods (2020) instead of public or commodified private goods. The idea of social-technical systems is considered to adhere to that of social-ecological systems, which is at the basis of the theory of commons and CPRs (Wolsink 2020).

This approach not only addresses the challenges of infrastructure and regulation but also leverages the opportunities for community empowerment and sustainable development. Furthermore, it can be used in the debate on the creation of acceptance of RE (Wolsink 2020).

The reason for investigating whether RE can or cannot be considered within the range of commons, even though as a non-traditional one, can be also rooted in argumentations of ethical nature. The first step is the consideration of the strong relevance of energy for the maintenance of the current levels of socio-economical development and the so-called decent living standard (Rao & Min, 2017), by which access to energy can be described as essential material condition

for the achieving of human wellbeing, leading scholars to the introduction of considerations of ethical nature about the governance of energy and access to it (Sovacool 2014, 2016, Jones 2015, Mcharg 2020, Ren 2023). Stefano Rodotà elaborates that goods and services (e.g. public local services) exist that can be described in terms of conditions for the wellbeing of citizens and consequently of preconditions to the exercise of democratic citizenship. Therefore, all citizens, as equally worthy of dignity, shall be granted equal right of access to these resources, which shall be considered as *commons*.

While in a strict economic sense the RE would make it relatively cheap to exclude users and to commodify the resource (Polanyi 1944, Hermann 2021), observations of ethical and distributional nature introduce an added level of complexity. In fact, by following this thread of thought, it would emerge that the application of technological or monetary instruments for the exclusion of users can be furtherly implied to be an element of disruption of democratic and constitutional values.

From a more economic point of view, RE they can be still defined “commons” in terms of the “model of governance and management based on the common appropriation and of free access, whether within a pertinent territorial dimension” (Saccone & Ottoni, 2015) that is applied to these resources. These institutional configuration would well arise by means of social preferences derived from ethical norms of non-discrimination for the access to certain goods (Ostrom 2005, Saccone & Ottoni 2015, Dodds 2005).

From the perspective of social welfare, the cost generated by the exclusion from access to energy by application of a logic of commodification (and therefore exclusion by means of “pure” pricing mechanisms) may be high, for example in terms of maintaining or even accentuating vulnerabilities and conditions of poverty in the population (Kashwan 2021).

2.1.4. RECs as institutional model for the commoning of renewable energy

As energy is essential for wellbeing and maintaining decent living standards, by considering RECs as institutions of communing for energy, communities can ensure that access to energy is treated as a fundamental right, promoting social equity and resilience. This approach aligns with the broader understanding of common goods and their potential role in supporting human rights and community wellbeing.

A second step is on the other hand, to be seeked by the analysis of both the structure of the technological system of the infrastructure necessary for the production, distribution and consumption of RE, as well as the legal design of the governing institution.

To the scope of the present study, the legal and institutional analysed model is the one of RECs. These are designed as voluntary association of individuals who will to self-produce to supply their energetic needs at a convenient price. It is designed as “a legal autonomous entity, based on voluntary and open participation, effectively controlled by the members of the coalition”¹.

¹ RED II

The legal design includes several elements of attention, such as the collective and participatory nature of the structure, along with the freedom of access and recess, and “non-profitability” of the organization.

These elements can be observed also in the descriptions of governing institutions of commons elaborated by Ostrom (1990, etc). Elinor Ostrom’s principles for managing common-pool resources can be considered coherent to the legal design and scope of RECs. The hypothesis of the paper is that they can also be found within the foundational charters of existing RECs in various countries (three). These principles include clearly defined boundaries, collective choice arrangements, effective monitoring, and conflict resolution mechanisms, and that can be synthetically described by conjuncting the description of the control rights (Schager & Ostrom 1992; Cole & Ostrom 2012; Ottone & Sacconi 2015) and the eight design principles (Ostrom 1998, Ottone & Sacconi 2015), as explained more in detail within the paper and used as basic reference for the leximetric analysis. By adopting these governance frameworks, RECs can induce the management of renewable energy resources as commons, balancing the costs and benefits among all members while maintaining sustainability.

Treating renewable energy as commons presents both challenges and opportunities. One major challenge is the initial investment required for infrastructure development. Unlike traditional commons, which often involve natural resources with minimal initial costs (e.g. the resource systems is already existing, does not need to be built from scratch; it holds “only” costs of maintaining), renewable energy infrastructure such as solar panels and wind turbines require significant capital investment. Additionally, regulatory and policy frameworks must support the collective management of renewable energy. This includes facilitating community ownership models, providing incentives for shared renewable energy projects, and ensuring fair access to the grid.

Bowles (Bowles et al., 1999) stresses the importance of an institutional design tailored to the specific context and needs of the community, ensuring that they promote cooperation and prevent free-riding. For RECs, this involves creating governance structures that facilitate inclusive decision-making, transparency, and accountability. The interplay of social preferences, incentives, and institutional design in managing common-pool resources is also discussed underlining the importance of social preferences, such as altruism, reciprocity, and fairness, in the effective management of commons. In the context of renewable energy, these preferences play a crucial role in fostering cooperation among community members. For instance, individuals who value sustainability and community welfare are more likely to participate actively in renewable energy projects and adhere to collectively agreed-upon rules. He furtherly highlights the necessity for a well-designed incentive structure, that align individual interests with collective goals. He argues that incentives should not only be material (e.g., financial rewards) but also social (e.g., recognition, reputation). In RECs, this could mean offering financial incentives such as reduced energy costs for participants, alongside social incentives like public acknowledgment of contributions to the community’s sustainability efforts.

On the other hand, treating renewable energy as commons offers significant opportunities. It promotes community engagement and empowerment, allowing local communities to take control of their energy production and consumption. This can lead to increased adoption of renewable energy, improved local resilience, and enhanced social cohesion. Moreover, it aligns with the principles of sustainability and equity, potentially creating the so called “comedy of the commons” (Frischmann 2005, 2012), resulting in a spillover of positive externalities from the developed infrastructure (here seen as the commons), with not just the members of the REC benefitting from the direct advantages like the access to RE, reduction of the energy expense and access to the services, but expanded trickle down benefits to the whole local “extended” community (not member of the organization), as the access to the ancillary services and all the positive spillover effects of the REC, which may range from (but not limited to) the organization of sensibilization events, to educational projects, to actions of requalification of the urban area of interest.

3. Methodology

The coding methodology takes moves from the CBR Labour Regulation Index Dataset (‘CBR-LRI’) (Armour 2016, Adams 2017), and we have retraced some of its steps for the construction of our dataset. The process of creation of the template here presented is divided into a few phases. First the phenomenon or interest has been identified and a numerous set of charters of existing and functioning RECs from the three countries is created by the collection of files available online. Then, through accurate reading, the different articles and described topics are individuated and clustered by similar context (e.g. definition of property right and access, definition and processes of decision-making members of the collectivity, etc). Later these pieces of information have been confronted with the principles described in regard to institution of commons and new, more precise clusters have been created. These types of information have been subsequently abstracted from the existing charters and confronted with other pieces of research describing institutions of the commons and practices of governance of these (Kollock et al., 1990; Ostrom, 1990). On the basis of these analysis, the pieces of information previously collected have been used to elaborate a scale of “completeness” per each indicator, which intends to map each information from generic to accurate in relation to the principles characterizing institutions of commons. On this, each piece of information from these or other charters of RECs can be assigned an ordinated value between 0 and 1. The goal is the creation of a fitted template that is able to determine whether or not each charter of REC describes an actual institution of commons and to which “completeness” per each of the governance mechanisms that define one.

Step 1: Identification of the general phenomenon of interest and of the object of analysis

The phenomenon analyzed here is the statutory moment of RECs, which ends out in a charter. From the legal perspective, a charter is a requirement for this form of organization, which indicates the object of action, the goals of the body, as well as determines the mechanisms of governance, allocation of rights, responsibilities and authorities within it. It also contains provisions regarding mechanisms of general problem solving. From the institutional perspective, this founding document can be described in terms of a contract (a social contract of the collectivity of interest), which formalized the institution, by offering an agreed-upon description of the institutional arrangement and the ways in which it shapes the interactions within the organization, restricting among possible alternatives of interactions.

Step 2: Collection of a preliminary sample of charters

To develop the template for the leximetric analysis which the authors intend to use to later investigate if and how Renewable Energy Communities, as forms of collective distributed generation and consumption of renewable energy, present governing mechanisms à la Ostrom, a preliminary sample of charters has been collected.

This sample has been collected in order to provide knowledge of actual structure, composition and texts of existing charters. By means of through analysis of these texts, it has been possible to individuate the realistically possible content of any of these documents and the realistical modalities of implementation of rights and design principles in this typology of papers.

The preliminary sample is composed by charters by France, Italy and Switzerland. France and Italy both are recipient of the Directive 2001/2018 of the European Commission, art. 22, which promotes the institutionalization of Energy Communities in European countries. Switzerland, even not being a EU member state, both formally and informally receives influence of the international policy in the region. Switzerland, in fact, holds various bilateral agreements for the incorporation of the EU law, due to its extreme proximity and *de facto* political and economic significance of the EU regimes to the country (Oesch, 2019). To strengthen this relationship, especially on the energy issue, as Switzerland is closely connected to the European energy grid, both as a transit country, with 41 interconnected transit lines, and for its notable storage capacity.

Given the compatibility of the cooperative form of firms with the model of RECs, it is also considered of interest that the three countries all have a cooperative tradition.

The preliminary sample is constituted respectively of:

- Seven (7) charters for France
- Five (5) charters for Italy
- Four (4) charters for Switzerland

The sample has been composed of a mix of arbitrary selection of RECs and practical accessibility of the texts of the charters. Attention has been given to includes entities constituted in different juridical form (subjected to the availability of already existing RECs and legally possible juridical forms per country), to verify if substantial differences The

charters are public documents for each entity, and the ones analyzed for the present research have been collected through the websites of the Energy Communities.

Step 3: Development of a conceptual construct

The conceptual construct of analysis of the charters is concerned with the institution of commons for the governance of natural resources. Given the collective and local nature of the REC model, the present study tries to identify whether and how these entities implement some governance structures typical of the institutions of commons, and therefore bring about a commodification of the renewable energy resources *prosumed* within them.

Step 4: Identification of indicators or variables which express the construct in numerical terms

The coding algorithm for the present study was based on the extraction of indicators about various common governance mechanisms about the five control rights à la Ostrom (*Schager & Ostrom 1992; Cole & Ostrom 2012; Ottone & Sacconi 2015*) and other aspects derived from the *design principles* (*Ostrom 1998, Ottone & Sacconi 2015*). To structure this analysis, we delineate distinct categories encompassing these crucial aspects (here referred to as “variables/indicators”), being:

- **Access:** The right to enter a resource or a defined physical property. In the case of REC, the charter does not usually make explicit mention about the access to the physical property (such as the real estate and the REC plants that are of property of the REC as juridical configuration or of full availability of it, due to being of property of one of the associates or “rented” by an external entity, e.g., an energy utility). The charters mostly refer to “access” in terms of membership to the juridical entity. In our preliminary sample of charters, from either of the three countries, no actual reference to the access to the physical property has been found mentioned.
- **Withdrawal:** The right to harvest resource units, namely the right to obtain the “products” of a resource. Attention is given in RECs to the resource, which can be intended as the share capital and profit of the entity and/or as the energy self-produced and self-consumed within the configuration. In the Italian case, for example, revenue derives from the incentives linked to the self-consumption of energy within the community and from the profit derived from the sale of excess energy into the market. Therefore, withdrawal is divided into A for the monetary resources and B for the energy resources.
- **Management:** The right to manage the resource, that is, the right to regulate internal use patterns and transform the resource by making improvements. In the case of RECs, it indicates the allocation of the rights of management among the members of the entity, in most cases by democratic election of a few members as parts of the directive council, which is usually the designed executive body of the entity.

- **Exclusion:** The right to determine who will have access right over resource and how that right might be transferred. In the charters of RECs, this variable usually describes the rights and duties connected to membership and how actual members can decide on future members or on the exclusion of a member who operated against the entity. Such right is usually exercised in a non-direct form by means of a representative intermediate body (e.g., the council) supervised in its policy orientation by the general body of members (e.g., the general assembly).
- **Alienation:** The right to sell/transfer these rights. In the case of RECs, the right to sell or lease either or both of the above collective rights. In these entities, the rights of management and exclusion are usually connected with the membership and transferred along it.
- **Boundaries:** Clearly defined boundaries of individuals, families, or businesses with common rights to access a given resource, and of such given resource (e.g., the separation between a river and a lake) must be clearly defined. As the present analysis makes use of both the definitions of control rights and design principles and as the first ones already includes in “access” definition of individuals etc. (usually as members of the entity) who can enter the resource, “boundaries will here be solely used to indicate the definition of such resource. In the case of RECs, the definition of boundaries included in the charters usually includes the juridical form of the entity, the social scope/object of action of the collectivity itself, and sometimes admissible possessions of the entity. It may therefore be said that the boundaries are here intended as definition of non-physical (e.g., social, legal and economic) infrastructures of the REC. An actual description of the actual real estate, power plants, etc. is here hypotized but is usually not found in these charters.
- **Consistency and congruence:** The distribution of benefits must be proportional to the costs, and the restrictive conditions of access (time, space, quantity) must correspond to and be suitable for the local situation. As seen in the analysed charters, benefits and costs in RECs are sometimes linked to different forms of membership, and therefore of contribution to the entity. Moreover, given the goal of RECs to generate societal value and reduce energy poverty², the hypothesis of specific reference to facilitated/assisted access to benefits for users in condition of vulnerability or poverty is here included.
- **Participation:** Mechanisms of participation to the collective choices (process of definition of the rules) about the resources. RECs are designed to be collective entities, democratically controlled by the members of the community. For this scope, usually mechanisms of vote in a general body (e.g. assembly) and election of executive representative members (organized in bodies) are given in the charters. While most charters contain the “one head, one vote” principle, due to the chosen juridical form, either the level of contribution (e.g. in the form of joint stock companies) or the typology of member (founding or regular member, e.g. in the case of the Italian “fondazione di partecipazione”) may determine different participation rights. This

² Directive (EU) 2018/2001 art. 67

indicator shall be divided by A) distribution of voting/participation rights and B) mechanisms for voting.

- **Monitoring:** Those who carry out monitoring and control activities, if they must be accountable to the users, or they themselves must be users. This indicator shall be divided A) by the definition of the mechanisms of monitoring and appeals for accountability and B) by the definition of members who can act as “watch dog”. In the case of RECs, a further distinction may be made between A.1) monitoring of the behaviour of a single member and A.2) monitoring over the operate of the executive bodies.
- **Sanctions:** Provision, proportionality (graduation) and typology (monetary or not) of sanctions. In the case of RECs, as emerged by the analyzed sample of charters, sanction usually consists in the exclusion from the entity, without provision of proportionality and of possible monetary (or other) sanction.
- **Conflict solution:** There must be easily accessible and accepted institutional systems to settle disputes between users and between those delegated to regulate access and users. In the case of RECs, these mechanisms are usually defined for the case of appeal of members sanctioned of exclusion by the directive council in front of the general assembly. Such mechanisms may be applied also in the case monetary or other sanctions where provisioned, and/or in case of perceived disproportion of the chosen form and amount of sanction.
- **Subsidiarity:** There must be easily accessible and accepted institutional systems to settle disputes between users and between those delegated to regulate access and users. In the case of RECs, this indicator is usually referred to the recognition of the superordinate authorities and to the definition of mechanisms of reference towards the central administration bodies, e.g. in forms such as legal/financial auditor, transparency and publicity of acts, etc.
- **Levels of governance or multi-governance:** Every activity related to the governance of the common resource (appropriation methods, consumption monitoring, conflict resolution) must be organized across multiple levels, in harmony and never in conflict. In the case of RECs, this can be referred to the presence of an organizational structure internal to the entity, in the form e.g. of intermediate representative bodies, each of which with powers and mechanisms of control by means of members, other internal bodies of by the whole body of members (e.g. by democratic decision of the general assembly).

Step 5: Development of a coding algorithm

The coding algorithm of this analysis takes moves from the extraction of a name and definition for each indicator from the framework of commons (see the reference above). The second step is the delineation of a coding template.

The analysis is conducted on the texts of a sample of charters from RECs in France, Italy and Switzerland, collected from the websites. The texts have been consulted in their original languages (Italian and French).

Central to our analytical approach is the utilization of variables, a fundamental tool in statistical modelling.

Step 6: Identification of a measurement scale embedded in the algorithm

In this codification, variables serve as indicators of completeness of the detailing of the information which, according to the authors, shall be included to fully describe the matter in question withing each indicator. The variable makes use of a grading from a value 1, indicating the presence of the definition, with the most pertinent detailing withing the charter, while a value of 0 signifies its absence. By employing these variables, we aim to systematically evaluate the incorporation and representation of various governance mechanisms within the charters of RECs, thereby offering valuable insights into their regulatory frameworks and operational dynamics.

Step 7: Allocation of weights to the individual variables/indicators

Of the indicators, some use a binary 0-1 meaning “presence-absence” of the information withing the charter, others are furtherly detailed on an ordinal scale between 0 and 1, that intends to weight each indicator to an imaginary ordinating scale. Numbers, therefore, are for pure ordinating purposes. The scoring approach is detailed and justified in the template.

The template may contain hypothetical scoring values for some of the indicators, referring to a possible definition of the indicator according to the experience and literature of the commons, even though that is not found in any of the analysed texts.

4. Coding template

Variable	Definition	Template
<i>Property/Control rights</i>		
Access	The right to enter a resource (a defined physical property)	<ul style="list-style-type: none"> - Equals 0 if the charter does not include any definition of the rights to enter/recess the organization, nor to the physical property; - Equals 0,5 if the charter contains definition and general criteria for access/recess; - Equals 1 if the charter contains definition and criteria of different typologies of access to the organization and resources, and of recess.
Withdrawal	The right to harvest resource units: the right to obtain the “products” of a resource	<p>A) Monetary resources:</p> <ul style="list-style-type: none"> - Equals 0 if neither definition nor criteria is given about the sharing of exceedance of supply for the shared capital of the configuration;

		<ul style="list-style-type: none"> - Equals 0,5 if the possibility of sharing is defined without further indication of modalities and criteria. - Equals 1 both whether modalities/criteria are given for the sharing of the exceedance of capital, and whether such action is stated as not possible, given reason of indivisibility of the capital or inability of reallocation of capital due to the legal configuration. In such second case, modalities of “indirect withdrawal” may be indicated as well, in terms of destination of the capital exceedances for social activities.
		<p>B) Non monetary resource:</p> <ul style="list-style-type: none"> - Equals 0 if neither definition nor criteria is given about the withdrawal/consumption of the energy resource that is produced and shared within the REC. - Equals 0,5 if the definition of the consumption of energy is given; - Equals 1 if the charter contains definition and criteria for the consumption of energy.
Management	The right to manage the resource: the right to regulate internal use patterns and transform the resource by making improvements	<ul style="list-style-type: none"> - Equals 0 when not defined. - Equals 0,5 when such right is defined and there is indication of the subject responsible for it; - Equals 1 when the procedural process of the decision-making process, by means of the responsible members, is detailed.
Exclusion	The right to determine who has rights on the resource: the right to determine who will have access right, and how that right might be transferred	<ul style="list-style-type: none"> - Equals 0 if there is no definition of such aspects in the charter; - Equals 0,5 if there is specification of criteria and /or modalities for admission/exclusion the right is attributed to a representative body of members (e.g. by means of the council); - Equals 1 if there is specification of criteria and /or modalities for admission/exclusion the right is attributed to the full body of members (e.g. by means of the general assembly) .
Alienation	The right to sell/transfer these rights: the right to sell or lease either or both of the above collective rights	<ul style="list-style-type: none"> - Equals 0 if there is no definition of this right; - Equals 0,33 if the possibility to sell/transfer the membership is not allowed;

		<ul style="list-style-type: none"> - Equals 0,66 if limits to the possibility to sell/transfer the membership are provisioned (e.g. mechanisms of acceptance, waiting times, limits to the typology and total number of members, etc.); - Equals 1 when this possibility is described and granted.
<i>Design principles</i>		
Definition of the boundaries of the resource	Clearly defined boundaries: individuals, families, or businesses with common rights to access a given resource (e.g., a water basin) and the boundaries of the given resource (e.g., the separation between a river and a lake) must be clearly defined.	<ul style="list-style-type: none"> - Equals 0 if no definition of the resource access is given is found in the charter; - Equals 0,25 if the only boundary defined is that of the juridical form of the entity; - Equals 0.50 if the boundary defined includes the juridical form of the collectivity and its social scope/object of action; - Equals 0.75 if, in addition to the previous, the definition includes a list of goods admissible to be of property of the entity (e.g. quotas, real estate, etc.); - Equals 1 if the definition includes, in addition to the previous, also the definition of the real estate, power plants, etc. possessed by the entity.
Consistency and congruence	The distribution of benefits must be proportional to the costs imposed by the rules under which the resource is made available, and the restrictive conditions of access (time, space, quantity) must correspond to and be suitable for the local situation.	<ul style="list-style-type: none"> - Equals 0 if no reference to proportionality, limitation and or differentiation of benefit to cost is defined within the text. - Equals 0,5 in both the following cases³: <ul style="list-style-type: none"> A) when different kinds of associates are given different benefits and right in consequence of their status within the entity; B) when the text contains the definition of no difference in rights or benefits within the entity among the members in relation to their level of contribution (e.g. number of detained quotas). - Equals 1 if, given the definition described in the previous weight, further provision includes forms of “facilitated” access to benefits and rights for members in condition of vulnerability.

³ The two scenarios A and B are given the same weight as the author does not perceive them as different levels of definition, given that such choice may depend on the principles embedded in the chosen juridical form.

Participation	Mechanisms of participation to the collective choices (process of definition of the rules) about the resources	<p>A) Distribution of the right to vote:</p> <ul style="list-style-type: none"> - Equals 0 if no provision on participation rights, mechanisms, representative bodies and procedures is given. - Equals 0,5 if the charter contains the definition of participation rights as proportionated to the level of contribution of the member, mechanisms, representative bodies and procedures. - Equals 1 if the charter contains the definition of participation rights in terms of "one head, one vote" (or similar) regardless of the level of contribution of the member, mechanisms, representative bodies and procedures. <p>B) Mechanisms of voting:</p> <ul style="list-style-type: none"> - Equals 0 if the charter do not contain description of the mechanisms of voting; - Equals 0,5 if the charter contains provision of only in-person mechanisms of voting; - Equals 1 if the charter contains provision of different mechanisms of voting, such as in-person as well as more inclusive mechanisms of voting (e.g. distance voting)
Monitoring and control over conducts	Those who carry out monitoring and control activities, if they must be accountable to the users, or they themselves must be users.	<p>A .1) Monitoring over members:</p> <ul style="list-style-type: none"> - Equals 0 when no provision is given within the text; - Equals 1 when there is definition of mechanisms of monitoring and control of activities. <p>A.2) Monitoring over executive members/bodies (e.g. elected):</p> <ul style="list-style-type: none"> - Equals 0 when no provision is given within the text. - 0,5 when there is definition or the mechanisms for the users (e.g. in the form of the general assembly) to determine and monitor over the agenda of the entity (which is often put in action by representative bodies such as the council and presidency). - 1 when there is definition or the mechanisms for the users (e.g. in the form of the general assembly) have right to determinate and monitor over the agenda of the entity, the acts of the REC are full public and available within the

		<p>entity and the same assembly has right to syndicate over the partial/wrong fulfillment of the agenda and operate sanctions to the representative body entrusted of such fulfillment (e.g. demotion from the role)</p> <p>B) Definition of a watch dog:</p> <ul style="list-style-type: none"> - Equals 0 when no provision is given within the text; - Equals 0,33 when specific characteristics of the users who may exercise monitoring are defined, and they are solely responsible for the control of conducts and the determination of accountability of the charged member; - Equals 0,66 when specific characteristics of the users who may exercise monitoring are defined and they refer to a collective body (direct, as the general assembly, or representative as the directive council) to determine the accountability of the charged member; - Equals 1 when all members of the entity can exercise monitoring over each other and they refer to a collective body (direct, as the general assembly, or representative as the directive council) to determine the accountability of the charged member.
Sanctions:	Proportionality (graduation) and typology (monetary or not) of sanctions	<ul style="list-style-type: none"> - Equals 0 if no provision about sanctions is contained in the text. - Equals 0,5 when those found guilty of moral and material harm to the entity are sanctioned by expulsion, for determination of a representative body/of the whole body of members in the figure of the general assembly. - Equals 1 when those found guilty of moral and material harm to the entity can be sanctioned in different ways (e.g. including forms of reimbursement) ranging to expulsion for determination of a representative body/of the whole body of members in the figure of the general assembly.

Mechanisms of conflict resolution	There must be easily accessible and accepted institutional systems to settle disputes between users and between those delegated to regulate access and users.	<ul style="list-style-type: none"> - Equals 0 if no provision is contained in the text. - Equals to 0.33 if a plurality of members has mechanisms to contest the actions of the representative bodies (e.g. in the general assembly). - Equals 0,66 if the charter also defines the possibility for sanctioned members to contest the decision (e.g. in front of the general assembly, with may revoke the sanction). - Equals 1 when the charter also defines the possibility for each member to appeal to a mechanisms of conflict solution.
Subsidiarity and acknowledgement of superordinate authorities	Explicit recognition of the right to self-organize	<ul style="list-style-type: none"> - Equals 0 when no recognition of superordinate authorities is contained in the text. - Equals 0,5 when superordinate authorities (e.g. the State) are recognized by reference of the existing legal framework withing the text of the charter. - Equals 1 when, given the recognition of the superordinate legal framework, specific figures and instruments of control and reference towards bodies of the central administration are planned (e.g. legal/financial auditor, transparency and publicity of acts, etc)
Levels of governance	Every activity related to the governance of the common resource (appropriation methods, consumption monitoring, conflict resolution) must be organized across multiple levels, in harmony and never in conflict.	<ul style="list-style-type: none"> - Equals 0 if there is no recognition of levels of governance within the REC. - Equals 0,5 when the governance and, consequently, the property rights are allocated in different intermediate (representative) bodies withing the entity, without the clear definition of mechanisms of democratic control of the members on such bodies (e.g. some charters may attribute the general assembly rights of direction of the activity of the entity, without stating internal transparency of the acts and mechanisms of control, as it may be the possibility for the assembly to demote the members of such bodies). - Equals 1 when the governance and, consequently, the property rights are allocated in different intermediate (representative) bodies withing the

		entity, each of which with mechanisms of control operated by other bodies or by the whole body of members (e.g. by democratic decision of the general assembly).
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5. Further steps

The present work intends to be the preliminary step of development of the leximetric template of analysis, to be later applied on a wider sample of charters, in order to get a clear map of whether or not RECs entail a form of commonification of the energy system.

Furthermore, the lucidity of the development template and some carried out preparatory test, clearly suggest the possibility to implement an AI powered version of the template, for it to be executed by a softer and to be able to scrutinize a much wider sample of charters than the one originally envisaged.

Lastly, given the common legal framework offered by the Directive REDII (and consequent national implementation) on the topic of RECs in the EU, and given the many similarities found in the preliminary phase by the charters of the three states, the authors hypotized that this same template can successfully be applied to examine charters on any European REC. By being able to widen the analysis to this point, the resultant evaluation could manage to offer a much broader map and understanding of the phenomenon across Europe.

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Annex: List of charters used in the preliminary analysis to the creation of the leximetric template

REC	Country	Date of constitution ⁴	Juridical form	Geographical position	Link
Association Blais' watt	France (EU)	2019	Association	Blaisois	https://blaiswatt.fr/ Charter: https://test.blaiswatt.fr/wp-content/uploads/2023/10/Statuts-Association-Blaiswatt-v3-1.pdf
Fabri K Watt	France (EU)	17/03/2021	SCI C ⁵ SAS ⁶ a capit	Isle d'Espagnac	https://fabrikwatt.fr/ charter: https://www.dropbox.com/home/Statuti/France?di=left_nav_browse&preview=FABRI+K+WATT+-+Statuts+constitutifs.pdf

⁴ When present, the following different information will be highlighted as follows:

C – Date of constitution

M – Date of most recent modification of the analysed charter

⁵ Société coopératives d'intérêt collectif

⁶ Société par actions simplifiée

			al variable		
SCIC Mayennes Bois Energie	France (EU)	11/01/2018	SCIC	Parigne sur Braye	https://www.mayenne-bois-energie.fr/
SAS "Oléron Sous le Soleil 17"	France (EU)	03/07/2020	SAS a capital variable	Saint-Georges d'Oléron (constituted by municipalities)	https://www.oleron-sous-le-soleil.com/le-projet
Pôle Energ' éthique des Préalpes d'Azur	France (EU)	30/08/2016	SCIC SAS a capital variable	Saint-Vallier-de-Thiery	https://pep2a.fr/qui-sommes-nous/
COWATT	France (EU)	28/07/2021	SAS a capital variable de l'économie sociale et solidaire	Nantes	https://cowatt.fr/
"Comunità energetica rinnovabile "SIEN"	Italy (EU)		Associazione del terzo settore	Siena	Charter: https://drive.google.com/file/d/1syudTlgcNmzkXpo_8_lbhwhLLOx4DAr6/view Guidelines: https://drive.google.com/file/d/1syudTlgcNmzkXpo_8_lbhwhLLOx4DAr6/view

ENERGIE" E.T.S."			(Iscritta al RUNTS)		
Comunità Energetica Rinnovabile Ventotene (CERV)	Italy (EU)	C-08/10/2021 M-28/04/2023	Associazione	Ventotene	https://www.cerventotene.it/images/statuto/CERV_Statuto_approvato_il_28_aprile_2023.pdf
CER Energy City Hall	Italy (EU)	C-18/12/2020	Associazione non riconosciuta	Magliano Alpi	Deed of incorporation: https://www.comune.maglianoalpi.cn.it/portals/1322/SiscomArchivio/9/ATTOCOSTITUTIVOComunitenergeticaEnergycityhall.pdf
Associazione CER Bonnarò	Italy (EU)	13/07/2023	Associazione	Sardegna, Sassari	Deed of incorporation: https://bussola.s3.eu-west-1.amazonaws.com/1931941/ATTOCOSTITUTIVO-PITZORNO.pdf
CER Energia Nostra	Italy (EU)	13/04/2023	Associazione	Friuli	Statuto https://www.energianostra.it/wp-content/uploads/2023/04/13_04_2023_Statuto-registrato.pdf
Cellios - cooperative solaire	Switzerland (non-EU)	26/04/2020	Cooperative firm	Lusarne	https://www.cellios.ch/wp-content/uploads/2020/10/CELLIOS-statuts.pdf
Associazione Solstice Valais	Switzerland (non-EU)	C-25/01/2022 M-06/09/2023	Non profit association, assisting the development of a	Grimisuat Valais	https://solstice-valais.ch/wp-content/uploads/2023/09/Solstice-Valais-Statuts-09.2023-2.pdf

			solar cooperative		
Coopérative Solaire Neuchâtel	Switzerland (non-EU)	C-20/06/2016 M-27/09/2017	Cooperative firm	French canton of Switzerland, northwest, French border, lake & mountains	https://coopsol.ch/wp-content/uploads/2023/05/Statuts-du-27.9.2017.pdf
Société coopérative Newatts	Switzerland (non-EU)	10/09/2022	Cooperative firm		https://www.newatts.ch/wp-content/uploads/2022/10/newatts_2022.09.10_Statuts_EC.pdf