COllective action Models for Energy Transition and Social Innovation

Collective Action Initiatives. Some theoretical perspectives and a working definition

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Abbreviations and acronyms

CAI:	Collective Action Initiative
DES:	Distretto di Economia Solidale (Solidarity Economy District)
DSO:	Distribution System Operator
ESP:	Energy System Provider
GAS:	Gruppo di Acquisto Solidale (Solidarity Purchasing Group)
GHG:	Greenhouse Gas
IT:	Information Technology
LEC:	Local Energy Community
NECP:	National Energy & Climate Plan
NGO:	Non-Governmental Organisation
PV:	Photovoltaic
RED:	Renewable Energy Directive
RES:	Renewable Energy Source
SME:	Small-Medium Enterprise
TSI:	Transformative Social Innovation
WP:	Work Package

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1 Introduction: collective action, social innovation and COMETS' ambition

Collective action stands as a foundation for social life. Any action of any member of the social body is wrapped in bundles of collective action, which involve agents, and agencies of different nature. Collective action is the foundational element of any mode of existence, bad or good, wrong or right, and the way in which it organizes makes any collective, a singular entity.

Collective action produces collective goods. The potential free-rider problem as collective action configuration presupposes is not important here. The free-rider problem has been extensively considered by utilitarians due to the heavy reliance utilitarianism implies on methodological individualism. Even if there are free-riders, they can be there just because there is a common good, or collective good or even also a public good. We know that free-riding can threat the integrity and functionality of the common good, but as it has been historically demonstrated, any collective good has its own antibodies. Thus, the first consequence of collective action is a collective good, and such a good, as in the case of energy, is not appropriable or eligible to be privatized for individual profit and utility. The production of collective goods also means that people who are engaged in collective action can collectively control and own the collective good, which is managed in a common way and produces welfare (rather than profit) for the collective and beyond.

It is widely recognized that for the energy transition to be effectively pushed, the active engagement of various social actors in designing and implementing renewable sources and technologies play – and should play - a crucial role. This is true both in the designing and implementation, as well as in grasping and satisfying, of social needs and concerns related to energy. But a truly active engagement may be reached by challenging the current energy regime through strategies and processes that might give large companies or technical systems a lesser role. Thus, a claim is made for finding innovative processes to allow people – either formal citizens or not - to actually take part in the decision-making processes collectively and, at the same time, to be able to drive improvement in society, both by satisfying current needs and by creating new opportunities for people to act - to produce social innovation. In this deliverable, we will take a starting point to investigate social innovation processes, conditions and outcomes of the definition provided by Hubert et al. (2010) "as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. In other words, they are innovations that are not only good for society but also enhance society's capacity to act."

But how does collective action connect with social innovation? The collective action that produces new types of goods or commons or is able to restore old commons that had been monopolized, captured by market forces or privatized, is social innovation. New collective goods, new common goods, are social innovation *per se* because they counteract privatization and individualization, and because they promote new community interactions and consider a wider definition of social welfare than traditional approaches, which helps fuel the growth of these initiatives. Here, social innovation,

as in the case of the innovation that follows new energy collective goods, is sculpted by principles of environmental and social justice, inclusion, poverty alleviation and resource sharing as a form of mutual support. All of which generate social welfare. Social innovation, thus, means that a new social configuration is needed to manage the new collective good produced by collective action. Here the act of communing also implies the structure for managing the new commons (governance aspects). In this framework, it is worth to recall here that by 'transition' in the energy system it should be considered not only the transition from a centralized/fossils-based system to a more decentralized/renewables-based system, but also the more complex transformation of a private good (as energy currently is) to a different type of collective/common good, owned and/or managed and/or exploited by wider groups of cooperating people to increase common welfare. This 'commonalization' of energy is a process, implicitly innovative in itself, able to push further innovative adaptation of the socio-economic structure. In a word, a deep grassroots social innovation that, starting from the very local level (micro), can potentially upscale through complex mechanism of interaction (imitation, diffusion, etc.) to an overall transformation of the system at the global, aggregate level (macro).

COMETS thus has the ambition to conceptualize and further solidify the triangulation of collective action, collective goods and social innovation, intended as a way to manage the new commons revived by the action of citizens.

With respect to the high ambition of the project, the ambition and the objectives of the present deliverable are key for the basis of the width of the scientific production throughout the duration of the project. The variety of experiences all around Europe refer to collective perspective and the heterogeneity of COMETS partners. This deliverable is intended as an exploratory exercise aimed at providing a theoretically and methodologically starting point for the following research steps to be taken. That starting point will be a provisional shared definition of CAI (Collective Action Initiative) in the energy system, that is to be updated along the way (on the basis of further research results). The deliverable is organized as follows. In Section 2, the theoretical debate that has been developed for the last century around collective action is taken into account and the most relevant perspectives to look at collective action are explored. In Section 3, focus is provided on the relevance of the collective approach in the field of energy, with specific attention paid to the related social aspects (impact and innovation processes). Here, the main results of a focus group involving the COMETS Consortium are presented jointly with a list of collective experiences in energy intended as an illustration useful to define the boundaries of COMETS object of research. Finally, Section 4 explores the main internal and external conditions that may support/challenge CAI development. This section proposes a first set of dimensions to be accounted for in order to provide a description of CAIs characteristics, development and effects. Finally, Section 5 will summarize the main findings.

2 Collective action: a theoretical perspective

2.1 Collective action, the basis of social life

Collective action is a perennial problem for social and philosophical sciences. For instance, collective action is at the base of Hobbes social contract as a rational way to escape conflicts and wars. Spinoza investigated collective action as a mode of human rationality. In a certain sense, Spinoza built a solution to any collective action problem into his definition of rational human nature. The rational individual is someone who realizes that his or her nature cannot be fulfilled except in society. This awareness inevitably leads individuals to cooperate with others on a rational basis. In a broad sense, collective action is the solution that humans embrace to cope with problems that are individually unsolvable (Rosenthal, 1998).

This leads to the centrality of collective action for the social realm. It is one of the core constituent elements of social life, in other words it may greatly contribute to a social ontology (Schatzki, 2003). We assume that collective action and not individual action is fundamental to social life. It does not imply that we are not aware of the free-rider problem or the problem of individual agency. Instead, this emerges when collective action is scarcely effective or when new social configurations push people to act and to perceive their action individually, thus challenging the different collective bodies that regulate social life. It also contends that collective action can go beyond the line that theorists have traditionally relied on in demarcating the social against the material (Schatzki, 2010). COMETS not only focuses on collective action as one of the basic features or structures of social realm, but also focuses on a peculiar object or site of collective action: production, distribution and use of energy. This implies a couple of challenges: on one side, we try to explain how collective action can manage a material thing such as energy without delegating it to complex, large and often bureaucratic organizations operating in the field of energy. This is a crucial aspect of our investigation: at the end, as we understand it, large bureaucratic organizations are not collective action. Their governance is based on indirect representation, rather than direct participation to day-to-day management. Decision power is distributed on the basis of shareholding/voting rights associated to capital invested or other historical rights for veto (i.e. private property and exclusivity, rather than inclusion and openness). In this sense, collective action entails a radical social innovation in the field of the management of natural resources, such as energy. On the other side, we aim at demonstrating that action (and collective action mainly) is not done under the full control of consciousness. Action should rather be seen as a node, a knot, and a conglomerate of many surprising sets of agencies that have to be slowly disentangled (Latour, 2005). It is a continuous source of uncertainty that has to be explained. In few words, we are trying to investigate what makes all of us do the same thing at the same time, in the same space (even social or physical) for the same goal. Agencies and actors are not the point of departure to explain collective action in the energy transition, but rather what have to be explained[1].

[1] In this document we refer to actors, agents and agency in a very interchangeable way. However, we know that around concept such as 'agency' there was and there still is a very large debate. We do not held a very clear preference about different definitions of agency, but we prefer those that implies the enlarging of the notion to

Among many other issues, collective action poses other intriguing dilemmas of social life that are also in question in COMETS: why, despite of being a constituent element of social life, does collective action appear as a mere sum of individual acts? Additionally, why does it often solidify into institutions, bureaucracy, and organizations, losing its systemic dynamics? A more trivial dilemma regards the question of whether individuals acting collectively get or gain more compared with acting via individual acts. Often, collective action is seen as the mere sum of individual acts or the chaotic bundle of individualized practices, for example in the case of the race toward 'positional goods'. Since not all can have, in the positional sector, what someone can have, this race for goods is accompanied by a distributional struggle that exacerbates the social tensions rather than heightens social integration, thus generating a new beggar-my-neighbour (Hirsch, 1977). In the case of energy, the dilemma to be solved is if people acting together can simultaneously satisfy their own individual energy needs or preferences while contributing to solve a common problem like that of global heating or the environmental crises. Often, these cases of collective action dilemma are not win-win situations, thus people must choose what course of action they pick: if in favour of an anonymous collective or in favour of themselves.

In many cases, people act collectively also because they are disappointed by the behaviour of their energy provider and decide to take a new path, leaving it and taking their faith in their own hands. This latter, showed by Albert Hirschman (1970), is a pure case of exit in which people as customers or voters, instead of voicing or remaining loyal to their provider, party, or company, decide to experience new practices and strategies of goods provision for better common welfare. In short, by collective action, we might mean the choice by all or most individuals of the course of action that, when chosen by all or most individuals, leads to the collectively best (expected) outcome. This course of action can be also referred to as cooperative behaviour (Elster, 1985).

2.2 The power of collective action

Not all the scholars who investigate the energy transition acknowledge the potentiality of collective action to challenge the current energy system. Some see collective action only as a more efficient and perhaps rational way to manage energy but do not fully recognise its power. The collective is energy. If we focus on the historical conjuncture at the turn of the twentieth century, we can notice how

collective action. Agency has been usually defined as the capacity of a single agent – namely an individual – to act and choose courses of action in line with his/her will. A very early definition (Emirbayer and Mische, 1998) states that agency is a "temporally embedded process of social engagement, informed by the past (in its 'iterational' or habitual aspect) but also oriented toward the future (as a 'projective' capacity to imagine alternative possibilities) and toward the present (as a 'practical-evaluative' capacity to contextualize past habits and future projects within the contingencies of the moment)". However, our interest is devoted to the collective agency, whereas an autonomous capacity to act and change the world is proper of a collective of individuals that act univocally. Collective agency is supposed to be formed by a number of other agents that enact in such a way that a collective emerges as a living singularity. The enactive theory of agency (Froese and Di Paolo, 2011) explores the concept of collective agency with the ideas of multi-agent systems and multi-system agents and argues that a genuine collective agency would instantiate agency at both the collective level and at the level of its component parts. Moreover, a genuine collective action is able to generate its own internal or endogenous normativity. Our perspective enlarges this vision anchored on biological paradigms such as autopoiesis, by integrating the genuine collective action with other dimensions explained in the document.

theorists in the humanities and social sciences were engaging with energetics and thermodynamic theory in their work. Following the radical developments of nineteenth-century physics, philosophers, sociologists, and literary authors reconceived 'non-material' phenomena (mind, society, culture) as part of the natural world through related concepts of energy, force, vibration, and rhythm. An energetic materialism emerged in which scholars reimagined matter as energy and contended with the dynamic relationships this ontology implied. While dynamic and developmental accounts of nature are often associated with evolutionary theory in the nineteenth century, we can say that the science of energy contributed equally to a metaphysics of transformation. The Henri Bergson's theory of mind and matter, Emile Durkheim's theory of the social, Henry Adams's theory of history can be seen as important developments in twentieth-century thought aimed to revise the notions of matter and interaction by elaborating them in a new discourse of energetic materialism (Badia, 2014). Energy communities are also energetic communities in the sense that the collective action from which they rise is social power by definition, even if it is exerted through the control of devices and apparatuses aimed to capture and convert energy, a control that has consequences for the collective action itself. The perspective pursued here aims to emphasise the power of people instead of the power from technical devices.

We can underline the fact that collective action in its different configurations can affect the development of countries, influencing their fate of growth or decline, as suggested by Mancur Olson (1982). Of course, collective action has not a predefined direction: it can support or help different groups often conflicting each other. In other words, collective action is the strategy to affirm interests of one social side against another one. From another point of view, collective action is that strategy that favours individualistic behaviour represented by the free rider metaphor. If, as suggested by Olson, individuals will only choose to join a group if the private benefits offered exceed the costs of their personal commitment (Olson, 1965), thus the free-rider strategy remains more plausible for people. Each neighbour would like to enjoy the undoubted utility/income that arises from draining without himself having to shoulder his shovel and drain. What one can do, however, all cannot; for it is the central tenet of the economics of shirking that, as Arthur Stinchcombe (1980) explains, "each one is better off if he or she gets a salary without working, but all are worse off in a society of slackers". The optimal scenario for the would-be slacker involves a society in which all citizens are co-operators; the worst scenario involves a society in which all operate egoistically (Riesman, 1990). Three possible devices that people use to solve the prisoner's dilemma are the following: those who choose non-cooperative strategies get a bad reputation and so learn to be cooperative; those who are taught by parents that non-co-operators have unhappy lives; or that an official can be paid a salary to make the cooperative choice (Stinchcombe, 1980). These devices result in people often solving prisoners' dilemma games without being conscious of them. The structures that have the function of solving social dilemmas are created and maintain themselves as socio-material devices made of organizational, consciousness, and technical aspects.

Olson developed an ambitious attempt to synthesise the topics of growth and development, efficiency and flexibility, free trade and involuntary unemployment, and to correlate them with the size and power of the special-interest groups, which comprise the corporate society. Olson's central

conclusion is stated in terms of group size: large groups will fail; small groups may succeed (Reisman, 1990). Olson causal explanation of the rise and decline of nations in the light of collective action is too huge and often misleading to be used here, but it can be useful in some way. Let us consider for instance the altruistic attitudes about observable outcomes or results and suppose an individual would be willing to sacrifice some leisure or other personal consumption to obtain some amount of a collective good because of an altruistic concern that others should have this collective good. This individual's preference ordering takes account of the collective good obtained by others as well as of personal consumption. This assumption of altruism does not imply irrationality, or a tendency to make choices that are inconsistent with the maximal satisfaction of the values or preferences the individual has. On the contrary, as in the case of energy communities and other CAIs we are going to investigate, this is a rational choice aimed to bring well-being to everybody while reducing GHGs emissions. Ostrom holds many structural variables postulated by Olson for having collective action, but she develops also a critique of them (Ostrom, 2010). Focusing on structural variables that make collective action possible, she includes: the number of participants involved; whether benefits are subtractive or fully shared (i.e., public goods vs common-pool resources); the heterogeneity of participants. How size might affect the likelihood of cooperation depends on how other structural variables are affected by the size of a group (see Ostrom, 2001). In the case of subtractiveness of goods, she criticizes Olson because for her the common-pool resources are subtractable in nature. She also includes the problems of overharvesting and crowding, present for example among important types of collective pool resources including forests, water systems, and pastures. Differently from the pure model of collective pool resource, energy is a natural good mediated by socio-technical regime. Consequently, it can be seen as a hybrid that shares both the feature of public and collective goods and of the common-pool resources. By definition, public goods and common pool resources are both non-excludable. The main difference is their rivalry property: public goods can be consumed without reducing availability for others, while consuming common-pool resources will decrease the available resources for others. From the point of view of heterogeneity, Olson (1965) argued that if there were one or a few individuals who had much stronger interests in achieving a public good, the probability of a group achieving a public good increased even though the good was still likely to be underprovided. Others have speculated that heterogeneity in assets, information, and payoffs are negatively related to cooperation due principally to increased transaction costs, as well as the conflict that would exist over the distribution of benefits and costs. For Ostrom there are many arguments that point to heterogeneity as a serious deterrent to cooperation (Ostrom, 2010).

Collective action can present different aspects that can threat its feasibility, but at the same time, it is restorative of the supportive society. Whereas market and money relations take the place of more organic social bonds, collective action helps to cope with two social facts underlined by Fred Hirsch (1977) and that are of primary significance for COMETS. Firstly, social frustration. Once economic growth brings mass consumption to the point where it causes problems of congestion, pollution, and scarcity – or, said bluntly, where consumption or jobholding by others tends to crowd one out — then the key to personal well-being is again the ability to stay ahead of the crowd. Generalized growth

then increases the crush. Thus, the frustration in affluence results from its very success in satisfying previously dominant material needs. Hence, the paradox of affluence. It embodies a distributional compulsion, which in turn leads to individualism. Strictly speaking, the individual benefit from the isolated action is clear-cut, but the sum of benefits of all the actions taken together is nonetheless zero. The only way of avoiding the competition in frustration is for concerned people to coordinate their objectives in some explicit way, departing from the principle of isolated individual striving in this sphere. That is to say, that only a collective approach to the problem can offer individuals the guidance necessary to achieve a solution they themselves would prefer. Secondly, waste. In a world of scarce positional goods, resources must be wasted on defensive consumption, as in the case of sprawling suburbs - where the desire of more and more people to live in the suburbs leads to reduced access to air and open space for the inhabitants of present suburbs, and consequently to an increasing wastage of time and energy in an attempt to reach a destination ever more distant from the downtown cultural and occupational opportunities. These are cases of waste, which means either more input for the same output, or even more input for an inferior output. In the case of energy, it is particularly true whereas the perpetuation of consumption as individual behaviour will never cope with the fossils' shortage or the renewables' intermittence.

The arguments of Olson, Hirsch, and Ostrom introduce the question of collective goods that emerge from collective action. Energy, as managed by collective action, emerges as a collective good, whose permanence requires strong conditions, as we are going to show in the next section of this report. A simplified but useful definition of a collective good, as distinguished from an individual good, is that its 'consumption' by one individual does not reduce the possibility for other individuals to 'consume' it. Another useful distinction is between public goods and commons/common goods – the shared resources which people manage by negotiating their own rules through social or customary traditions, norms and practices. The case of renewable energy fits well with both collective good and common good definitions.

2.3 Theoretical models for investigating collective action

Collective action is resurfacing as a fundamental topic of social science investigation to explain social phenomena, such as social change or renovated forms of movements' mobilization (see for example Willer, 2009). Literature usually presents many theoretical models to explain collective action. Russell Hardin, for example, looks to find out why people choose to act together in situations that the models find quite hopeless (Hardin, 1982). He uses three constructs of modern political economy - public goods, the Prisoner's Dilemma, and game theory - to test public choice theories against real world examples of collective action. Others, for instance, starting from an institutional public choice analysis of public participation in terms of the collective action problem, emphasise the roots of participatory activities in the incentive structures facing potential participants. Other ones then go on to consider the strategies that may be adopted for encouraging greater public involvement distinguishing three different modes of environmental planning, in terms of the rationale for participation, the severity of the collective action problem and the associated participatory strategy that can be adopted (Rydin and Pennington, 2000).

Among contemporary approaches, *Resource Mobilization* theory sees the emergence and development of movements as arising from the availability and use of resources, such as skill, money, labour, and so on (McCarthy and Zald, 1977; McCarthy and Zald, 2001; for a critique see Jasper, 2004). It looks primarily at how networks of people, professionals, leadership, permanent organizations, incentives, and cost–benefit calculations come together to generate direct, measurable impacts on political and social issues. It argues that the success of social movements or collectives depends on resources (time, money, skills, etc.) and the ability to use them, and thus mainly focuses on sociological variables. This approach takes into account influences from outside, such as support from various organizations or the government. Resource mobilization theory extends its analysis of collective participation and mobilization to expectancy-value theory. It is assumed that the willingness to participate in a social movement is a function of the perceived costs and benefits of participation. Expectations about the behavior of others are seen as an important expansion of the expectancy-value theory and make this framework applicable to movement participation. (Klandermans, 1984).

Political Opportunity Structure theory studies the impact of structure on collective action, and vice versa. It highlights the role of the political system, the larger social environment and culture, in the emergence, dynamics and outcomes of social movements. It argues that social movements must be studied within their particular, societal, political and cultural contexts, and it is able to show how 'open' or 'closed' political systems affect the nature and tactics of collective actors, how they create new possibilities, or provoke or radicalize forms of collective action. Tarrow (1996: 54) defines the concept as the "political opportunity structure, I refer to consistent - but not necessarily formal, permanent, or national - signals to social or political actors which either encourage or discourage them to use their internal resources to form social movements". This is also a perspective that will be accounted in this document.

Frame Theory studies the role of the shared assumptions and meanings held by actors in interpreting events and redressing problems. It seeks to explain collective action in terms of the motives, beliefs and discourses manifested by actors. It focuses on how frames are produced and utilized during different phases of a movement, and on how ideas, sentiments and culture affect the repertoires of action and contention. It points to the functions of ideology, its ambivalence and implications for supporters, counter movements and authorities. It argues the pertinent role of language, leadership, social movement organizations and the media in framing processes.

However, collective action requires a longer outlook to understand its roots in social thought. Charles Tilly, who combines the first two approaches presented above, discusses four types of collective action coming from different sociological traditions: Marxian, Durkheimian (structuralist), Millian (utilitarian) and Weberian (Tilly, 1978).

The classic Marxist analysis derives shared interests from the common position in the organization of production and consumption system, changes in interest from shifts in the organization of this system. Any set of people in a common relationship to the means of production and consumption form a class, but classes vary greatly in internal structure and common consciousness. Shared aims

and beliefs emerge from shared interests, as mediated by the internal structure and its relationship to other classes. This perspective thus suggests that collective action results from shared interests as mediated by changing classes internal structure and the relationship to other ones. This profound change in class structure can be easily seen whereas we think at the global consequences of different crises that marked recent decades. Ecological crisis is undoubtedly generating new forms of class consciousness at the global level.

The basic Durkheimian idea presents a society stressed by a continuous struggle between forces of disintegration (notably, rapid differentiation) and forces of integration (notably, new or renewed commitment to shared beliefs), between innovation and tradition. From the basic notion, Durkheim derives models of three different kinds of collective action: let us call them routine, anomic, and restorative. Routine collective action goes on in the area of the conventional or normal processes of social reproduction, devoted to routinely renewing shared beliefs. Anomic collective action increases as the society slides down from the routine whereas dynamics of social differentiation, complexification, and reaction occur. Anomic collective action can be seen as both positive and negative processes of innovation and change, both in any case shaking shared beliefs and structures. Restorative collective action occurs whereas processes of normalization move the society back into the conventional mode of existence or ways of living. This prospect has been very familiar during the past years when social sciences were rather focused on functional and structural dynamics of social systems. A prominent even unconscious supporter of this vision was Fred Hirsch, which underlines how the so-called moral nexus is under threat when society becomes more and more affluent. The decline in friendliness and increase in selfishness is properly the consequence of the increasing affluence, the marketization of social reciprocity, and the expansion of monetary exchange for collective reproduction.

John Stuart Mill and the utilitarians represent the treatment of collective action as a strictly calculating pursuit of individual interest. The argument of the logic of collective action is here based on the strong assumption that individual actions are motivated by self-interest, or on the assumption of what we can call narrow rationality. This perspective underlies the individual acquiescing in a set of binding political arrangements (the government, the rules of the game, or some system of cooperation) at the expense of some personal short-run interests, in order to ensure the pursuit of those interests in the long run. The clearest contemporary expressions of this view appear in the models of collective choice: the determinants of alternative outcomes in situations in which two or more parties make choices affecting the outcomes. In a sense, all of microeconomics deals with collective choice. Microeconomic models have been the best developed and most popular in the field.

In Max Weber's treatment, groups commit themselves to collective definitions of the world and of themselves. The definitions incorporate goals, entail standards of behaviour, and include justifications for the power of authorities. Collectives sometimes act on the basis of their traditional roles, sometimes on the basis of their rational/legal designation as agents for the group and sometimes on the basis of the charisma of their leader(s). The bases the group adopts strongly affects its organization and its fate. In Weber's account, the structure and action of the group as a whole

spring largely from the initial commitment to a particular kind of belief system. Beliefs have their own logic and force. Weber offered his fullest account of the origins of the fundamental beliefs in his discussions of religion and of charisma. According to Weber, whereas many people, for whatever reason, find that the new definitions of the world provide more coherent answers to the problem of meaning they face than do the old definitions already available to them, they join and the group expands. Then the group as a whole faces the problem of the 'routinization of charisma'.

The theories at hand clearly lead in different directions. Several are rather oriented towards a collective ontology; others are oriented towards an individual ontology. In many areas they are too incomplete to permit decisive testing against the facts. Where they are well-specified, it often turns out that they are talking about different things: theories of collective choice apply to situations in which the alternatives are limited and well-defined, theories of collective behavior refer to what happens when the standard choices are suspended. These aspects are relevant for COMETS, because the increasing interest in new social forms of energy organization discloses the limits of the current energy global system itself. The strategies to cope with it can be very different, for example focusing on choice is different from focusing on action.

Thus, we can get different approaches for our task and they can also be merged together. Theories in the tradition of Mill deal mainly with exchange systems (those in which the thrust for people to act collectively is the desirable return that someone else will give them). Durkheimian theories deal mainly with integration systems (those in which the collective action is built upon a sense of common fate or identity). Weber's line emphasizes threat systems (those in which the emerging collective action is a response to a future threat, such as global warming). Marx's line of explanation underlines the collective nature of social life and the unavoidable growth of alternative modes of production–consumption as the material condition for any social change challenging the status quo.

2.4 Boundaries of collective action

Drawing the boundaries of collective action is probably one of the most complicated endeavour scholars have to face. Indeed, we are never alone in carrying out a course of action. Action is always collective, engendering varying sets of agents. Thus, tracing boundaries between actions that are collective and those that are not, is an indebted operation. However, we have to disentangle the different agencies constituting what is often put under the semantic umbrella of 'collective action' by grasping different phenomena and behaviours. For example, the behaviour of an institution, of a corporate actor, such as an enterprise, or the behaviour of a group of individuals that collectively take decisions.

Trying to avoid this confusion, someone refers to the decision makers not as 'collective' agents but as 'individual' agents. For Elster, for instance, even when in fact they are corporate actors, they are individual in the sense of having one decision to make. The firm sets one price for its product and not as many prices as the number of people employed in it (Elster, 1985). Others, such as James Coleman, contend this vision. For Coleman, social theory has too often taken the easy path of creating, conceptually, exactly the kind of creature at the micro level that, by simple aggregation, will produce

the observed systemic behaviour—whether that systemic behaviour is the orderly and mundane functioning of a bureaucracy or the spontaneous and emotional outbursts of a crowd (Coleman, 1994). Since the systemic behaviour being studied seems to exhibit certain properties, the simplest social theory to account for that behaviour is the one that generates the system as merely an aggregate of persons having the same properties.

The distinction here is between agents that behave individually and whose aggregate is *per se* a collective action and those that by acting together manifest a so called systemic emergent property of collective action. For what refers to COMETS, our interest is more on the dynamic of the sometime disordered and tumultuous collective action that leads toward sudden and unpredictable changes and innovation than on an institutional and bureaucratic embodiment of these actions. In other words, this distinction can be useful for our purpose in that we can bound our collective agents as those grassroots movements or communities or cooperatives that take decisions all together, privileging an horizontal and bottom-up procedure of decision making rather than a top-down model as in the case of corporate actors. For example, Welch and Yates (2018) underline three ideal types of collective critical for sustainable transitions: one is the bureaucratic organisation, very familiar to standard models of change; the others are groupings and latent networks that are largely overlooked. For Welch and Yates, bureaucratic organisations are the socially legitimated institutional form of collective that most closely resembles the model of the 'agentic actor' (Meyer and Jepperson, 2000), meaning that their contribution towards change is familiar and usually overplayed. Bureaucratic organisations develop relatively explicit agendas or goals, strategies through which they will be pursued, and they integrate around these strategies through complex internal divisions of labour. For the authors, classical models of collective action are inadequate to account for the transition to sustainability, even though they recognize that 'collectives' are the major agents of this transition. In our view, institutionalised bodies can be seen as agents of energy transition, but they have to be distinguished from other very different agentic collectives.

2.5 Forms and bodies of collective action

Communities, cooperatives, collectives, groups, but also clans, tribes, villages, neighbourhoods, all show forms of collective action. Community is, however, the more used word to allude to new forms of self-organization in the energy field. Community has been and still is an enduring preoccupation in social sciences. Community – which we can provisionally define as a social collective bound by a common identity, values, and norms – was already implicated into the early analysis of social change, modernization, urbanization, industrialization and so on (e.g. in the works of Tönnies, Durkheim, Weber, Park, Wirth, Boas). Since then, community has been the common core underlying concepts such as identity, cooperation, organization, networks, culture, social capital, urbanity, care, health, neighbourhoods. Recently, we can notice a reoccurrence of the term indicating many phenomena often very different among them and even contrasting. As noted by Zygmunt Bauman (2001 and 2017) words have meanings: some words, however, also have a 'feel'. The word 'community' is one of them. It feels good: whatever the word 'community' may mean, it is good "to have a community", "to be in a community. In a community, Bauman goes on, we all understand each other well, we may

trust what we hear, we are safe most of the time and hardly ever puzzled or taken aback. We are never strangers to each other. We may quarrel - but these are friendly quarrels, it is just that we are all trying to make our togetherness even better and more enjoyable than it has been so far. While guided by the same wish to improve our life together, we may disagree how to do it best. In short, there is a lot of rhetoric around this word, and this has to make us alert in using too easily and without accuracy the term itself.

There have been many attempts to define the concept of community. These have taken two distinct directions: the 'organic' conception and the 'ecological' conception. Scholars such as Ferdinand Tönnies and Max Weber delivered this organic conception, placing emphasis primarily on belongingness, close personal contacts and identity of interests as the chief characters of community. Scholars such as Robert Park, Robert MacIver, Emory Bogardus, and Louis Wirth shared an ecological, spatial, and geographical conception of community. For them, community is a collective whose members share a common territorial base for daily activities. Soon, however, these two conceptions conflated, thus making that the term 'community' came to indicate meanings that are more complex. Thus, 'community' is employed to describe a fixed locality (a given geographic area) as a basis of social organisation. From this point of view, a traditional rural village is a community where people are born, live and die. Community is used to refer to a local social system or set of relationships that centre upon a given locality. From a sociological point of view, it is the concentration of relationships, rather than the geographical factor that matters. The term 'community' is also used to describe a quality of relationship which produces a strong sense of shared identity. This usage does not give any importance to the spatial or geographical aspect of the community. It does not depend on physical whereabouts or even on people having met each other. Applied to energy communities, these distinctions seem still valid. For instance (see Bauwens, 2017), it is common to speak of 'community of interest' in a Weberian and utilitarian way, or of 'community of place' whereas the reference is clearly to an ecological and spatial vision provided years ago by Robert Park and Ernest Burgess (1921).

2.6 The components of collective action

The most persistent problem in analysing collective action is its lack of sharp edges: people vary from continuous intensive involvement to passive compliance, and interests vary from quite individualistic to nearly universal. To investigate collective action we embrace a mobilization model that we believe it is the most appropriated to understand dynamics of collective action that are not related to social uprisings, riots, revolutions and so on, but to more 'inconspicuous' attempts to escape the incumbent hegemony of energy providers while simultaneously coping with global environmental risks such as climate change. Four important components or variable characteristics of contenders in the energy market are interest, organization, mobilization, opportunity, and collective action itself.

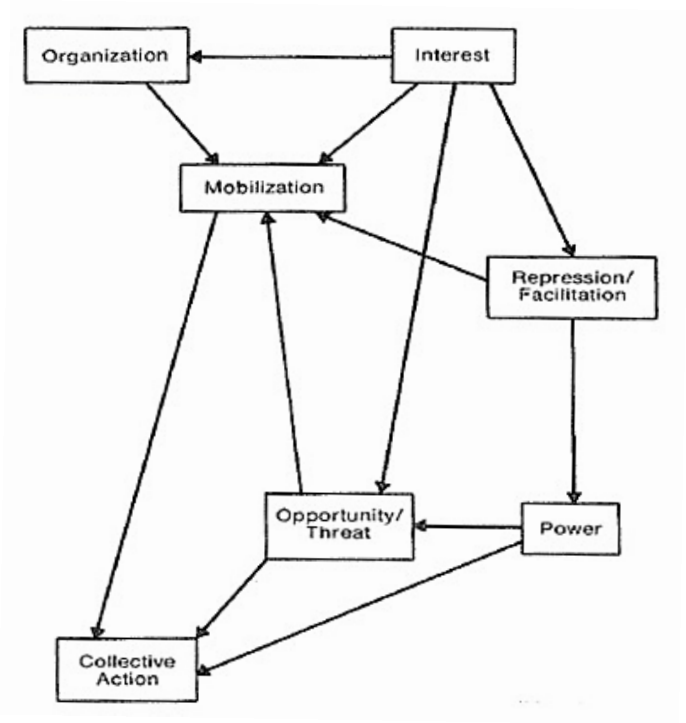

Figure 1 - The mobilization model (source: Tilly, 1978)

2.6.1 Interests

Interests are the gains and losses resulting from a group's interaction with other groups. We will deal with what constitutes a relevant group, and how to identify or measure real and durable interests. The shared advantages or disadvantages of a collective likely accrue because of various possible interactions with other collectives. Most analyses of collective action mobilization take the groups involved, as well as their interests, for granted. Once we notice who is acting, it rarely seems difficult to explain why they, and not other collectives, are acting. Nonetheless, many groups fail to mobilize, some mobilized groups fail to act collectively, some collective actors fail to reach their goals, and many actors come and go. A valid theory of collective action must explain the comings and goings. Part of the explanation surely resides in the fact that individuals have varying interests in collective action. Theories in the tradition of utilitarianism give us little guidance in the identification of a group's interest. Yet they suggest that the nature of the collective's central decision-making structures - its market, its system of access - strongly affects which people have an interest in acting together. Durkheimian theories tell us to watch the creation and destruction of collectives through the changing social differentiations and related classes and roles dynamics. They tell us to expect greater action (or at least a different kind of action) from the collectives being most completely and rapidly transformed, for example nucleus of middle class that fell to be victims of injustice or of a process of downward. In this perspective, individual and collective interests generally conflict in the short run. Moreover, individual reactions and impulses – for instance the disappointment they experience as consumers or as citizens – can easily transform into more rational interests, this depending on the capacity of society to channel their resentments. Weberian theories also draw our attention to social changes, providing an anticipation about activity of groups, which have attached

themselves to new systems of belief. Shared belief itself leads to a definition of interest, and stimulates action oriented to that interest.

The interest, as a lens to forecast collective action presents other dilemmas. The first is about the relationship between interest and organization. A major effort in literature concerned the proper way to identify the interest of a collective. To try to solve it, there are two alternative strategies: 1) infer the interest from the collective' s own statements and actions; 2) infer it from a general analysis of the connections between interest and social position. Utilitarian theorists tend to do some version of the first: they try to ground their analyses on utilities or preferences revealed directly or indirectly by the actors. Social structuralists often do some version of the second: they determine a group's interest by analysing its relationship to the socio-economic structure.

The first choice - inferring the interest from the collective' claims and actions - is open to serious objections. Many groups appear to be unaware of their own real reasons to act together. Either they have not articulated their shared interests, or they have done it falsely. At the same time, the appropriate evidence is very hard to identify and assemble. People often say conflicting things or nothing at all. But the second one - inferring interests from a general analysis of the connections between interests and social position – also has serious drawbacks. It aims to override a group's own vision of its interests. General interest schemes commonly reveal a conflict between short-run and long-run interests that can leads to ambivalent and often unsuccessful strategies. In short, which is the 'real' interest? Answering this question could result crucial if we assume that people behave as they do because the goals they fashioned for themselves appear to influence their behavior even when those goals are trivial, vague, unrealistic or self-defeating. To respond to the dilemma we can treat the regime of production, distribution and consumption of common goods (such as energy) as predictors of the interests people will pursue in the long or in the short run.

The second, and perhaps more important dilemma, concerns the potential conflict between individuals and group interests. Often conflicts lead to fractures inside the collective and these fractures among members may be the cause of the vanishing of collective action. Conflicts can cross all the range of interests that enter the collective action process. The way in which these tensions can be hold under control depends on the organization.

We can go beyond the concept of 'interest' by embracing the term 'motivation', which sounds less utilitarian. There are always forces mobilizing, driving, and energizing individuals to act, interact, and organize, but there is not a consensus about the nature of these forces, or teleological structures. However, we suggest that collective action applied to the energy field is mobilized by expectations regarding collective and self-interest that some time can be harmonized, some other time can enter in conflict. For instance, individual utility (e.g. money), needs satisfaction, deprivation avoidance, and personal security can struggle with the including, cooperating and trusting others, social esteem and approval, the use of deliberative capacities for the definition of lines of conduct, collective and commons property or use, opportunity to distribute energy surplus to vulnerable people. This long list of plausible motivations to act together pertains to two different ontological schemes, one individual and the other one collective. However, acknowledging the cruciality of this dilemma for

collective action, the potential conflicts temper because people are always inserted in different systems of action that mainly takes a daily-life configuration and it is impossible for people to go out of these systems of practices and thus to avoid the conciliation with the others. The constraint exercised by these systems of practices is undoubtable, but there is often the possibility to change if people acknowledge collective action as a powerful leverage of innovation.

2.6.2 Organisation

The organization is that aspect of a group's structure which most directly affects its capacity to act on its interests. Clearly, one of the problems is to determine which features of organization do make a difference. Is it possible, for example, that how much are members committed makes little difference to the form and intensity of their collective action? Is it possible that the neatness of an organization's division of labor matters greatly? Organization corresponds to the extent of common action and unifying structure among the individuals in the population. Organization is not static; it is but a process, an increase in common action and/or unifying structure (disorganization happens when there is a decline in common action and/or unifying structure).

We find two main elements in the organizational analysis. 1) Categories of people who share some characteristics (e.g. there are all females, all residents of the neighbourhood). A full-fledged category contains people all of whom recognize their common characteristic, and whom everyone else recognizes as having that characteristic. 2) There are also networks of people who are linked to each other, directly or indirectly, by a specific kind of interpersonal bond: a chain of people each of whom owes someone else. If the common characteristic of the interpersonal bond is ordinary, then the categories and networks defined by them tend to be large.

However, networks have in their disclosing only a descriptive function. Networks only indicate the extent of people included in the collective action, maybe their closeness, but not their deep motivation for doing that or, again, the reason of their mobilization and the way in which a variety of actors are enrolled in the action itself. Most often in social sciences, ‘social’ designates a type of link taken as a specific domain. However, in the perspective we are here suggesting, our look moves toward a complex of social, material, economical, and moral principles and connections that go far beyond the investigation of social networks.

Our notion of organization stresses the group inclusiveness: how does it come to absorb members' whole lives. For ‘inclusiveness’ we can choose among three related indicators: the amount of time spent in collective action, the amount of energy devoted to collective action, the proportion of all social interactions in which the members and other people are taking into account the fact of group membership. Other features of a group's structure one might want to consider in judging how ‘organized’ it is are its efficiency and its effectiveness - or the structural features presumably affecting efficiency and effectiveness, such as differentiation, centrality and stratification. We stress inclusiveness on two grounds: (1) the hypothesis that it is the main aspect of group structure affecting the ability to mobilize; (2) the intrinsic difficulty of separating effectiveness and efficiency from the mobilization and collective action. By the standard of inclusiveness, an isolated community

will tend to be highly organized, but so will some occupational groups, some religious groups, and some political groups.

We need these indicators in order to highlight about the individuals and groups that could, in principle, mobilize. We also need them to specify what it means to say that organization promotes mobilization. The number of potential mobilizers is enormous as well as the number of 'challenging groups'. Instead of attempting to prepare an unbiased list of all potential mobilizers, we can take one or two dimensions of differentiation which are of theoretical interest, search for evidence of group formation, and then of mobilization, at different locations along the dimension, letting the differentials test more general assertions concerning the determinants of organization and mobilization. In analyses of energy alternatives to the market, we can take the entire population of CAIs, divide it into categories and types of energy production, then document variation in the organization (cooperatives, purchasing groups, municipal-driven communities, and so on), type and intensity of cooperation, and propensity to challenge incumbents. Different ways of dividing the population of CAIs will produce different results, helping us to decide which differentials are durable and general. However, to explain group differentials as determinants and core variables of collective action, we have to take into account all our components: interests, organization, mobilization, and opportunity. Interests and organization alone are not enough to explain the course of collective action. The reasoning about isolated masses and toughness gives a particular but inadequate account of the organizational structure and individuals' interests characteristic of different countries and regions. But it says nothing about differentials in mobilization or opportunity to cooperate. Mobilization and opportunities improve the picture of the collective action.

2.6.3 Mobilisation and resources' control

Mobilization is the process by which a group acquires collective control over the resources needed for action. Resources may be labour power, goods, weapons, votes and many other things, insofar as they are usable in acting on shared interests. Sometimes a group such as a community has a complex internal structure, but few pooled resources. Sometimes it is high in resources, but the resources are all under the control of individuals. The analysis of mobilization deals with the ways in which groups acquire resources and make them available for collective action. Mobilization regards the extent of resources that go under the collective control of the contender as a process, an increase in the resources or in the degree of collective control (we can call a decline in either one demobilization) can get important consequences for the outcomes of collective action itself.

Amitai Etzioni (1968: 388-389) defines mobilization as "the process by which a unit gains significantly in the control of assets it previously did not control... A mere increase in the assets of members, of subunits, or even of the unit itself does not mean that mobilization has occurred, though it increases the mobilization potential. The change in the capacity to control and to use assets is what is significant". Etzioni offers a rough classification of assets, or resources: technical (e.g., energy plants, local grid); utilitarian (e.g., energy services, money); normative (e.g., loyalties, obligations, trust). A group mobilizes if it gains greater collective control over technical, utilitarian, and normative resources, demobilizes if it loses that sort of control. Etzioni's classification of resources, that we bent

over our scope, is helpful and interesting. In our case, we focus on a set of resources that vary from factor of production nominally under collective control to an outcome that can be thought as a collective good, the energy itself used in different places by different members.

Loyalty refers to the breadth of members' commitments to deliver resources. It has three dimensions:

- the amount of resources committed;
- the range of resources involved;
- the range of circumstances in which the resources will be delivered.

Albert Hirschman (1970) considers loyalty as one of the major alternative modes of demand for an organization's services. In the context of response to decline in the performance of organizations, he distinguished three possible reactions of consumers, clients, or members of a given organization: exit, voice, and loyalty. Economics, Hirschman comments, treats exit - a cessation of demand for the commodity or service - as the normal response to declining quality. In the ease of schools, governments, and other organizations whose performances fluctuate, he argues, two other responses are common. The relevant public may voice its dissatisfaction, with implicit or explicit threats of exit. Or it may tolerate unsatisfactory performance for a while because the costs of exit or voice are greater than the loss of quality. That tolerance is a measure of subjective returns from the organization, hence of loyalty. Here loyalty can be turned from the former organization that provides energy to the new one that substitutes it. The changing direction of loyalty, the withdrawal of the loyalty from one organization to another one less bureaucratic, centralized, and authoritative, is the challenge of the emerging collective actions in the energy field. Here trust plays a role providing the basis for loyalty: loyal people are those that trust the collective to which they belong.

The major variables affecting the probability of delivery are therefore: the extent of competing claims on the resources involved; the nature of the action to which the resources are to be committed; and how organized the mobilizing group is. If the resources are free of competing claims, if the action clearly defends the interests of every member, and if the group is an all-embracing moral community, then the probability of delivery is close to 100 percent. Loyalty then is at its maximum and the probability of departure or contestation - exit or voice - is at its minimum. Indeed, a significant part of the work of mobilization goes into changing these three variables: reducing the competing claims on resources controlled by members; developing a program which corresponds to the perceived interests of members; building up a group structure which minimizes exit and voice.

Mobilization is also the outcome of some unusual situations. Usually people, individuals and groups that initiate a process of change, merely act in the way on which elements of a system of practice link together. Practices are in this perspective bundles of different elements that change: these bundles put together goals or teleological systems, knowledge, rules, physical environments populated of artefacts and natural resources, discourses on all that.

Collective action dynamics show often a changing mix of the priorities assigned to exit, voice, and loyalty. The professionals concentrate on accumulating resources free of competing claims, the

rationalists on adapting their program to current group interests, the moralists on building an inclusive group.

Thus, any group's mobilization program breaks down into these components:

1. Accumulating resources;
2. Increasing collective claims on the resources:
    a) by reducing competing claims;
    b) by altering the program of collective action;
    c) by changing the satisfaction due to participation in the group as such.

Collectives do their mobilizing in a number of different ways. We can make crude distinctions among defensive, alternative, and preparatory mobilization (Tilly, 1978). In defensive mobilization, a threat from outside induces the members of a group to pool their resources to avoid bad consequences for its members. This is case of people that cooperate to avoid not genuine food, increasing prices, the superpower of corporate actors. Alternative mobilization is often top-down. In this case a group pools resources in response to opportunities to realize its interests in a way which is alternative to the existing ones. A common form of offensive mobilization consists of the diffusion of a new alternative organizational strategy. Preparatory mobilization is with no doubt the most top-down of all. In this perspective, the group pools resources in anticipation of future opportunities and threats. The early experiences of cooperatives go in this direction. They built up a store of money to cushion hardship – future unemployment, the loss of wages, and the shortage of some fundamental good such as energy. It also puts together knowledge and organizational skills, for example in the case of energy cooperatives, which take care of all aspect of energy cycle. In a general view, cooperatives can greatly increase the capacity of their members to act together: to make collective demands, to find solution to commons problems, to develop alternatives for the future. Often alternative and preparatory strategies are indistinguishable. The basic distinction is between defensive and alternative mobilization that implies also different future horizons, one conservative the other alternative. In few words, common sense says that the riches mobilize conservatively, in defence of their threatened interests while the poor mobilize radically, in search of what they lack. However, the riches are constantly mobilizing to take advantage of new opportunities to maximize their interests. The poor can rarely afford to.

Lastly, for implementing (and investigating) mobilization and (widely speaking) innovative social processes, may play a crucial role the profile of the actors that initiate a process of change or innovation. Particularly relevant seen to be those that can be recognized as ‘catalytic innovators’ (Moulaert et al., 2017) since they are defined by five distinct qualities. First, they create social change through scaling and replication. Second, they meet a need that is either over served (that is, the existing solution is more complex than necessary for many people) or not served at all. Third, the products and services they offer are simpler and cheaper than alternatives, but recipients view them as good enough. Fourth, they bring in resources in ways that initially seem unattractive to

incumbents. And fifth, they are often ignored, put down, or even discouraged by existing organisations, which do not see the catalytic innovators' solutions as viable (Moulaert et al., 2017).

The approach based on catalytic innovators is interesting, insofar as it also opens a window on social innovation. However, it seems to us it suffers of some limitations. First of all, it is an approach that privileges a top-down vision, where leaders or innovators induce the process of mobilization. Second, it is very close to the Weberian individual 'charisma' where the rational blends with the irrational (the magic capabilities of the charismatic leader). Third, its capacity to attract interests and resources is often overestimated.

2.6.3.1 From mobilization to collective action

Collective action is joint action in pursuit of common ends. Up to this point, we have argued that the extent of a group' s collective action is a function of: (1) the extent of its shared interests (advantages and disadvantages likely to result from interactions with other groups); (2) the intensity of its organization (the extent of common identity and unifying structure among its members); and (3) its mobilization (the amount of resources under its collective control). Soon we will add the opportunity/threat structure as crucial determinant of a group's collective action.

Collective actors attempt to produce collective goods that have a specific value in relation to their interests and are expending valuable resources in the effort. If we can imagine assigning relative values to the collective goods produced and the resources expended, we can think of a contender as gaining, losing, or breaking even. Diagrammatically, we have Fig. 2. In the shaded area above the diagonal, the value of the collective goods obtained is greater than the value of the resources expended; that is a gain (Tilly, 1978). Below the diagonal, we have losses, and the diagonal itself is a break-even line.

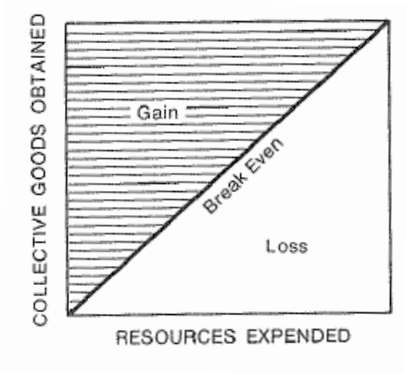

Figure 2 - Gains and losses in collective action (source: Tilly, 1978)

In any collective action, there are real limits on how much to gain or to lose, the two main limits being mobilization and opportunity. The group cannot expend more resources than it has currently mobilized: that sets an unbreakable limit in one direction. The opportunities for gain are finite: that sets a limit in the other direction. Both mobilization and opportunity limit the possible gains from collective action. It clearly follows that a change in mobilization or opportunity will produce a change in the set of gains and losses available to a group. Zero mobilization equals zero gains.

2.6.4 Opportunities/Threats

It concerns the relationship between a collective and the current state of the world around it. Changes in these relationships sometimes threaten the group's interests or alternatively provide new chances to act on those interests. The problem with studying opportunity is that it is hard to reconstruct which opportunities are realistically available to the group at the time. We can minimize that disadvantage by looking only at contemporary collective action or by concentrating on situations in which the opportunities are rigorously defined and strictly limited. Then we lose our ability to follow large-scale changes, in their real complexity, over considerable periods of time. In this first rough statement of the model, opportunity has three elements:

Power: the extent to which the outcomes of the collective's interactions with others favours interests over those of the others; acquisition of power is an increase in the favourability of such outcomes; loss of power is a decline in their favourability. This perspective is useful in that CAIs often establish relationships with several other actors such as experts, bankers, funders, politicians, institutions, governments. All these relationships can strength or weak the collective action potential.

Costs: we refer here to the costs of the contender's collective action resulting from interaction with other actors or entities. Viewed as a process, there are actions by another agent which raise the contender's cost of collective action as well as there are actions which lower the contender's costs. In the latter case, we can speak of facilitation's forms.

Opportunity/threat: this pair indicates the extent to which other collective agents, including corporate actors such as institutions or corporations, are either: (a) vulnerable to new claims which would, if successful, enhance the contender's realization of its interests; or (b) threatening to make claims which would, if successful, reduce the contender's realization of its interests.

Apparatus or device: here we refer to an assemblage of technical and social elements that, in a given moment, has the strategic function to respond to an urgency or to plan strategies of reproduction of the system itself. In the case of energy, it indicates fundamental changes in the different operations of the energy regime.

3 Collective action for the energy transition

3.1 Energy as a common and the potential of collective action in the energy field

In the previous section, we explored the collective action perspective as an important frame to explain the dynamics of social systems. Moreover, we introduced the idea that the main outcome of collective action is the generation of different collective or common goods (we use here the adjectives 'collective' and 'common' in an interchangeable way until further notice). Networks of social cooperation often develop into systematic patterns of collective action in neighbourhood associations, cooperatives, social centres, networks and social movements. These collective-based forms of social cooperation have the potential to give rise to different common goods developing cultures of horizontality, commons ecologies, and new organizational forms. In this section, we shine light on the current debate on different forms of collective action generating new energy commons.

Rather than participating as mere and passive energy consumers, members of a collective can assume several different roles within the energy system. Civil society engagement in the energy market can take several forms (ILO, 2013; DECC, 2014) and the concept of collective action in the energy transition is subject to different interpretations within the academic literature. Some define them as any sustainable energy initiative led by no profit organizations, not commercially driven or government led (Walker and Devine-Wright, 2008, Hall et al., 2016). Some others stress the grassroots innovation nature of community energy, as driven by civil society activists and by social and/or environmental needs, rather than rent seeking (Seyfang et al., 2014). For all, they get the potential and can often influence the ways and the extent to which energy is produced, distributed, consumed, and dissipated.

The considerable degradation or loss of many natural resources, including fisheries, lakes, and forests, as well as the major reductions in biodiversity and the accelerating climate change, pose the problem of the reasons of such dynamics. Many of these resources have been managed for centuries as commons. Rivers, forests, ecosystem services, and geo-system services such as raw materials and renewable and non-renewable energy, have been ruled in a collective way just to preserve their fertility. The changes toward strong private property regimes of management accelerates their degradation and losses. Energy is by definition a common: directly or indirectly it comes from the Sun, and no one owns the Sun.

Commons imply collective action. No common can be managed individually, be it a natural or a corporate person. A common is defined in the field of energy as a resource which is owned and managed by a community, with a system of rules for production and consumption of the resource. For Bollier (2014, 15), a common is "a resource + a community + a set of social protocols". A common is characterised by situations where there is a social dilemma, or a need for collective action – which Darnton describes as a "'tyranny of small decisions' whereby the outcome of millions of individual decisions is in conflict with what people collectively want" (Darnton, 2008, 6). Scholars including Rose (1986), Künneke and Finger (2009) and Frischmann (2012) argue that infrastructures should be considered as commons, due to the positive social and economic externalities of universal access

to energy, the negative climate externalities of associated greenhouse gas emissions, and the natural monopoly tendencies of energy infrastructure.

A common is also characterised by consumption and production activities being carried out by the same groups of individuals. This was the case in historic agricultural and peasant communities, and it is now being rediscovered in a modern context with the concept of 'prosumption' (Ritzer, 2010). This term is widely used in the context of smart grids, both with reference to individuals (Mitchell, 2014; Skjølsvold et al., 2015) practicing 'self-consumption', and with reference to community production and consumption (Karnouskos, 2011; Hertig and Teufel, 2016; Moreno-Munoz et al., 2016). At the same time, the growth of the community energy sector (Seyfang et al., 2013; DECC, 2014; Blanchet, 2015; Bauwens et al., 2016), and the movement for energy democracy (Sweeney, 2012; Platform, 2014; Angel, 2016), shows an appetite for collective, local participation in the development of the future energy system and greater participation in energy system governance.

A vast and growing volume of practical action for sustainability converges on a common principle of creating and defending commons as an effective and democratic form of action that overcomes the limits of both state and market: that of the state to effectively legislate and to enforce that legislation without recourse to authoritarianism, and that of markets to build in criteria for sustainability that contradict their fundamental premise (Bollier and Helfrich, 2012). With respect to energy, shifts towards community ownership and remunicipalisation of services represent an alternative pathway towards decarbonisation of generation combined with changing patterns of provision and usage necessary to reconcile sustainability and justice (Blanchet, 2019). We can therefore define collective action initiatives as those that seek to create new commons based on linked principles of sustainability and social justice as complements or alternatives to the actions of state and for-profit business.

Detailed case study research on community-based initiatives from several European countries revealed them to enable significant reductions in carbon footprint in all four domains of activity considered (energy, food, waste and transportation): most markedly through provision of renewable electricity and heat, generating reductions of up to nearly 85% on baseline levels of associated (domain-specific) emissions and reductions of up to a quarter in beneficiaries' overall carbon footprints (Landholm et al., 2016).

Extrapolating from the realised emissions reductions of case study initiatives, the TESS research project estimated potential overall reductions of 73% or more across Europe in the (considered unlikely) scenario that every EU citizen was involved in a community-based initiative (Celata and Hendrickson, 2016). Modelling of two potential low carbon transition pathways for Europe, one driven by technological substitution, the other by upscaling to regime level of relevant niche innovations, indicated the latter to produce deeper and longer-lasting reductions in carbon emissions (Hof et al., 2016). In terms of historical examples, Denmark's emergence from the 1970s on as a pioneer both in installation of renewable energy and (for a time) global leader in manufacture of wind turbines was the result of basing rollout of wind power in a pre-existing culture of cooperative ownership of infrastructure (van Est, 1999). The Austrian solar thermal industry grew to a leading

position in global manufacturing from origins as a self-organised popular education movement among an initially small number of self-construction enthusiasts in rural parts of the country (Ornetzeder, 2001; Ornetzeder and Rohracher, 2006). In Germany, EWS-Schönau developed from a local community initiative to a regional network operator and nationwide renewable energy supplier despite strong opposition from the incumbent operator by leveraging popular support for its political vision of a more democratic and decentralised energy system, leading it to become a significant national player without compromising its core values (Sladek, 2014).The concept of Collective Action Initiatives deployed in COMETS integrates various precedents in the literature. These include Sustainability Transitions, Social Innovation, and Community-based initiatives. Each of these, in common with CAIs, is relevant to numerous domains of action and has specific expressions in the field of energy.

The interdisciplinary and transdisciplinary research field of Sustainability Transitions arose in the late 1990s in response to the need to anticipate, deliberately initiate and manage the socio-technical transitions necessary to bring about sustainable development (see Loorbach et al. 2017 for a recent review). Among its key concepts are regimes and niches. A regime is the predominant socio-technical configuration in any domain, such as energy. Niches are sites of innovation in some way isolated from coercive pressures exerted by the incumbent regime, hence able to explore alternative socio-technical configurations and reveal challenge power relations that hinder transitions to sustainability (Avelino, 2017). Although sometimes initiated within incumbent regimes as controlled sites of experimentation, niches increasingly arise as what are termed 'grassroots innovations': autonomous initiatives self-consciously transgressive (to varying extents) of predominant values and approaches and adopting sustainability as a core ethos rather than correction or secondary concern (Seyfang and Smith, 2007). Community energy has been identified as one such grassroots innovation niche (Seyfang et al., 2014).

Integrating insights from sustainability transitions and social innovation theory, the concept of Transformative Social Innovation (TSI) refers to a form of social innovation that "challenges, alters and/or replaces established (and/or dominant) institutions in (parts of) the social-material context" (Haxeltine et al., 2016, 19). TSI initiatives, therefore, not only act as innovation niches, they explicitly seek to change their wider context by stimulating institutional change, though this raises risks of appropriation or marginalisation (Bauler et al., 2017). One example is sustainable energy initiatives in the INFORSE network, whose work has contributing to narratives in favour of renewable energy moving from the margins of public opinion in the 1970s to the mainstream, with almost universal support for a goal of 100% renewable energy in countries such as Denmark and Belgium (Elle, 2015).

Overlapping with both grassroots innovation and TSI is that of community-led initiatives (or community-led initiatives): action towards defined environmental and/or social goals on the part of self-organised communities, whether associated with a geographical locality (as a community of place) or common interest (community of practice) (Penha-Lopes and Henfrey, 2019).

All these forms of collective action initiatives transcend, in both potential and practice, purely piecemeal, marginal and small-scale action. Sustainability Transitions refers to the 'empowered

niche' (or niche-regime), which emerges when niches gain enough power to challenge, or even replace, the dominant regime (Haxeltine et al., 2008). However, empowerment is no simple concept: TSI takes place within complex and fast-changing dynamics of power relations across shifting boundaries, in which windows of opportunity for systemic change might arise unexpectedly and vanish rapidly (Avelino, 2017). A significant dimension of this empowerment derives from participation in translocal networks that integrate connections of mutual support, social learning and collective action from local up to transnational levels (Avelino et al., 2019). Rootedness in common narratives and shared values shared and deepened through participation in translocal networks empowers community-led initiatives to mount consistent and effective challenges to dominant regimes and associated cultural discourses (Henfrey and Ford, 2018). On this basis, social, cultural and technological innovation originating in localised initiatives can translate into transformative change at higher levels of scale (Henfrey et al., 2017).

3.2 CAIs in the energy field as a driver of social innovation

The growing amount of research and investigations devoted to the social aspects of the energy transition focuses on both processes and outcomes (energy as a good). Some of them concentrate on population attitudes and values regarding the transition towards renewables, whereas others focus on more structured ways to enhance the energy transition, for example upon the so-called energy communities. As we are going to see, under the term 'community' there are a lot of different collective action configurations, from cooperatives to purchasing groups, from neighbourhood energy communities to virtual communities exchanging energy in a virtual market. All these studies have extended merits for casting new lights about the social limits and potentialities of the energy transition, and yet they lack something.

Theoretical perspectives on the market acceptability of renewables and on the social acceptability of the energy transition are understood on the view of three main visions:

1) those looking at national styles of regulation: these perspectives open up scenarios usually regarding the regulation of energy market and its diversification coming from the addition of renewables to conventional fossil sources. However, these studies remain in the side of market providers that are seen as the principal actor of these innovative changes. Sometimes the analysis extends on the characteristics of the political systems as well as on its capabilities to impose or drive these changes, or conversely to be manipulated by fossil energy lobbies. The social, in the sense of consumers and users, remains in the background, often conceptualized as 'public opinion';

2) those analysing the barriers to renewable energy: analysis of barriers to the spread of renewables is also a common and conventional way to look at the topic. Here the focus is not on the capabilities of proponents to propel solid changes towards renewables, but the individuation of obstacles and the ways to overcome them. Obviously, this is a worthy effort, but it is rarely approached as collective action or the way to overcome obstacles in a collective effort. Barriers are often seen as dependent by markets and institutions, such as subsidies for conventional forms of energy, high initial capital costs, imperfect capital markets, lack of skills or information, financing risks and uncertainties, high

transaction costs, and a variety of regulatory and institutional factors (Painuly, 2001; Beck and Martinot, 2004; Chakraborty et al., 2016). Social barriers are rarely investigated, or they are seen as problems of information, communication, rejection of technology, and so on;

3) those looking at the factors that drive local acceptance and opposition to renewable energy (Sovacool and Pushkala, 2012): a third area of scholarship can be found in those studies looking at the local acceptance (or opposition) to renewable energy projects and that mainly focuses on social aspects. Here the opposition is especially against wind farms or solar farms. The approach of acceptance/rejection of these technologies is faceted, however it can be said that the prevalent prism for understanding, or the watermark of, such investigations is the idea that people oppose these plants because not well educated or informed. On the contrary, they accept renewable plants when informed or when sharing positive values and attitudes towards renewables. From the point of view of attitudes and values investigation, as we know it, these studies approach agents as individual objects of energy policies deliberated by different corporate actors, being them governments or incumbent providers. This is the reason why these studies often focus on social acceptance, which means the availability of people taken on their generality to embrace new ways to produce and, less, to consume energy (see for example, D'Agostino et al., 2011; Sovacool and Blyth, 2015). As it is self-evident, social acceptability - which depends on values, attitudes, and interests (mainly about the lowering of energy price for consumers) - implies a passive role of agents, whereas the 'action' to be performed is only the fact to change provider – from fossil energy to renewable energy provision.

The outputs of relevance of/for social dimension (innovation) have been categorized under the headings of:

a) Local jobs and wealth creation;
b) Reduced (energy) poverty;
c) Fairness and democratic systems;
d) Empowerment and social values;
e) Increased social acceptance[2] of renewables;
f) Increased energy security as neither import nor transport is required;
g) Education, higher awareness of sustainable practices;
h) Challenging the status-quo and existing socio-technical regimes;
i) Informal networks and social movements;
j) Gender.

a) Local jobs and local wealth creation

The potential capability of the CAIs for the energy transition to create local jobs is sometimes mentioned in existing literature (e.g. Koirala et al., 2016). This capability should basically derive from the fact that the energy transition is generally associated with a shift from centralized energy

[2] The authors find the term 'social acceptance' problematic in that it may imply a simplistic problem-solution whereby solutions made by policymakers etc. need to be 'accepted' by communities. Nevertheless, we have kept it in because it is referred to in the literature in this way.

infrastructures to decentralized ones and with reduced need for energy imports. Decentralized energy infrastructures are indeed supposed to require more use of local energy and material resources and wider engagement of local communities. Evidences of these effects are nevertheless lacking (Kunze and Becker, 2014, 51). On the one hand, the sign of the net balance between jobs destroyed in non-renewable energy sectors and jobs created because of a transition to decentralized renewable energy systems depends on economic considerations concerning, among others, the costs of involved technologies and of human and energy resources. Under this point of view, despite the fact that renewable energy sources can sometimes be used at zero costs (solar energy is an example of these zero cost energy sources), it is not that straightforward that the costs of jobs created in renewable energy sectors are lower than costs in non-renewable energy sectors, notably in those countries where the diffusion of renewables relies heavily on state subsidies (Green, 2011). On the other hand, even in the case of a positive balance, it is not so automatic that jobs created would be 'local' due to the higher knowledge content of renewable energy technologies. CAIs aiming to local ownership of energy equipment, sources and distribution systems remain however certainly an interesting potential opportunity to generate local wealth in so far as profits deriving from energy generation and distribution can in principle be kept by owners and used locally (Creupelandt and Vansintjan, 2018). A number of authors have found that local energy communities contribute to local economic development (Hoffman and High-Pippert, 2010; Shaw and Mazzucchelli, 2010).

b) Reduced (energy) poverty

Energy poverty reduction is an explicit aim of several collective initiatives undertaken by energy cooperatives. This objective is generally addressed by developing solidarity schemes (either using revenues from renewable energy generation or not) that can contribute to reduce energy bills of vulnerable members or by providing them with services or education to reduce energy consumption (Friends of the Earth Europe, 2018). The opinion that CAIs undertaken by local energy communities can reduce energy poverty is mentioned in several documents of European Institutions (Coulon and Krieger, 2018; O'Brien at al., 2018). Despite some indicators are being used to measure it (see European Commission, 2015), the question remains whether this concept can be defined and measured in a way that captures all its facets.

c) Fairness and democratic systems

According to a case study on various energy projects (Hiteva and Sovacool, 2017), elements of energy justice were demonstrated through social innovation (defined by the authors as an equitable distribution of costs and benefits, affordability, due process and greater participation in decision-making). Specifically, the grassroots energy community identified: showed an enhancement of access to energy services and benefits; created value by providing capacity building, training, and access to discounted; materials, services and low cost finance to reduce household energy usage; and participation in energy decision making and vision building. Similarly, drawing on a number of case study examples, (Bianchi and Ginelli, 2018) describe the importance of social, spatial, structural, intergenerational and procedural equity in achieving acceptance of energy projects – and those case studies show how energy communities foster this equitable consensus.

A number of authors praise energy communities for their 'democratic' characteristics, which are often linked to ideas of enhancing democratic influence of citizens on their energy provider (Van der Schoor et al., 2016); and having less dependency[3] on energy providers with a specific focus on the improvement of the wellbeing of disadvantaged actors (Schreuer, 2016). Barr and Devine-Wright (2012) found that community energy projects help to promote a more sustainable and resilient society while offering communities legitimacy, consensus, and voice.

According to Seyfang et al. (2013), by enabling and empowering communities to collectively change their social, economic and technical contexts to transition to more sustainable lives and practice their ideological commitment to sustainability, community energy projects help groups and individuals to overcome the structural limitations of individualistic measures by bringing communities together with a common purpose.

d) Empowerment and social values

Bauwens and Defourny (2017) found that energy communities in Belgium have social capital in terms of social identification with the cooperative and generalized interpersonal trust and network structure. Based on their research on three case studies (wind technology in Denmark, the solar collector do-it-yourself movement in Austria, and the development of car sharing in Switzerland), Ornetzeder and Rohracher (2013) make a number of conclusions regarding grassroots one-issue communities – including that they share an innovation culture based on democracy, openness, diversity, practical experimentation, social learning, and negotiation. Rogers et al. (2012) found that energy communities build on local knowledge and networks to find foster locally appropriate solutions and community cohesion.

e) Increased social acceptance of renewables

Authors discuss the topic of social acceptance in relation to the issue of legitimacy. Ornetzeder and Rohracher (2013) found that the grassroots nature of energy communities was important in the early phases of development and provided empowerment for the projects which gave them a certain level of legitimacy. This was done by linking the projects to broader societal discourses and movements including e.g. antinuclear, limits of growth, Hewitt et al. (2019). Similarly, studies have found that where benefits are seen in an equitable way in the community, public acceptance is likely to be greater (Rogers et al., 2008; Warren and McFadyen, 2010).

f) Increased energy security as neither import nor transport is required

CAIs targeting local energy generation and management of energy demand are supposed to increase energy security. Integration of different energy technologies and local energy sources and carriers is generally seen as the best technical approach to increase security. Integration of co-generation and local distribution networks of heat and electricity is an example of how this integration can be achieved (Koirala et al., 2016). Overall, increased energy security relies however on a combination of

[3] Schreuer (2016) found that these conditions in energy communities are evident, but not always seen at the same time, and in fact they may sometimes compromise one another. For example, the provision of additional resources to bottom-up initiatives (e.g. feed-in tariffs provided by the state) increases their resource base but also creates a new dependency relation.

technological renewable energy solutions, business and governance models (see the example of renewable energy model regions, in Ooms et al., 2017, 37). As energy balance is achieved at the local level in larger areas, national energy systems might however experience negative consequences in case peak demand of many areas coincides. To avoid this, smart integration systems operating on a large scale become necessary. From a perspective of increasingly integrated energy systems, local energy security becomes therefore inevitably interlaced with larger scale security.

g) Education, higher awareness of sustainable practices

A number of studies mention the educational benefits of energy communities. Rogers et al. (2012) state that they help to create awareness and transparency on energy issues that may be unclear or confusing. Seyfang et al. (2013) found that community energy projects help to raise awareness of sustainable energy issues, improving public receptivity to renewable energy installations, increasing engagement in behaviour-change initiatives and helping to reduce carbon emissions (Millard, 2017).

h) Challenging the status-quo and existing socio-technical regimes

CAIs for the energy transition may be promoted not only in terms of instrumental solutions, nor to convince others that such solutions matter, but rather to question technical regime conventions and to debate the critical implications of sustainable energy when understood in new ways (Smith et al., 2016). These types of initiatives can be framed theoretically through Critical Theory (Feenberg, 2002) in so far as they activate processes that make it apparent the social structure dominating an issue and propose actions to liberate people from such dominance.

i) Informal networks and social movements

Informal networks and social movements are often very important to the development of CAIs for the energy transition. Sustainability movements focused around finding more sustainable ways of living and informal networks of people often play the role of drivers and motivators of these initiatives (see the case study represented by the Cloughjordan Ecovillage, in Ooms et al., 2017, 13-17). Supporting networks may be networks of individuals or of associations which might in their turn be supported by local administrators. Social movements and network initiatives in this area are often the result of initiatives undertaken by citizen denouncing problems generated by over-professionalization, privatization and lack of a real commitment to sustainability from major energy suppliers (De Moor, 2013)[4].

j) Gender

Gender studies in the field of CAIs for the energy transition result to be relatively scarce. One study that could be identified in this area focuses mostly on investments involved in renewable electricity production by citizen participation schemes in Germany (Fraun, 2015). This study reveals differences between men and women in the ownership of citizen participation schemes, in the average investment sum and in the decision-making bodies. Factors responsible for these differences

[4] On networks, see cases A1, A2 and A3 as described in Ooms et al. (2017).

are clearly context dependent and result from a combination of cultural, social and political aspects which can reinforce and strengthen gender inequalities. The narrow focus on technical and economic aspects of mainstream research and policy approaches adopted in this area often impedes a deeper understanding of the dynamics at stake.

3.3 Looking for a working definition of CAIs: results from a focus group

A prerequisite for COMETS research activities is a joint understanding of what CAIs are and the boundaries (see Chapter 2) that distinguish a collective experience to be considered as a CAI from other similar collective experiences. With this aim, besides the wide literature review already reported in the previous section, the following two paragraphs presented the main results of facilitated small group discussions organized, within a wider workshop, in the second day of the COMETS Kick-Off Meeting held in Torino on May, 20-21, 2019.

All COMETS partners took part in the activity. They were randomly assigned to four different groups and asked to discuss two main topics related to this deliverable:

- Which collective experiences can be considered as CAIs in the energy field?
- How (i.e. through which dimensions and indicators) can their development be described and their performance measured?

Below are the main findings and issues raised from the groups' discussions. A short summary of the main agreed conclusions is provided at the end of the paragraph. On the basis of the groups' discussions, the most relevant aspects to be covered in the definition and description of CAIs are the following:

Developing a shared definition

- Working definition: seeking a shared definition should be understood as a working definition and should be set as wide as possible.
- Regularly updated: since the definition will be fed by surveys, case studies and other project research activities, it needs to be updated throughout the project implementation. The question is to which extent a wide definition can be accepted and become useful:
- Relation to the energy transition: a definition of CAIs should build on activities related to the energy transition, which go beyond the activities related to transitioning from a fossil fuel-based to a low-carbon energy system (i.e. increase of renewable energies). The basic requirement is that many people engage in some way to act in the energy sector towards the energy transition. The definition should also enable the possibility to measure impact on social innovation and the energy transition.

Various aspects to be considered

- Different scopes of CAIs: experiences active in the reduction of energy production, including energy savings, storage of energy, energy efficiency increases, material for energy, built-in energy (e.g. into buildings and infrastructure), behavioral change and change of expectations about how much energy is needed for a 'good' life should be considered. Alternative initiatives, such as e-mobility (e.g. electrical bike-sharing, charging from the grid - even though it could originate from fossil fuels) should also be included;
- Typologies: there are various typologies that differentiate based on the types of activities (e.g. consumer cooperatives, production cooperatives, distribution cooperatives) and whose characteristics may sensibly vary across countries;
- Evolution of CAIs: it includes examples such as district heating moving into IT, cooperatives that developed out of anti-nuclear campaigns and now active in the Energy Transition CAIs, etcetera;
- Decision-making processes: the internal processes play a role in defining a shared initiative as collective (i.e. democratic, participative) but still has to be decided to what extent actors involved should have the ability to influence decision-making (e.g. incorporating concepts such as one share, one vote or other democratic procedures). Oftentimes a plurality of actors (citizens) is involved and a key role is played by the initiator of a CAI. A big point is whether a particular CAI should still be considered without paying attention to the involvement of other social actors (i.e. private companies)[5] that actually governs the initiative;
- Social innovation: role of social innovation in challenging the status quo and the incumbent system (e.g. ESP initiatives to set/control prices). The potential for social innovation, which could be big, null or not measurable, is key to this investigation;
- Alternative aspects: other areas to be considered may include the degree of voluntarism, limits to membership (physical, location-wise, financial), educational components, the role of profits/earning of money and types of benefits.

Energy sector components to consider:

- Impact: The direct connection and impact on the energy field has to be considered as a requirement. Many 'collective' experiences may have only an indirect impact on energy and possibly not easy to grasp if it is having any side effect on the overall system. For example, investigating whether or not an initiative with a strong energy saving component is impactful due to efficiency side effects or due to the initiative itself[6];

[5] For example, financing platforms facilitating the financing of projects through increasing the number of members. Some projects may be financed through a platform that may be promoted by a company ('community of investors'). However, it is possibly considered a form of social innovation insofar as the platforms are creating communities; people can also invest directly which is a form of empowerment. Funding platforms could be either be seen as CAIs themselves or as tools for CAIs.
[6] An example of a CAI that may or may not be considered is: coordination among owners of apartments in a building (e.g. as common in Estonia). Such an initiative is composed by citizens and will impact energy consumption/savings through agreeing, e.g., on renovating the building and installing new heating devices. It was suggested to consider these, unless they are forced by law to take action.

- Production: setting a threshold for the minimum and maximum capacity installed - or alternatively - based on relative expressions with respect to size (e.g. minimum/maximum energy production per capita for the members/households of CAIs).
- Supply chain: all areas of the energy supply chain should be considered - from production and distribution to purchase and savings - embracing the full spectrum of engagement in the energy sector;
- Involvement of renewables: in some initiatives, activity is mainly focused on reducing prices, so that the 'transition' element (e.g. emissions reduction) is missing in the intentions of participants.

Based on what discussed and reported above, a general agreement has been reached on looking for descriptors that relate to the organizational structure and history of the initiatives, to their performance and quantified contribution to the energy transition and to the need of gathering meaningful contextual data. Defining CAIs may have several major fallacies: the definition may be overly broad; the definition may be too narrow or; it may lead to mutually exclusive, incomprehensible or circular definition.

Therefore, a first set of properties have been identified:

- size and location (urban/rural dimension, economic and social environment);
- technologies invented/adopted/diffused;
- mission statements and co-benefits expressed;
- business models developed/deployed;
- types and scales of energy services provided;
- organizational models chosen;
- decision-making processes followed.

We therefore define Collective Action Initiatives as an integration of all these strands: undertaking social innovation aimed at transformative change – social, cultural and technological - in dominant regimes through a combination of predominantly local action and participation in trans-local networks that enact - either consciously and involuntarily - core values relating to sustainability and/or social justice and inclusion.

In general, a strong fragmentation across initiatives can be observed: CAIs tend to develop separately from each other as small entities, in different locations, often specialized in a single type of renewables (solar, wind or biogas) or in energy saving, a single type of collective action (e.g. production, distribution, investment, education), or a special focus (e.g. a specific hardware or software, network solutions vs. off-grid solutions, high technology vs. low technology). Furthermore, there is a boundedness of the field of activities. The focus of CAIs in the energy sector tends to be on energy production and distribution, whereas there is much potential in synergizing with CAIs in related fields such as building, transport and food – therefore CAIs with a more holistic approach connecting various fields (such as transition initiatives or ecovillages) are not well represented in

renewable energy networks like REScoop. Finally, CAIs are confronted with the challenge of spreading and scaling: the development of CAIs is strongly context-dependent (depending on social capital, leadership, communication and visibility, the maturity of the culture of participation, regulatory specificities, local and regional political and economic situation, etc.) and cannot spread and scale based on a one-size-fits-all approach.

Some open questions are raised from the discussion and will be taken into account along the next stages of the project development:

- Should CAI be considered if members are private companies (e.g. GreenCoop in Slovakia)?
- Should worker cooperatives be included? For example, in Sweden coops were funded by private companies to enable wind park investments for employees.
- Should crowdfunding models be included? E.g. Énergie Partagée in France, Zelena Energetska Zadruga in Croatia. They enable citizens to invest into renewable energy without the need to be a member. Cooperatives act as finance manager.
- What about projects initiated by cities (e.g. in France to enable citizen investment; 'Energy Clusters' in Poland)?

3.4 Looking for a working definition of CAIs: examples of CAIs in the energy field in Europe

As a follow-up of the group discussions reported in the previous paragraph, all the participants were requested to 'apply' their approach to CAIs by providing some paradigmatic examples (taken from their own country) of collective experience that could be considered as examples of a CAI. The table below presents the results of this exploration, with basic descriptions of the specific experiences (columns A, B and D, respectively country, name and link to the website), a brief description about the main activity and the extent to which a collective perspective is implemented (column C) and a final evaluation about whether or not it can be a CAI.

A. Country	B. Name of CAI	C. Description: activity and collective profile	D. Link	E. Is it an example of CAI?
Norway	METSA Group	Metsä Group produces over 15% of the renewable energy in Finland. In 2018, it produced a total of 29 TWh of renewable energy of which a majority, 25 TWh, was used in their own production. One would need to check whether it is organized in the cooperative model.	https://www.metsagroup.com/en/Sustainability/climate-and-nature/bioenergy/Pages/bioenergy.aspx	Maybe
Denmark	Kalvebod Smart Village	A garden community that decided to create an energy community by putting solar panels on their community house. A clear collective action movement with democratic voice and social cohesion around and energy project.	http://voresomstilling.dk/projekt/hf-kalvebod-smart-village/140	Yes
Denmark	Energy Lab Nordhavn	There is a lot of discussion and research about creating an energy community around Nordhavn and the private Copenhagen International School (which has a facade completely covered with solar panels). However, this is an example of a tech push by the private sector, research institutes and universities, and the Copenhagen Solution Lab (part of the municipality). It hasn't been initiated by the local residents and so far there is no evidence that they are even interested in being part of an energy community.	http://www.energylabnordhavn.com/	No
Denmark	The energy collective project	This is a tech push initiative and isn't really a collective action. Rather, it is an organization that facilitates energy collectives by offering blockchain support.	https://the-energy-collective-project.com/	No
Denmark	Svalin	This is a local energy community. However, it is a demonstration project initiated by research institutes rather than the community and so the residents didn't necessarily have the ambition, impetus, or economic risk guarantee.	https://weou.org/energy-collective/	Maybe
Denmark	Samsø Energy Academy	Originally the Samsø island was the shining example of a collective action initiative that resulted in a 100% renewable energy island and collectively owned wind turbines. It has since morphed into the Energy Academy which provides support, education and outreach to other communities	https://energiakademiet.dk/	Maybe
Spain	Arterra Bizimodu	Ecovillage that works on many environmental and social aspects. They have a project on biogas and they are starting a photovoltaic project.	https://arterrabizimodu.org	Yes
Spain	The different municipalities part of Ecoolocal	Several municipalities that work with the civil society and tech support from ecooo, to work on energy at local level.	http://ecooo.es/ecooolocal/procesos/	Yes

Spain	Viure de l'aire	First eolic community project in Spain	http://www.viuredelaire.cat/en/	Yes
Spain	Som Movilitat	Cooperative project that create local groups on sustainable shared mobility.	https://www.sommobilitat.coop/en/	Yes
Italy	E' nostra	First Italian energy cooperative able to both produce and supply electricity as well to assist its members providing energy services for energy efficiency. Started in 2014 as the first Italian supply coop, merged in 2018 with Retenergie, one of the oldest and biggest Italian energy coop.	https://www.enostra.it/	Yes
Italy	Retenergie	Energy coop founded in 2008 "to contribute to a new economy based on principles of environmental sustainability, sobriety and solidarity". Developed and owned several renewable generation plants (mainly PV) and provided to its members other energy services including energy audits, collective purchasing schemes.	http://www.retenergie.it/	Yes
Italy	We for green sharing	Italian multi-utility which developed several energy coops: first PV plan developed in 2010 (Energyland), then two others in 2011 and 2015 (Masseria del Sole, Fattorie del Sole). More recently a hydropower plant. Also offers participation in electricity purchase group (even without the need to invest).	https://www.weforgreen.it/	Yes
Italy	Energia Positiva	A newer energy coop started operating in 2015 buying existing PV plants and opening ownership to its members. It currently owns 14 plants, has 270 members participating with a total of 3 million euros raised by members. They also act as a purchasing group of electricity. Energy efficiency pilot projects are under development.	https://www.energia-positiva.it/	Yes
Italy	Civico 5.0	Initiative promoted by Legambiente (Italian environmental association) to improve energy efficiency of block of flats. It selected 25 families (2 per block of flats) and offered to them several audits: energy efficiency, indoor pollution, indoor gas emissions, noise pollution. At the end of the audit process they offered the families practical solutions to improve any of the above, in terms of technical solutions and economics. No implementation, only audit, information and awareness creation. The programme has ended in 2019 and will be replicated.	https://civicocinquepuntozero.it/	Maybe
Italy	"Territorio Sostenibile" Oil Free Zone	Aimed at creating the Energy Community of the Pinerolo Area. First effort to take advantage of the Italian law regulating (or at least defining) the so-called Oil Free Zones. The covenant was signed on last 15 April 2019. 25 Municipalities signed so far (out of around 40 of the Pinerolo Area). The Pinerolo Area is 1,350 square km and has 150,000 inhabitants.	NA	Yes
Italy	Abbassa la bolletta	Purchasing power group promoted by Altrocomsumo (Italian association for protection and awareness of consumers) aimed at gathering energy consumers in order to bargain better retail electricity and gas prices on the market. In the last round of subscriptions they gathered 60.000 consumers and over 10.000 have subscribed a new contract for electricity and gas provision benefiting of a saving of 310euros on their annual energy bills. The initiative is now closed.	https://www.altroconsumo.it/landing/abbassa-la-bolletta?partnerkey=aclpd	Maybe
Spain	Network for Energy Sovereignty – Barcelona	Xarxa per la sobirania energètica (Xse) Catalonia emerged when different organisations and individuals identified energy-related problems affecting local populations, including fracking, the managing of hydroelectric dams by private corporations and extremely high voltage power lines, and the building of a pipeline through Catalonia to transport gas from Algeria to Europe. It also wanted to challenge government obstruction of renewable energies, and collusion with companies that creates some of the highest electricity prices	https://transformativecities.org/atlas-of-utopias/atlas-11/	Yes

		in Europe. This is an example of social innovation and not just a new energy-related business model.		
Italy	Solidarity Purchasing Groups (GAS) and Solidarity Economy Districts (DES)	GAS and DES represent a great example of social innovation where societal issues become the direct driver to reduce carbon footprint.	http://www.co-energia.org/	Yes
International	City and energy as a commons	Activities being developed in relation to commons around Bologna Regulation represents important examples of new governance models which are relevant for the energy transition.	https://labgov.city/tag/cogovernance/	No
Poland	Spółdzielnia Nasza Energia (eng. Our Energy Cooperative)	The first energy cooperative in Poland (from 2014). It was initiated by the company BIOPower. It is based on the cooperation of four municipalities from the Zamość poviat: Komarów-Osada, Sitno, Skierbieszów, Łabunie. An energy node consisting of three biogas plants. The shareholders are local farmers and municipalities.	http://biopower.home.pl/o-firmie/	Maybe
Poland	Wspólnota Mieszkaniowa Pszczelna (eng. Housing Community Pszczelna)	24 kW photovoltaic roof system was implemented (96 solar panels). The shareholders are all members of the housing community (apartments owners).	http://www.administrator24.info/artykul/id10152,szczecinska-pszczelna-z-wlasna-elektrownia	Yes
Poland	Wrocławska Elektrownia Słoneczna (eng. Wroclaw Solar Power Plant)	Panels cover a total area of 0.5 ha. The power plant will produce 700,000 kWh annually. The shareholders are all members of the housing community (apartments owners).	https://wroclaw-poludnie.pl/	Yes
Spain	SOMobilitat	Cooperative project that promotes a sustainable mobility. They share electric vehicles (cars, vans, ...) in each community/neighborhood.	https://www.sommobilitat.coop/	Yes
Spain	GoiEner	GoiEner is a cooperative project for the generation and consumption of renewable energy.	https://www.goiener.com/	Yes
Spain	OCU	They make collective purchases of electricity and gas with citizens who join their initiative, but the decision is not made by citizens. Also, they don´t 'give importance' to the kind of energy (renewable or not) they buy, the price is prioritized.	https://www.ocu.org/especiales/quieropagarmenosluz/	No
Spain	Trabensol	Cooperative of Senior Cohousing in a building "bioclimatic, geothermal, with little environmental impact and low energy consumption".		Yes
Belgium	Buurzame Stroom	LEC - Neighborhood initiative, tenants, owners and businesses. rooftop lending to install solar panels for electricity production sharing in the community	http://buurzamestroom.energent.be/	Yes
Belgium	Allons en vent	Cooperative, the cooperants of which invested in windmills for their children. Also involved in other cooperative schemes such as bio-food, eco-construction, education and art & culture	https://allonsenvent.be/ http://www.vents-houyet.be/realisations.html	Yes

Belgium	Ecopower	Cooperative, electricity production, cooperants are owners of the installations. Fair-fin label	https://www.ecopower.be/	Maybe
Belgium	Ecloud	DSO initiative to set up Community Virtual Power Plants in business parks. Aim to share means of production, increased energy efficiency and increased auto-production, advantageous tariff schemes. Incumbent system initiative	https://www.ores.be/entreprises-et-industries/faire-economies/e-cloud-cooperer-dans-les-zonings-pour-une-autoproduction-plus-efficace	No
Belgium	Nieuwe Dokken	LEC - urban development project (mixed residential/commercial) with underlying specific philosophy based on sustainability and renewable energies to adhere to when coming to live to the neighborhood	https://denieuwedokken.be/	Yes

Box 1 - Looking for a working definition of CAIs: main findings from the experiences investigated

There are several types of initiatives that can be considered under the umbrella of collective action. Initiatives are scrutinized by looking at their organizing structure — whether they are developed and managed bottom-up or top-down. Out of the 32 initiatives listed, the majority are accepted as collective action initiatives in the energy sector (20 'Yes'). These include projects that are clearly initiated and managed by citizens, such as the Housing Community Pszczelna in Poland. However, not all can be considered collective action (5 'No'), as highlighted in the Danish Energy Lab Nordhavn, which is an example of a tech push by the private sector, research institutes and universities, and the Copenhagen Solution Lab (part of the municipality). This was initiated by the local residents but so far there is no evidence that they are interested in being part of an energy community. Some of the initiatives are in a gray zone when being considered as a collective action initiative (7 'Maybe'), either because it was initiated top-down by an incumbent actor (gas companies, as exemplified in Poland by 'Our Energy Cooperative') or research institutes (seen in Denmark by Svalin). In these cases, it is difficult to have a definite 'yes' or 'no' because they still show signs of collective action by engaging citizens. They require more in-depth critique to establish whether or not they fall under the umbrella of collective action.

4 The four dimensions of collective action. Processes and effects of CAIs in the energy field

The previous section showed how collective action in the field of energy can generate not only new forms of energy goods but also influence broader aspects of social life, which is commonly referred to as 'social innovation'. In this section, we focus on the material processes of collective action and attempt to apply it to the model of collective action drawn in Section 2.6: interests; organization; mobilisation and resources' control; and opportunities/threats.

4.1 Interests, motivations and values

People act together when expectations of some return in terms of money, improvement of individual or social and environmental well-being, equality, solidarity and other values are on the horizon. All these, apart from money, show that people involved in collective action are attracted by the possibility to generate collective goods. These may be both traditional collective goods that have been turned toward privatization (e.g. water, public spaces, food) and new forms of goods, such as information, science, mobility, and energy. In the second section, we contended the idea that interests are the moving principle of collective action that is too bent towards individualism and rationalism. If we share the idea that all that is generated and reproduced in daily life is collectively made (but individually appropriated), interests and motivations to act collectively are immanent to the daily life activities of all people (Sennett, 2012). The motivation is to cooperate, even if the market forces trying to bend them to an individualistic logic have influenced many of these actions. Production and consumption are thus seen as collective activities that can be deployed collectively and be managed independently of other entities, such as private enterprises or the state.

As argued by Alan Page Fiske (1992), people are fundamentally sociable - they generally organize their social life in terms of their relations with other people. Fiske postulates that people in all cultures use four relational models to generate most kinds of social interaction, evaluation, and affect. Cultures use different rules to implement the four models. The motivation, planning, production, comprehension, coordination, and evaluation of human social life may be based largely on combinations of the four models:

- *communal sharing*, people treat all members of a category as equal;
- *authority ranking*, people attend to their positions in a linear ordering;
- *equality matching*, people keep track of the imbalances among them;
- *market pricing*, people organize their interactions with reference to ratios of this metric, so what matters is how a person stands in proportion to others.

The relational models theory explains social life as a process of seeking, making, sustaining, repairing, adjusting, judging, construing, and sanctioning relationships. It postulates that people are oriented to relationships as such, that people generally want to relate to each other, feel committed to the basic types of relationships, regard themselves as obligated to abide by them, and impose them on

other people (including third parties). Thus, people construct complex and varied social forms using combinations of these four models, implemented through diverse cultural norms and rules. People's chief social conceptions, concerns, and coordinating criteria, as well as their primary purposes and principles, are usually derived from the four models. This means that people's intentions with regard to other people are essentially sociable, and their social goals are inherently relational. People interact with others in order to construct and participate in one or another of the four basic types of social relationships.

Collective action is aimed to make collective goods - 'Goods' in the sense of being social objects of value, (whether tangible or not) that satisfy given socially determined needs, desires and aspirations. They are collective goods, in the sense that they are use value to a plurality (De Angelis, 2017). An airport lounge, for example, is a use value to a plurality, as is any public space, such as an aqueduct, a train, a park, a school or a street. Also, any mass-produced commodity is a use value to a plurality in the sense that it serves the necessary or acquired needs of a subset of a population, although this cup, this computer, this car is a use value only to the user. What is common to all these cases is that the plurality is largely silent - it is just a passive user or consumer of these goods. To make it a collective or common good, the plurality needs to emerge as a plurality of commoners, by claiming ownership of that good. To claim ownership is not simply a question of defining property rights in the legal sense. A plurality that claims ownership of one or more goods is one that, in different forms, given situations and contexts, not only uses or accesses that use value, but that also governs its production and reproduction, its sustainability and development. In doing so, the plurality shapes a relationship with that good and with the environment in which it is produced, while the subjects of that plurality govern the relations with one another.

However, to attain collective action is not a simple effort. Collective action has been, in some way, taken from people, or in another perspective, it has been delegated to other agents, such as private enterprises or states. Thus, a mix of conditions and situations that COMETS will investigate supports its development. In the end, rationally acting subjects meet on the market to realise their rational interests, whereas, in fact, they act as executors in accordance with social laws which they themselves have generated historically and reproduce through their rational behaviour and over which they have no control (Adorno, 1990). Some interests and needs can find satisfaction also out of collective action. But collective action is a need that goes beyond its immediate process. Collective action challenges this appropriation of its outcomes by other agents, all competing on the market.

4.2 The organizational process

4.2.1 Energy communities and cooperatives: organizational forms and conventional approaches to collective action

Current literature usually refers to collective action in the energy field as community energy initiatives (Walker et al., 2010; Seyfang et al., 2013; Wirth, 2014; Yildiz et al., 2015), which are often organized in the form of energy cooperatives. We often see cooperatives as the more diffuse form of organizational bodies. Energy cooperatives can be clearly defined beyond 'energy community' for a

couple of reasons. Firstly, the International Cooperative Alliance (ICA) provides a set of seven Principles that are commonly used to characterize the structural goals of cooperatives. These Seven Principles of the Cooperative Identity are (International Cooperative Alliance, 2018):

1. Voluntary and open membership;
2. Democratic member control;
3. Member economic participation;
4. Autonomy and independence (from external companies, investors and governmental institutions);
5. Providing education, training and information (for members);
6. Cooperation among cooperatives (to promote the cooperative movement);
7. Concern for (the external) community

Secondly, most member states of the European Union provide a specific legal business form for cooperatives within their national legislation, which often reflects the principles set out by the ICA (Roberts et al., 2014; Cocolina, 2016; European Parliament, 2019). Although there is diversity across legal forms in different countries, strong participation of members in decision-making is the most commonly adopted feature in all national legislations. A detailed description is given in the following paragraphs.

While the definition of energy cooperatives is clear, the situation varies across energy communities. The heterogeneity in the sector has led to a variety of different definitions. According to the International Renewable Energy Agency's (IRENA) Coalition for Action, energy projects are counted as community energy if they fulfil two of the following three elements (IRENA Coalition, 2018):

1. Local stakeholders own the majority or all of a renewable energy project;
2. Voting control rests with a community-based organization;
3. The majority of social and economic benefits are distributed locally.

As can be seen from all these elements, a strong focus on the locality of these (renewable) energy projects is key to the definition of community energy. Hicks and Ison (2018) go beyond these three elements, characterizing community energy along five spectra, which include:

1. Range of actors (from local individuals to international institutions/companies);
2. Distribution of voting rights and balance of decision-making power;
3. Distribution of financial benefits;
4. Scale of technology (from adjusted to local needs to focus on maximizing profit);
5. Level of community engagement.

Walker and Devine-Wright (2008) proposed a framework of analysis to characterize community energy projects, identifying two key dimensions: the process dimension, interpreted as "who the project is developed and run by […]"; and the outcome dimension, i.e. "[...] who the project is for and benefits in economic and social terms [...]". By taking advantage of the work of Candelise and Ruggieri (2017), community energy initiatives span between two extreme situations, as seen in Figure 3. The bottom left quadrant includes the cases in which a project is developed by an institution external to

the community, with minimal or no involvement of citizens, and only producing returns for the institution and its shareholders (e.g. a utility developed wind farm). On the opposite side of the spectrum there are the projects highlighting citizens' participation, which aim to bring returns and collective benefits to local communities. While recognizing the possibility of several possible combinations of processes and outcomes within the latter, the authors identify different typologies of projects, i.e. those that place more emphasis on the participative nature of the process (viewpoint A), while others are more concerned with the redistribution among citizens of the project benefits (viewpoint B) (Candelise and Ruggieri, 2017).

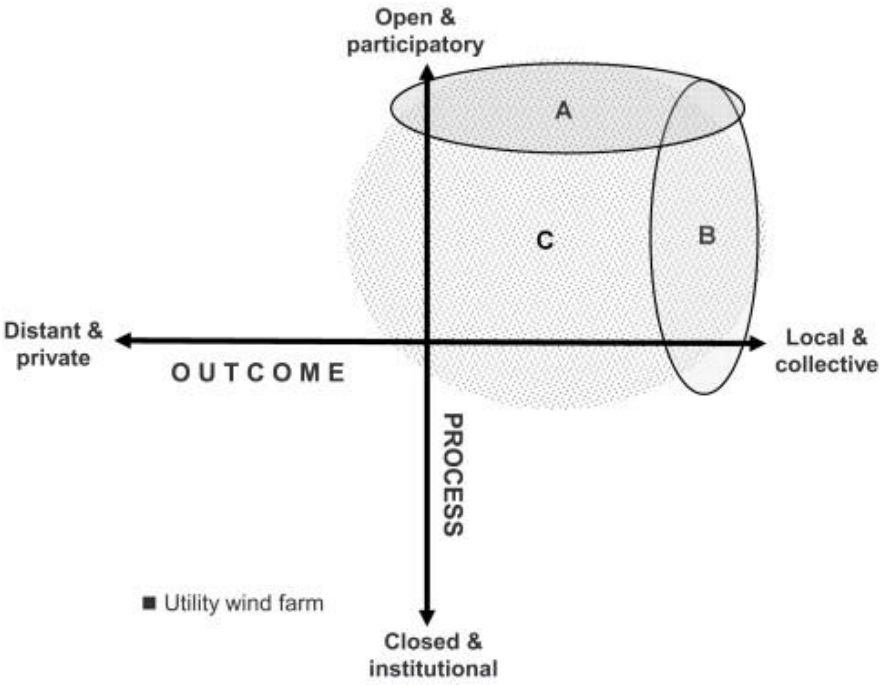

Figure 3 - Community energy – two dimensions. Understanding of community renewable energy in relation to project process and outcome dimensions (Walker and Devine-Wright, 2008).

Candelise and Ruggieri (2017) also identifies the institutional characteristics of community energy initiatives as affected by two major features:

- An economic element (as community energy initiatives are organizations operating in the energy market which can create revenues for their members);
- A community/participatory element.

The overall institutional structure of community energy initiatives can be affected by the relative weight of these two elements, which can skew them toward more market- or community-based logics in their dynamics of development and operation (Candelise and Ruggieri, 2017).

In general, it is relevant to highlight how organizational structure of collective action initiatives and - within that - the choice of the legal form is affected not just by the dynamics of creation, motivations and objectives of the initiative, but also by the legal framework of the specific country in which they are developed (e.g. possibility for tax exemption, member participation and decision-making processes, re-distribution of profits, codifying of goals for the enterprise).

The Council of European Energy Regulators (2019) has identified three different types of CAIs regarding their operations:

- *Community owned generation assets* (the most common type of energy community). They do not self-consume and sell the energy to a supplier. The income is shared or reinvested.
- *Virtual sharing over the grid*. They own and manage assets, share the profits and the energy produced among their members. They can be organized through a common supplier that is in charge of matching between production and consumption and supplies additional energy if it is needed.

Sharing of local production through community grids. The energy is physically shared through a community grid (island or islanded space).

There is a wide variety of technologies and strategies adopted by different energy communities (Oteman et al., 2014). Dominant technologies in this respect include wind turbines, photovoltaics (PV) and bio-energy (bio-gas) (Moss et al., 2015). From a survey of energy communities within the UK, Seyfang et al. (2013) found that solar PV was by far the most common technology, followed by solar thermal, heat pumps, onshore wind, biomass, followed by hydropower. Solar is also the dominant technology for energy cooperatives in Germany, however it is not at all prominent in Denmark or the Netherlands, where wind power is more popular (Oteman et al., 2014).

Some initiatives, such as the Transition Towns in the UK, do not advocate for specific technologies. Instead, they emphasize the need to transition away from fossil fuel sources (Seyfang and Haxeltine, 2012). Likewise, the *Energiewende* (energy transition) in Germany was influenced by elements within the civil society that opposed nuclear power after the 2011 Fukushima disaster (Moss et al., 2015).

Energy communities foster and strive for *economic goals* (e.g., reducing home energy bills, generating income for the communities, reducing energy poverty, local economic development, skills development, and job creation), *environmental goals* (e.g., reducing carbon emissions, improving the local environment), *social goals* (e.g., health and wellbeing, education, social cohesion, social inclusion, volunteerism), *political goals* (e.g., community empowerment, influencing energy policy, community leadership), and *infrastructural goals* (e.g., energy independence, building refurbishment). Out of all these goals, the top three found to be most significant in energy communities were reducing household energy bills, reducing emissions, and energy independence (Seyfang et al., 2013).

4.2.2 Legal forms and governance structure

The legal form can provide valuable initial information within the process dimension, specifically on the organizational structure of a CAI. Legal forms can generally be classified into three categories depending on their relevance for renewable energy CAI:

1) legal forms that require some form of participative decision-making structure, such as the 'one member – one vote' principle (the category with the highest relevance);

2) legal forms that allow for participative structures (but not required);

3) legal forms that do not allow participative structures (the least relevant).

Cooperatives are the most common legal form used in the European community energy sector (Huybrechts and Mertens, 2014; Yildiz et al., 2015) and are generally deemed to provide the best institutional framework for locally owned and participatory approaches to renewable energy projects. They encompass both the social and economic dimension in their scope and are characterised by a 'one member – one vote' decision making process, thus providing high levels of co-determination (ILO, 2013; Viardot, 2013; Huybrechts and Mertens, 2014; Yildiz et al., 2015). Out of the 28 EU member states, plus Norway and Switzerland, 17 countries have national laws that strictly require the 'one member – one vote' principle for cooperatives. Three countries (Sweden, Germany and Finland) additionally allow a proportional voting system, while Slovakian law only allows proportional votes based on membership shares. Luxembourg and Portugal generally adhere to the 'one member – one vote' concept, however it is possible for some members to obtain several votes and Poland only requires the one member – one vote principle for cooperatives with solely natural persons as members. Lastly, 6 countries (Belgium, Bulgaria, Hungary, Ireland, Malta and the Netherlands) do not require specific governance structures (Cocolina, 2016; European Parliament, 2019).

Depending on the national legal framework, other potentially relevant legal forms are associations, (limited) partnerships and foundations or trusts. In several countries, such as Denmark and Sweden, associations and cooperatives are combined into the same legal form (*forening/förening*). In other cases these are separate legal entities, for instance the German 'eingetragene Genossenschaft' (cooperative) and 'eingetragener Verein' (association). Partnerships on the other hand are common legal forms for CAIs in Denmark, especially in the wind energy sector (Wierling et al., 2018). An 'Interessentskap' in Denmark can be set up by a minimum of two legal or natural persons. Equal voting rights are allowed, but not required for this legal form. CAIs in the form of trust can be found in the United Kingdom, as so called 'community development trusts' (Seyfang et al., 2013). These are commonly set up with similar structures as a limited shareholding company, however instead of shareowners it has members. Members generally have the right to vote, however this right can be restricted to a specific group of members (Wilcox, 2019).

The legal form can furthermore provide information on the outcome dimension. Certain legal forms may require the generation and distribution of specific societal benefits. This is the case for the Swedish law, which differentiates between 'ekonomisk förening' (economic association) and 'ideell förening' (non-profit association). The ekonomisk förening is required mainly to promote its members' financial interests, whereas the 'ideel förening' is not allowed to generate profits for its members but rather generate non-monetary societal benefits (Bolagsverket, 2019a, 2019b). A similar classification can be found in the United Kingdom, where the legislation differentiates between the 'cooperative society (co-op)' and the 'community benefit society (bencom)'. The first, again, focuses on the member's financial interests while the second focuses on community benefits (BIS, 2011).

While the specific governance structure varies depending on national legislation, the participative nature of cooperatives is generally ensured through a general assembly, which convenes at regular intervals. For smaller cooperatives, the general assembly may directly manage its affairs. Larger cooperatives tend to have a board of directors, which is elected by the general assembly. Some national legislations, however, always require a board of directors. Additionally, a supervisory council may be required (European Parliament, 2019). In order to operationalize the governance structure for CAIs, COMETS will develop a ranking between different governance structures.

4.2.3 Example of energy community organizational processes: Italy

The main message from Candelise and Ruggieri (2017) in terms of organizational structure and financing of community energy initiatives in Italy can be condensed as follows:

- Initiatives are quite heterogeneous in terms of dynamics of creation and organizational structure;
- The sample (in Italy) is quite small so not that easy to characterize and define prevailing structures and practices;
- Several initiatives are top-down, with an emerging role of local authorities as proponents;
- The cooperative is the prevailing legal form, although evidence shows that it is not a guarantee of high levels of citizens participation to the initiative: citizens ownership is not necessarily higher in cooperatives versus limited companies;
- The prevailing financing structure is equity from citizens, with some role for local banks in providing debt for larger projects.

Similar analysis has been done for other EU countries, e.g. Germany (Yildiz, 2014; Yildiz et al., 2015) and the UK (Seyfang et al., 2013).

4.3 Resource control and mobilization: identifying dimensions and explanatory dimensions

As a starting point in operationalizing the concept of CAIs, it could be useful to pinpoint the following processes of mobilization that aim to exercise control upon resources needed for collective action. Resource control and the way it is implemented are fundamental for supporting mobilization and for having shared benefits. The nature of resources mobilized by the collective are also crucial to understand the features of collective action dynamics. For example, the fact that benefits are monetary or non-monetary is interesting to understand what the goals of collective action are.

1. **Community energy initiatives** have the following characteristics:
    - A form of **citizens ownership or financing** of an energy project;
    - **Citizens directly benefit** from the outcomes of the initiative.

2. **Other initiatives**, which do not fall in the definition of community energy above, i.e. citizens do not own or finance them necessarily (e.g. associations, grassroots initiatives for climate change reduction or fuel poverty alleviation) and where the objectives and the outcomes of

the initiative do not necessarily benefit their members, but is the benefit of a wider audience or a wider cause related to the energy transition.

Community energy initiatives are the most studied and have most data, usually regarding the actions driven by collectives and the outcomes they can generate. They can be structured and characterized in different ways, focusing on different types of activities and deliver different combinations of outcomes. They can be local or have a larger geographical scope. This indeed has an impact on their organizational, financing and economic structures. That is why COMETS proposes the two-dimension figure below (from Candelise and Ruggieri, 2017) to characterize them along the process and the outcome dimension. These two dimensions are further described with the use of explanatory variables indicated in the next section in order to develop more detailed data and information to better characterize and analyze their organizational structure and its implications.

In Figure 4, the process dimension (intended as the set of variables and elements which define how the initiative has been set up, why and how) spans from initiatives that are more market-based and less participative in their process, to those more driven by community logic. Along the outcome dimension, initiatives differentiate themselves by the type of benefits offered, i.e. monetary benefits (such as economic returns on investment or electricity bills savings), or non-monetary benefits (such as energy services or educational activities), or a combination of the two.

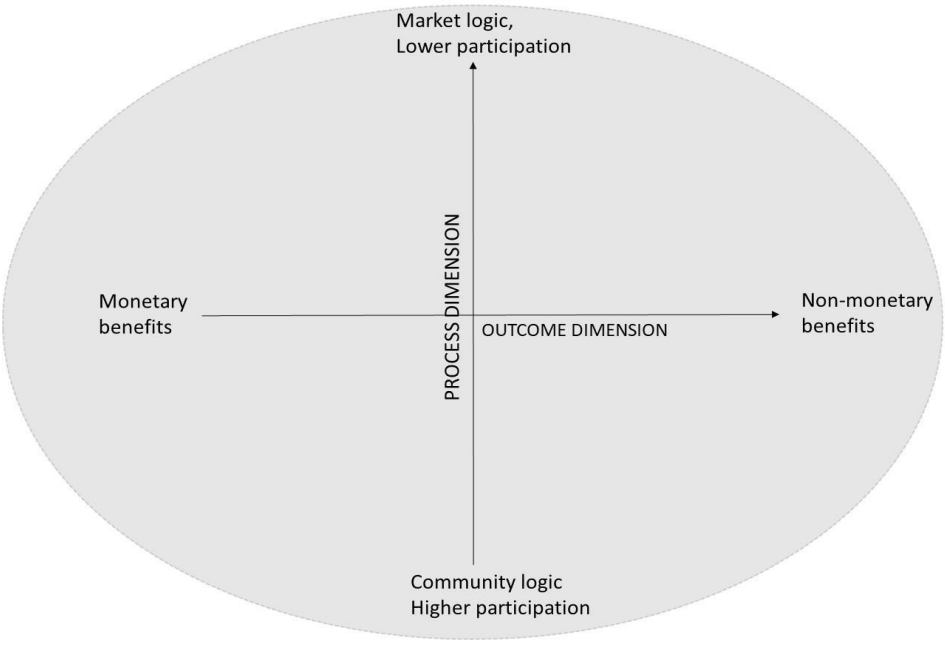

Figure 4- Characterizing community energy along the Process and Outcome dimensions (Candelise and Ruggieri, 2017)

CAIs and the energy transition: Naturally, a prerequisite to the classification along the Process and Outcome dimensions is the relevance of the CAI for the energy transition. Contributions to the energy transition can be associated to activities in the generation, distribution, trade and consumption of renewable energy, energy poverty reduction, awareness raising or the smart energy sector (Bauwens, 2019). Additional relevant contributions involve activities in the transport and energy efficiency sectors. Thus, the topic of 'energy transition' is rather an identifying dimension, as it limits

the scope for CAIs. Whereas 'Social innovation' is an explanatory dimension, as it describes new qualitative forms of CAIs.

In order to evaluate the strength of resource control management, further investigation of the organizational structures and financial issues of CAIs in Europe is needed. Evidence will be gathered along the COMETS project and the outcome dimensions identified above will be further classified into organizational and economic variables.

The financing issue of CAIs is intrinsically connected to the organizational structure of a CAI and its legal form. Therefore, a discussion of financing and economic governance cannot be separated from the requirements given by the legal form. Of course, minimum share requirements and regulation on share distributions both influence the membership structure and the extent of participation.

Funding strategies include the following:

- *Member-share financed*. A typical strategy for energy cooperatives and most relevant way of financing in general. Concepts of member-share financing can vary, depending on the country and/or legal form. For instance, in the German 'eingetragene Genossenschaft', a member normally buys one or several shares upon becoming a member, with each share having a fixed price that rarely changes over the years. In Sweden, on the other hand, shares are often tied to the amount of kWh a member wishes to purchase per year, and the fee must be paid each year. As found by Wierling et al. (2018), the accumulated amount of shares in energy-related cooperatives in Germany is estimated to be about 600 Mill. Euro.
- *Bank loans or community loans (lending model).* Strategy for community energy initiatives in general with strong local focus. Of course, the option for the lending model depends on the soundness of chosen legal structures and connected liability requirements.
- *Governmental subsidies, tax exemptions and other support-schemes*. The viability of chosen business models is crucially connected to the sustained financial support as seen by the downturn of Danish energy cooperatives (Wierling et al., 2018).
- *Crowdfunding platforms.*
- *Re-financing through economic returns.*
- *Donations.*

The most important explanatory dimension for the extent of funding is the envisioned engagement in a renewable energy sector. While PV projects can be done on a small scale and, therefore, only require a modest investment, current wind project (in particular, offshore wind projects) cannot be started without considerable financial commitments and long-term financial planning. With the general increase in the size and complexity of renewable energy projects, the scope for 'traditional' collective action initiatives is thus shrinking, demanding an adoption of innovative business models in the future.

4.4 Opportunities and threats. External conditions influencing CAIs development

There are many external conditions that influence CAIs creation and development. The motivations are diverse and differ from country to country, even between regions of the same country. This depends on their specific challenges, such as historical development of national energy markets and other cultural, economic and political factors.

In general terms, concerning the facilitating factors, the presence of a strong environmental motivation of the key stakeholders involved is the presence of clear external financial incentives, and the presence of a social support system (for example in terms of sharing a common identity and ideas) have all worked as positive driving forces for the development of CAIs. (Carrus et al., 2019). A study in Denmark, Germany and The Netherlands demonstrates that an evolving institutional configuration of the energy sector strongly influences the available space for community initiative development (Oteman et al., 2014). Another study in Spain concludes that the cooperative tradition is one of the factors that impulse the emergence of energy cooperatives in Catalonia or the Basque Country (Jimenez et al., forthcoming).

But there are also barriers to establish a collective initiative, such as the lack of awareness, community spirit and environmental concerns. Another big issue is legislation, especially legal uncertainty and many bureaucratic burdens individuals and collectives face when deciding to start an initiative. Thirdly, technological gaps still have to be closed, such as the stabilization of grid infrastructure (Carrus et al., 2019).

4.4.1 The role of regulatory frameworks

The regulatory framework plays an important role in the creation and development of CAIs. In the last decades, political and legal frameworks in all Europe have been designed to support an energy system based on centralised production using fossil fuels, in which citizens were passive consumers. But the role of consumers has changed and nowadays they are increasingly becoming 'prosumers', broadly 'energy citizens', drivers of the energy transition (Roberts et al., 2014) to a fairer, democratic, decentralised and with added social benefits energy (Friends of Earth Europe, 2018). In addition to this, some CAIs not only own the production of energy, but citizens are also now designing creative legal strategies to introduce themselves in the areas of grid ownership and management, and energy supply.

An analysis of community ownership and participation in the production of renewable energy (Roberts et al., 2014) showed that CAIs take many different legal forms. The choice often relates to the goals of the particular community, including tax treatment, profits, or even laws and legal frameworks. Some illustrative examples are shown in this section.

Nevertheless, citizens engagement in renewable energy production only found support in some local and national policies (Friends of Earth Europe, 2018). The community energy is less developed in Southern, Central and Eastern Europe, mainly due to the lack of supportive frameworks, or indeed some abrupt policy changes (withdrawal of support, sometimes retroactively). After 2000, changes in the EU energy policy provided some opportunities, such as the liberalisation of the electricity market. The Clean Energy Package, agreed by the EU in 2018, is a significant change.

The community energy movement received a boost through the EU´s 2030 climate and energy legislative framework that gives more chances for citizens to get involved in the energy transition, allowing communities and individuals the right to generate, store, consume and sell their own energy.

The Clean Energy for all Europeans package includes the RED II (The Renewable Energy Directive II, directive 2018/2001/EU). The RED II aims to meet EU emissions reduction commitments under the Paris Agreement. The directive establishes a renewable energy target for 2030 of at least 32%, with a clause for a possible upward revision by 2023. EU countries are required to draft the 10-year National Energy & Climate Plans (NECPs) for 2021-2030, outlining how they will meet the new 2030 targets for renewable energy and energy efficiency. This Directive is important for CAIs in the energy sector because it highlights: a) citizens and communities are stakeholders in the Energy System; b) citizens and communities have the right to produce, store, consume and sell renewable energy, and other rights such as consumers protection or access to all energy markets directly or through a third party; c) requires from the Member States a National Climate and Energy Plan; d) it simplifies administration and procedures.[7]

As the concept of energy communities is varied, the approach and support by the legislative frameworks vary between Member States e.g. in the Netherlands it is established a regulatory exemption in licensing requirements for new business models, while in Germany there are special rules in action schemes for RES support (Tounquet et al., 2019). This emphasizes that Germany and Denmark support a more classical local renewable energy community business models, while the UK, the Netherlands and Poland support more innovative business models.

An in-depth assessment of the treatment of energy communities in the 28 draft National Climate and Energy Plans (NECPs) was done by REScoop - the European federation of renewable energy cooperatives, in collaboration with the European University Viadrina (Roberts and Gauthier, 2019). The final plans will be due at the end of 2019 and have to be adopted by 30 June 2021. The analysis compiles relevant information about the NECPs. One of the conclusions is that most Member States positively acknowledge renewable energy communities (RECs) in their NECPs and some demonstrate their planned commitment. However, in most cases, this acknowledgment lacks concrete policies or measures. In the analysis of the NECPs, some Member States, like Greece, demonstrate a strong engagement with the role of energy communities in their energy system, whereas others, such as Sweden and Germany, completely ignore this role.

Other recent studies investigate the connection between community energy and social innovation (Riutort Isern, 2015; Kent, 2018). The first study concludes that community energy can be a catalyst for a deeper social change, which goes beyond the impact on people´s energy behaviour. The processes of integrating and contesting led by the community energy initiatives influence the creation of new governance practices.

[7] For a simplified analisys of the RED II Directive see Friends of the Earth Europe (2018).

A recent study estimates that half of all the European Union citizens could be producing their own electricity by 2050 and meeting 45% of the EU´s energy demand (Delf, 2016). This would only be possible assuming that policy and regulatory barriers are removed and national grids, distribution networks and electricity markets are developed in parallel with the growth of renewable energy production, more storage options and flexible demand side management.

Advances in technologies, telecommunications and data analytics provide CAIs new chances and opportunities. The digitalisation of the energy sector gives suppliers the opportunity to have a stronger relationship with consumers. The security and protection of these data should be completely guaranteed (Eurelectric, 2016)

The structure of the energy sector is complex. It includes the relationships among energy production, energy storage, distribution, energy market and energy demand and consumption (Yarnal). However, the traditional European energy systems (in terms of its technical and commercial market design) and its regulatory framework, are organized according to a traditional value chain of production, transport, storage, and distribution of energy, that picture is now far from the reality due to the changes produced in the last years (Hoppe et al., 2018).

4.4.2 Regulatory frameworks and the energy transition: examples across Europe

Spain

The collective energy consumption was specifically affected when the so-called 'sun tax' legislation introduced in 2015 imposed restrictions on shared residential self-consumption from PV systems. Consequently, self-consumption was only allowed for common elements, such as the garage, electricity in the staircases or elevators, and for individual neighbours having their own installation.

This regulation was appealed against at the Constitutional Court by the Government of Catalonia arguing a breach in the scope of competences assumed by the Government of Catalonia in matters of promotion and management of renewable energies and energy efficiency. The Constitutional Court ruled in favour of the Government of Catalonia and removed the provision that outlawed shared residential self-consumption from PV systems and supports the possibility of implementing self-consumption systems in residential areas and multi-apartment buildings where several users can benefit from them. The sentence highlights that these systems are a means to implement the nearly zero-energy buildings to which the European Union obliges after 2020.

The Constitutional Court also stated that the State does not have the power to enrol and to manage the registration of the systems, which is under the competence of the autonomous communities. This means that the autonomous communities are responsible for regulating the shared self-consumption systems and their registering system.

However, there is currently a legal gap and any homeowners' association could install their system without any regional regulation. It seems that the autonomous communities have different visions regarding the need to regulate shared self-consumption systems. While some autonomous communities analyse the possibility of having regional regulations to assure a greater legal security

for citizens who decide to share the energy they generate, other autonomous communities do not see the necessity for such a regulation.

In addition, the Spanish Government has presented a new regulatory proposal that, among other measures, regulates technical and economically shared residential self-consumption. The draft regulates shared self-consumption whether the owner of the system is the consumer of the energy produced or not. This entails that the regulation accepts that the owner of the system supplies the energy to several consumers, opening a new business niche. However, the regulation establishes several restrictive elements. First, the self-consumption system must be in the same property registry number as the consumption point. Second, the electricity generated by the system will be distributed among consumers depending on the power they have contracted unless they reach a different agreement. This individual fee is paid every hour, so the that the energy that is not consumed every 60 minutes is injected into the network. Therefore, it is not possible to compensate some consumption points with others. Although in some cases the energy surplus can be sold, the imposition of an individual fee cancels the main advantage of sharing the same system, making the most of all the self-generated energy and avoiding having energy surpluses.

The current situation for collective energy consumption from PV systems is very uncertain. Although after the sentence of the Constitutional Court shared residential self-consumption is allowed, the legal uncertainty and the unsecure regulatory environment is a barrier for collective action in this field (Velte, 2018)

The Netherlands

The Netherlands lags behind the EU-27 average share of renewable within the total energy production capacity: 3.6% versus 8.7% (Eurostat, 2019). Van der Schoor and Scholtens (2014) conclude that CAIs in northern Netherlands are emergent organizations, still undergoing organizational development. There is still some lack of specificity of goals at the local level, and active citizen engagement in municipal energy plans. The difficulty is that institutional organization of the energy sector in the Netherlands has traditionally been market-oriented, and this has left little space for civil society to influence the energy transition through CAIs. The discourse in the Netherlands has predominately been about economic efficiency of the energy system, and this leaves little space for the emergence of CAIs that are motivated by environmental issues (Oteman et al., 2014).

Historically, The Netherlands has exploited its gas fields, particularly in the North. In the effort to transition to a low carbon economy, regional governments are seeking to broaden their energy profiles (Hasanov and Zuidema, 2018). Local energy initiatives are beginning to emerge, motivated by increasing awareness of climate and global sustainability challenges, and a desire to foster more cohesion within communities. In the current legislation in The Netherlands, energy producers are responsible for VAT and energy taxes, unless the energy is produced beyond the personal meter. Energy communities are collectively lobbying to expand the tax exemption to apply to collective energy production (Dóci et al., 2015).

Germany

In Germany, the *Energiewende* (energy transition) encapsulates the strategy of phasing out nuclear power in favor of renewable energy while maintaining economic growth. The strategy stipulates that the last nuclear power plant will be decommissioned in 2022 and that by 2050, renewables will constitute 60% of Germany's energy portfolio. Currently, four firms control over 80% of the market for fossil and nuclear-based energy (Oteman et al., 2014). Of the renewable-based energy in Germany, nearly half is owned by private households, cooperatives or farmers. The largest group of energy cooperatives in Germany are based on solar energy and this has increased rapidly since 2007. There are also a few (45) wind cooperatives that began in the 1990s with a feed in tariff, and they therefore have a longer institutional legacy (Oteman et al., 2014).

The *Energiewende* has created a 'window of opportunity' for the CAIs that can align their visions within the new state strategy (Oteman et al., 2014). As such, this places challenges on local regions to develop energy self-sufficiency. While many regional authorities see a political opportunity for strengthening regulations, other non-governmental actors also are being mobilized: famers who can provide biomass or space for new wind turbines, prosumer networks, and green energy investors (Moss et al., 2015).

The *Energiewende* has had the effect of shifting institutions in villages, towns and regions. The *Energiewende* was not simply a top-down policy rollout; it promoted action from local institutions who saw an opportunity to benefit (or at least avoid harm) from the new initiative. This has led to not only a proliferation of energy cooperatives within Germany, but also to traditional energy service providers and mining firms to seek alliances with existing institutions to protect their interests, resulting in complicated power structures and a patchwork of infrastructure ownership. This mix of top-down and bottom-up agendas has generated heterogeneous actor constellations (Moss et al., 2015).

Moreover, German law allows citizens to found energy collectives rather easily, and German citizens have a fair amount of disposable income with which to invest collectively in local energy projects. Finally, there is well-developed cultural attachment to a homeland in Germany, which can strengthen the social aspect of local energy communities (Magnani and Osti, 2016).

United Kingdom

Community energy projects are seen as essential to sustainable energy transition and are supported by national policies of different party coalitions within the UK. Many policies seek to catalyze the role of CAIs, across Scotland, Wales, and England, through education campaigns, building energy efficiency, and energy communities (Seyfang et al., 2013).

According to Seyfang and Haxltine (2012), the Transition Towns movement in the UK is a movement instantiated by the twin sustainable development challenges of climate change and peak oil, and thus the need to divest from fossil fuels. Thus far, the Transition Towns movement in the UK has been largely successful in replicating their model to different communities internationally. However, they have seen less success in scaling up their activities to a larger membership base within the communities. It is also too early to tell what degree of success they have had in translating their

efforts to address other sustainability goals and initiatives, largely due to challenges of attracting wider interest, funding, and maintaining momentum. The authors found the Transition Towns often struggled with their visions, creating ambitions that were not necessarily achievable or realistic, and, at the same time, as a hierarchical accrediting institution they have remained vigilant about trying to protect the Transitions Town 'brand' from failed projects. The learning aspect has at times stagnated with awareness raising films that fail to draw in new local members. Nevertheless, the Transition Towns movement has grown rapidly, and has links to other voluntary organizations, social enterprises, and political parties (Seyfang and Haxeltine, 2012).

Italy

Hydroelectric power has traditionally been the most important renewable energy source in Italy, though this source has not expanded since the 1950s (Magnani and Osti, 2016). More recently, since 2009, solar voltaic installations have increased dramatically as a result of a generous feed-in-tariff. There are over half a million solar photovoltaic producers in Italy now (Magnani and Osti, 2016). With the liberalization of the energy system, new land-use tensions arose between agricultural biogas facilities, wind parks, and solar photovoltaic plants. As civil society becomes more mobilized in the energy transition, land-use is becoming the most frequent type of environmental controversy within Italy (Magnani and Osti, 2016). Though the energy market in Italy is still controlled by a few large firms, the energy CAIs have nevertheless continued to expand, including prosumer networks and energy purchasing associations. Despite this, the influence of energy communities on the sustainable energy transition in Italy has been slow to take shape, especially when compared to Northern European countries. This is largely due to administrative and socio-economics conditions in Italy and the large amount of power and influence held by the small number of large firms in the energy sector. Moreover, the complex legal aspects of collective energy project ownership still present a significant barrier, requiring specialized legal competencies (Magnani and Osti, 2016).

Finland

Energy communities in Finland are renewable energy projects or energy savings projects that have links to community action. Community energy in Finland is driven by local communities investing in solar panels, and an initiative of the NGO Friends of the Earth Europe to promote energy prosumers (Ruggiero et al., 2018). The role of energy communities in Finland is small, though the National Energy and Climate Plan recognizes the benefits of distributed generation and local energy self-sufficiency. However, there is limited policy support for local community energy production; the Finnish government has traditionally prioritized energy intensive industries. As such, investment grants are only available to companies, municipalities, and other similar legal entities, but not to individuals (Ruggiero et al., 2018).

The authors also identified three types of collective energy projects in Finland: cost reduction initiatives (motivated to reduce energy costs and combat energy poverty), technical expertise projects (led by a few members to address particular technical problems with existing energy infrastructure in the community) and system change projects (aiming to create new ways for producing energy and living more sustainably). One of the largest barriers in the Finnish context is

the lack of a shared vision, and this prevents the scaling up of energy communities (Ruggiero et al., 2018).

4.5 First set of dimensions to be accounted for in the following project activities

Based on sub-sections 4.1-4.4, a preliminary set of dimensions – to be later adapted to the specific research and engagement tools that will be used in the following phases of COMETS - is below identified to describe CAIs' profile, development and effects.

Interests and values:

- Individual interests: e.g. saving money; energy self-management; energy security and autonomy; sociability.
- Collective interests: e.g. sharing consumption and production; well-being improvement; environmental improvement; equality; solidarity; social inclusion; restoration of common goods; overcoming of prices as way to evaluate values.
- Moral values: closeness to wilderness or nature; ecological awareness; pro-environment mobilization, etc. (here we underlie the morality of the actions taken by humanity as regards the transformation of both the natural environment and its own collective nature).

Organisational process:

- Membership structure: number of members; openness to new members (whether membership is restricted to specific groups and whether membership is voluntary or required for certain individuals); members characteristics (e.g. socio-demographic characteristics, in case of natural persons); geographical scope of the initiatives (in particular, whether citizens involved are geographically close to the project (local) or spread over wider territories (e.g. national)).
- Types of activity: primary activity (whether energy production, energy consumption, energy services or a mix of those); characteristics of the projects implemented (e.g. technology type, plant size).
- Dynamics of organization: timing of creation and development; proponent(s) of the initiative; approach adopted, e.g. bottom up approaches (cases in which the launch and development of the project are driven by citizens or other types of grassroots organizations) or top down approach (cases where is another institution, such a local authority or a private company, leading the process, defining the structural features of the project and facilitating/steering the project development and the citizens' involvement).
- Organisational structure: legal form of the project (e.g. cooperative, limited company or other forms); instrument offered to citizens (i.e. equity or debt); ownership and level of citizens' involvement; organisational network (whether the CAI is part of a larger group/conglomerate or in turn owns subsidiaries itself).

- Distribution of benefits: collective aspect of benefit distribution (i.e. distribution to a single entity, only to members, to the external society); geographical aspect of benefit distribution (i.e. benefits for local society, or national/ international society).

Mobilisation and resources' control:

- Financing structure: e.g. self-funding, bank loaning, cooperative funding or a combination of those.
- Financial sustainability: e.g. duration of CAIs; sustainability of CAI goals beyond CAI existence; level of fulfilment of purpose.
- Benefits provided: monetary benefits (e.g. returns on investment offered, including potential saving on electricity bills); non-monetary benefits (any other services and benefits accruing from the project, e.g. other energy or community services provided, collective control of benefits distribution).
- Social innovation: e.g. jobs and wealth creation; energy poverty reduction; citizens participation and democratic empowerment; increased social acceptance of renewables; increased energy security; higher awareness of sustainable practices; challenging the status-quo and existing social technical regimes; strengthened social networks and social movements; gender equality.

Opportunities and threats:

- Environmental motivation and commitment of key stakeholders.
- Presence of clear and stable financial incentives framework.
- Supportive norms and regulatory framework.
- Presence of a supporting social environment (for example in terms of sharing a common identity and ideas).
- Presence of a local/national cooperative tradition and of a community spirit.
- Technological gaps: (e.g. stabilization of grid infrastructure).

5 Conclusions

This deliverable has shown how vast is the issue of collective action and how it is quickly increasing when applied to the energy field. Rather than just merging all the contributions and perspectives explored in this deliverable, we proposed a preliminary framework that both helps in taking into consideration the diverse perspectives here explored and could support the development of the following stages of the COMETS project. The expectation is for a refinement of the framework itself on the basis of the next activities' results, namely the evidences that will derive from WP2, WP3 and WP4.

As a general remark, we can say that collective action is the most fundamental form of social reality. Every social institution, relation, practice, but also every good, service, and facility rests upon the capacity of groups of individuals to engage in various forms of collective intentional behavior. A preliminary understanding of the 'social' requires an understanding of the nature of collective agency and of how the various aspects of the social world are grounded in it (Ludwig, 2016). Thus, we can claim that collective action is foundational of any mode of existence, as well as of the individuals participating in it. In this perspective, the collective comes before the individual inasmuch individualization is a process that takes ground inside the collective itself.

Referring here to what we introduced in Section 2, the first consequence of collective action is a collective good, and such a good, as in the case of energy, is non-excludable, not appropriable or eligible to be privatized for individual profit and utility: it can be privately consumed but without being subtracted to others. The collective action that produces new types of goods or commons, or is able to restore old commons that had been monopolized, captured by market forces or privatized, is social innovation. This 'commonalization' of energy is a process, implicitly innovative in itself, and able to push further innovative adaptation of the socio-economic structure. Therefore, the ambition is to explore collective action as a mean to put in motion, and then generate, collective goods such as energy – or, better, the different ways in which energy manifests - thus pushing social innovation. Social innovation thus results as the consequence of collective action and not as its premise.

In short, the social relevance of CAIs for the energy transition comes from the fact that: from one side, it can be the trigger, or at least the accelerator, of this crucial transition; from the other side, it is also able to create new conditions for collective and cooperating behaviour, thus generating or reinforcing social innovation. Collective action implies a self-generation of motivations and interests, those that can be linked both to further innovation as well as to disappointment regarding certain ways to manage a material thing such as energy.

Regarding the rising, diffusion and evolution of CAIs in the energy field, we identified some factors and dimensions (as listed in Section 4.5) that seem to play a crucial role. These can already provide a good, although provisional set of elements, that will be applied, and whose relevance will be tested, throughout next activities.

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