

Collective Action Initiatives in the Energy Transition. Supporters of a strong sustainability paradigm?

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Abstract: The overall objective of this contribution is to investigate Collective Action Initiatives (CAIs) in the energy sector (e.g. energy communities, cooperatives and purchasing groups) as a trigger for the implementation of a strong sustainability paradigm. The assumption is that the active involvement of citizens in the energy chain is a crucial requirement when considering the diverse dimensions of sustainability and to define and implement strategies that go beyond the technology-based weak sustainability paradigm.

A description is provided of the potential that CAIs have in supporting the UN Sustainable Development Goals, seen as an attempt to operationalise a strong sustainability paradigm. Then, through the analysis of a limited number of case studies, we argued that CAIs development might create the conditions for supporting SDGs through the provision of relevant social and economic changes. Finally, we explored the effect these changes might have in addressing three layers of sustainability (long-term horizon, energy transition and the local dimension).

Keywords: energy transition, collective actions, citizen engagement, strong sustainability, SDGs.

1. Collective Action Initiatives (CAIs) and sustainable development

1.1 CAIs in the energy field

Collective action is seen in several forms of social life: from communities, cooperatives, collectives and groups, to teams, clans, tribes, villages and neighbourhoods. Certainly, collective action represents the bedrock for social life. Any action by a member of the social body is wrapped in bundles of collective action, which involve agents and agencies of different nature.

Collective action is a perennial problem for social and philosophical sciences. For instance, it 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).

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).

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 the likeliest for people. 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 cooperators; the worst scenario involves a society in which all operate egoistically (Reisman, 1990).

With CAIs being such an important piece of the fabric of social life, we must then investigate the main features of CAIs. Figure 1 shows the interaction among the four main components, or variable characteristics, of contenders in the energy field, namely: interest, organization, mobilization and opportunity. The first dimension, *Interests*, refers to the gains and losses resulting from a group's interaction with other groups. *Organization* refers to the aspect of a group's structure, which most directly affects its capacity to act on its interests. *Mobilization* connects to the process through which both the amount of resources and their collective control by the contender can increase in time. Lastly, *Opportunity* corresponds to the relationship between a CAI and the current state of the world around it. In our adapted framework, this dimension includes power, which in turn, includes the relations to other actors, governments being one of them. The opportunity dimension also includes reactions to the CAI, either facilitation or repression, that affects its cost-benefit ratio. Changes in these relationships can threaten a group's interests or alternatively provide new chances to act on those interests.

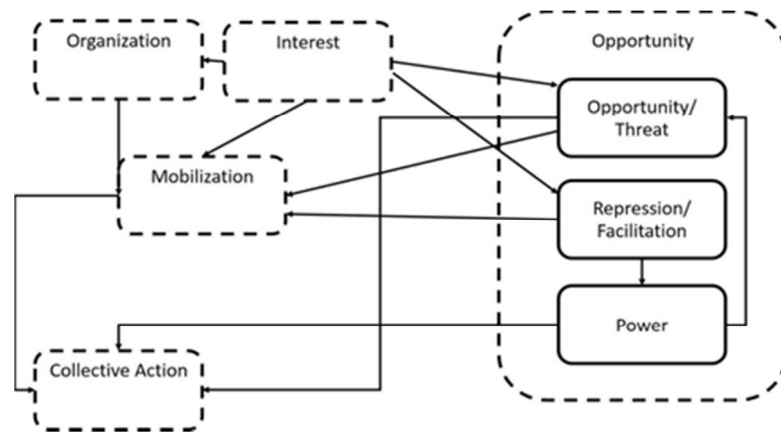


Figure 1 - The mobilization model for CAIs, adapted from Tilly (1978). Source: Gregg et al. (forthcoming).

In relation with the energy field, rather than participating as mere and passive energy consumers, members of a collective can assume several different roles within the energy system (ILO, 2013; DECC, 2014). The concept of collective action in the energy transition is subject to different interpretations within the academic literature, which defines them as any sustainable energy initiative led by nonprofit organizations, not commercially driven or government led (Walker and Devine-Wright, 2008, Hall et al., 2016). Instead they are often established by civil society activists and by social and/or environmental needs (Seyfang et al., 2014). For all CAIs in the energy field, they get the potential and can often influence the ways and the extent to which energy is produced, distributed, consumed, and dissipated thus playing a relevant role in the energy transition to renewable-based sources.

In its most basic terms, the concept of the ‘energy transition’ can be used to describe the passage from a situation where energy is produced through a certain energy mix - or where there is a given distribution of the relative weight of different energy sources - to another situation where energy is produced through a different mix. Today, in the field of environmental and energy policies, the term is used to mean the passage (expected and/or pursued) from an energy mix

largely based on harmful fossil fuel resources, to a mix predominantly based on clean, renewable sources. However, as argued by sustainability transition scholars, a transition is not only to be described in its merely physical aspects, but also involves far-reaching changes along different dimensions: technological, material, organizational, institutional, political, economic and socio-cultural, namely "sustainability transitions are long-term, multi-dimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption" (Markard et al, 2012, p. 956).

Hence, the collective creation of guidelines for sustainable consumption of energy services implies a categorical shift in the conceptualization of energy services from a private service to a common service. Furthermore, collective action initiatives provide a structure for fostering strong sustainability in the energy sector through inherent incentives to develop renewable resources and to promote sustainable consumption patterns. Collective action initiatives thus are a model and accelerator for the sustainable energy transition.

1.2 Weak and strong sustainability in view of SDGs

A widely recognized definition of the sustainability of a socio-economic system refers to the capability of the system to satisfy human needs at present without declining the opportunity of future generations to meet their own needs. This is an intergenerational rule that relies on the maintenance of capital stock and its capacity to generate a flow of goods and services that satisfy human needs. The capital stock, in the sustainability discourse, is not considered from a mere economic perspective but it is disaggregated into four different types: manufactured, human, social and natural (Costanza and Daly, 1992; Dietz and Neumayer 2007).

The provision of human well-being results from the exploitation of these four types of capital to produce the needed flows of goods and services. But in order to guarantee their availability for future generations, the level of capital stock has to be maintained. Weak sustainability is concerned with maintaining the total capital stock, without regard to its composition. It implies that the diverse kinds of capital are more or less substitutable. Strong sustainability, in contrast, calls for the conservation of the separate capital stocks. It assumes that natural and human-made capital are not perfect substitutes, but complementary and that specific efforts to preserve natural capital are required. Moving towards strong sustainability means moving from a siloed perspective towards a holistic perspective able to jointly pursue the reproduction of economic, social, natural and human capital.

A scientific and political endorsement to this multidimensional approach to sustainability was reached in 2015 through the adoption of the UN 2030 Agenda, resulting in 17 Sustainable Development Goals (SDGs). The aim of the goals covers all the relevant aspects to 'improve people's lives and to protect the planet for future generations'.

The sustainable development approach adopted in the SDGs can be considered as an attempt to operationalise a strong sustainability paradigm as it is based on the idea that equity and equality, prosperity and development, human rights and environmental conservation cannot be addressed separately. Indeed, the SDGs have been specifically formulated on the basis of four main elements (UNEP, 2015): human well-being is intrinsically linked to the health of natural ecosystems; global environmental challenges pose a threat to the long-term prosperity of development; addressing inequalities is critical for global sustainable development; sustainable resource management, and maintenance and safeguarding of natural capital are fundamental aspects.

Given the wide-range of goals, targets and indicators, interactions among them are inevitable. Beyond the valuable proponents of the SDGs, many synergies and complementarities can exist. Moreover, trade-offs are also possible when pursuing one objective could trigger negative results in another (Miola et al. 2019).

One clear example of interaction among the goals is the potential trade-off detected between social and environmental SDGs: increasing equality across income groups could produce positive or negative impact on the environment. This, of course, varies among countries (Scherer et al. 2018). Although investigated only in pairs (e.g. water vs. food, water vs. energy) the interaction among the goals varies from indivisibility (two goals can also be pursued jointly) to cancellation (objectives are perfectly contrasting) (Fader et al. 2018).

It is important to note that SDGs themselves and, moreover, the magnitude of these interactions, are also highly contextualized and thus the outcomes strongly depend on their localization and geographical scale (Miola et al 2019).

In dealing with these obscure interactional dynamics and their relevance, a systemic approach needs to be adopted both from the scientific and policy perspectives. With respect to the challenges posed by SDGs, the following section shows to what extent the collective action approach and initiatives in the energy field might play a relevant role in pursuing specific goals and in maximising synergies that addresses potential trade-offs.

2. The contribution of collective action initiatives to SDGs

The energy CAIs' model has a great potential in supporting the SDGs. Not only are they directly connected with some SDGs with regards to energy provision and environmental concerns, namely renewable energy (SDG7), but also climate change (SDG13) and sustainable provision of material needs (SDG9 and SDG12). In addition to other collective-led initiatives, they can play a major role in achieving targets related to sustainable cities and communities (SDG11), livelihoods and employment (SDG1 and SDG8), health and well-being (SDG3), education (SDG4), inequality and discrimination (SDG5 and SDG10), as well as social/institutional innovation for effective partnership and inclusive governance (SDG16 and SDG17).

This potential relies on the fact that the CAIs approach and ethical background is perfectly in line with the six 'essential elements' of the SDGs: dignity, prosperity, justice, partnership, planet and people. This provides practical instances of how the SDGs could be implemented, as a test bed for a scaling-up from the local to the global level¹.

The ambition of this section is to go beyond this alignment and to propose a deeper explanation based on concrete examples of energy CAIs. This includes the mechanisms that, driven by CAIs development, are likely to support the SDGs fulfillment. In other words, to shift from what extent CAIs may impact SDGs to how this impact might be produced.

The hypothesis here is that the interplaying between innovation and the changes in the social and economic fabric triggered by the development of CAIs in the energy sector is able to activate mechanisms that jointly affect a variety of SDGs dimensions, thus fostering the implementation of the strong sustainability paradigm.

The following are different domains of potential effects that might be triggered by CAIs. In the following sections, specific insights and examples are provided about the dynamics at stake.

¹http://wiki.ecolise.eu/index.php?title=Community-led_initiatives_and_the_Sustainable_Development_Goals

Empowerment of citizens and local communities: the process by which individuals, groups, communities and organisations gain confidence and mastery (e.g. autonomy, self-determination, influence) over their lives (Rappaport, 1984) and in claiming their rights. In CAIs, it is also a matter of citizenship education and civic engagement promotion and can be triggered by:

- strong community engagement;
- joint ownership;
- healthy and resilient communities;
- robust local economy.

Reinforcing knowledge assets: energy-CAIs opens many possibilities for reinforcing the knowledge assets of communities and collectives in a sector where participation is traditionally passive (i.e. consumption and consumers' rights). CAIs might favour a knowledge building process where the gap between 'experts' and 'non-experts' is reduced and the knowledge itself will be much more distributed. Keywords of this dimension of CAIs' impact are:

- collective learning;
- community learning;
- shift in awareness on issues related to sustainability;
- spread innovation in technologies, practices and behaviors.

Improving economy: where CAIs propose new ways for locally producing and/or exchanging energy, economies are likely to be improved in quantity and quality through the creation of:

- new types of incomes and businesses;
- new and more fair jobs.

Scaling up and diffusion of collective approach: successful CAIs might attract interest from other areas involved in similar endeavours and can profitably invest efforts in cooperating with multi-regional or international groups, thus pushing an enlargement of the initiatives:

- from the local to national level;
- exporting the model to other countries;
- through cross-borders cooperation to increase impact and power.

Addressing social concerns: CAIs may improve the social conditions of a community as a consequence of the produced economic improvement and as an implementation of their direct commitment in reducing diverse dimensions of social gap (e.g. gender, age, income), thus addressing:

- inequalities and gaps gender;
- poverty and access to resources.

In the next sections argue the potential impact of CAIs model on SDGs fulfillment by mapping the above listed key effects with three layers of strong sustainability: long-term duration of the processes, energy transition, localization of many problems and solutions related to sustainability challenge. These layers result from the clustering of the SDGs that are most likely to be impacted by CAIs development and represent a way to grasp the potential of CAIs in affecting contemporarily many diverse dimensions of sustainability.

2.1 Ensuring long-term sustainability through a collective knowledge building process

As introduced earlier, the definition of sustainable development is inherently intergenerational, thus supporting long-term impacts and visions. It may happen that measures which may even have a formidable potential effect, are not durable in the medium/long run or that their potential is limited or abandoned due to the lack of the competencies and visions they reclaimed or to the insufficient endowment or ability in taking advantage of infrastructures for their implementation or, lastly, to the lack of proper networks able to catalyze resources, knowledge and legitimacy. The challenge of long-term sustainability is therefore a matter of building a strong and shared knowledge framework among the agents of the processes mainly fed by adequate education on sustainability issues (SDG4), as well as by spreading proper tools and competences to fully take advantage of innovation tools (SDG9) and by building effective partnerships and relations of for exchanging information and experiences (SDG17).

CAIs have the potential to help fulfill the long-term challenges by creating a favorable environment to support the development of collective and collaborative learning processes within and among the initiatives. This is achieved by shifting the awareness of citizens about sustainability issues (SDG4 and SDG9). In order to scale up, CAIs have shown to create cooperation at varying levels of the system (i.e. rising from local to the national level) and beyond national boundaries (SDG17).

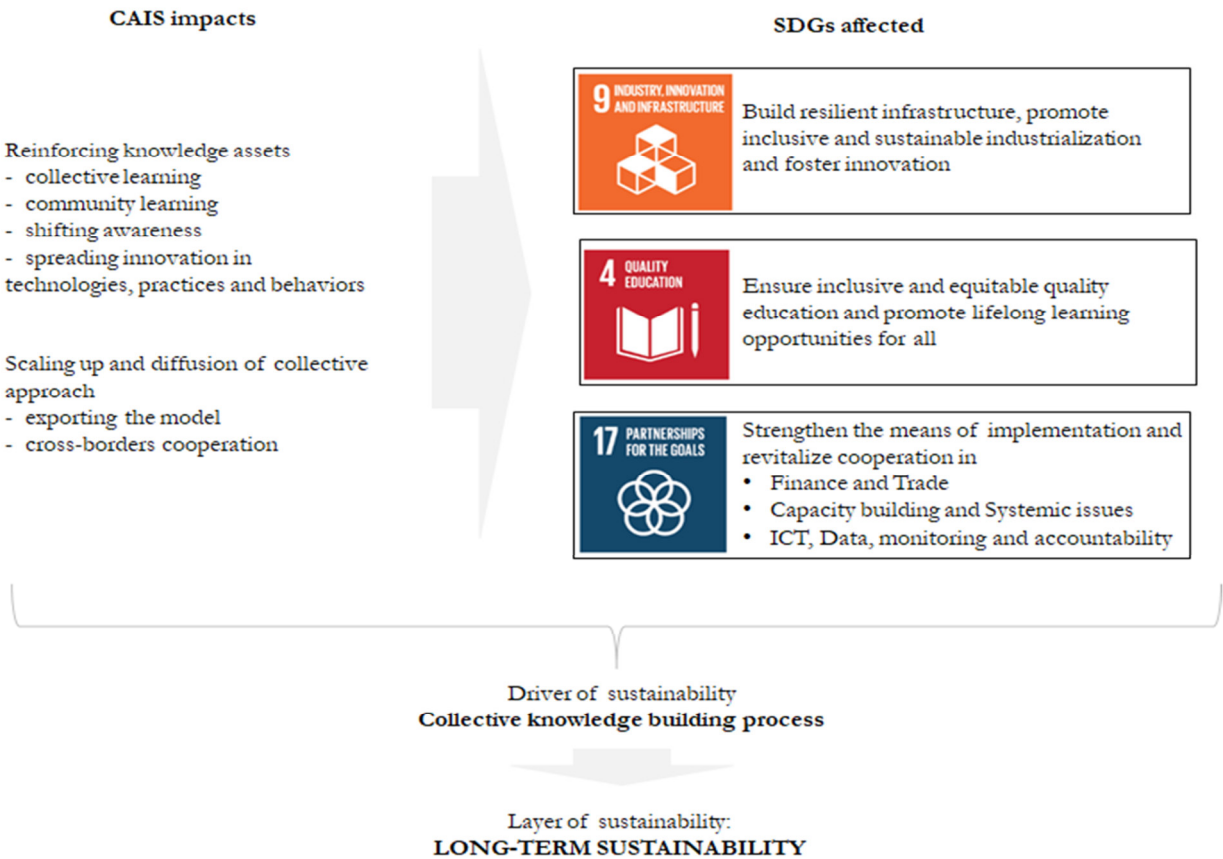


Figure 2: The Long-Term layer of Sustainability: related SDGs and CAIs impacts

Networks of CAIs are rooted in multiple, intersecting and ongoing learning processes, drawing on collective knowledge and wisdom gained over the years by movements and communities around the world. CAIs have been known to generate and share new skills, forms of social

organisation, cultural perspectives and actions necessary to the imperative needs of the SDGs. (Ecolise)

CAIs have the ability to improve and generate new skills, forms of social organisation, and actions necessary to understand and respond to emerging and fast-changing global situations by envisioning, planning, implementing and monitoring regenerative development pathways in local communities. (Ecolise)

Some of this intellectual and cultural capital has been incorporated into specific trainings, such as energy efficiency and demand response seminars and training. For example, Ecovillage Design Education and Transition Training have been proven successful activities used by CAIs in Europe.. In most cases, this takes the form of education about sustainability practices.

Specific educational methodologies, techniques and tools, include:

Ecovillage Design Education (EDE). The EDE was born out of the experiences of long existing communities and cutting edge educators in order to teach how to create a new way of living which brings together the four key dimensions of sustainability: social, cultural/worldview, ecological and economic.

Dragon Dreaming design framework for project and team management design framework and Sociocracy system for inclusive decision-making and governance. Dragon Dreaming is a systematic design process, a philosophy and a methodological framework for the realisation of collaborative and sustainable projects, organisations and platforms, built upon three principles: (Dragon)

- personal growth – commitment to your own healing and empowerment;
- community building – strengthening the communities of which you are a part;
- service to the Earth – enhancing the wellbeing and flourishing of all life.

Other examples of collective action in network building for improving knowledge about sustainability issues:

Transition Towns. The Transition is a movement that has been growing since 2005. It is about communities stepping up to address the big challenges they face by starting local. By coming together, they are able to crowd-source solutions. They seek to nurture a caring culture, one focused on supporting each other, both as groups or as wider communities. (Transition)

Ecovillages. An ecovillage is an intentional, traditional or urban community that is consciously designed through locally owned, participatory processes in all 4 dimensions of sustainability (social, culture, ecology, economy into a whole systems design) to regenerate its social and natural environment. Ecovillages are living laboratories pioneering alternatives and innovative solutions. They are rural or urban settlements with vibrant social structures, vastly diverse, yet united in their actions towards low-impact, high-quality lifestyles (Ecovillage GEN network)

ECOLISE (European network for community-led initiatives on climate change sustainability). All ECOLISE members work on community-led transitions, with the energy transition as a key ingredient. The work of ECOLISE concerns three levels: support of community-led initiatives through knowledge sharing and training opportunities, the facilitation

of collaboration among members and partners, and advocacy at the European level for the creation of policy frameworks supportive of community-led initiatives.

2.2 Supporting the sustainable Energy Transition

When discussing the ‘transition’ of 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. In order to address this challenge, energy should be provided for all (SDG7) together with shifting the energy chain towards a more sustainable model (SDG12). Additionally, attention to the impact of energy on climate change has to be considered as a permanente reference (SDG13).

In this framework, the relevance of CAIs derives from the strong involvement of citizens that pave the way for more sustainable behavior and practices. This is seen through the participation to the ownership of the energy plant (thus addressing SDG12), from the shift in the knowledge and attitude towards more sustainable technologies and practices (addressing SDG 12 and 13) and from the attention paid in the inclusion and reduction of social gap (thus addressing SDG7).

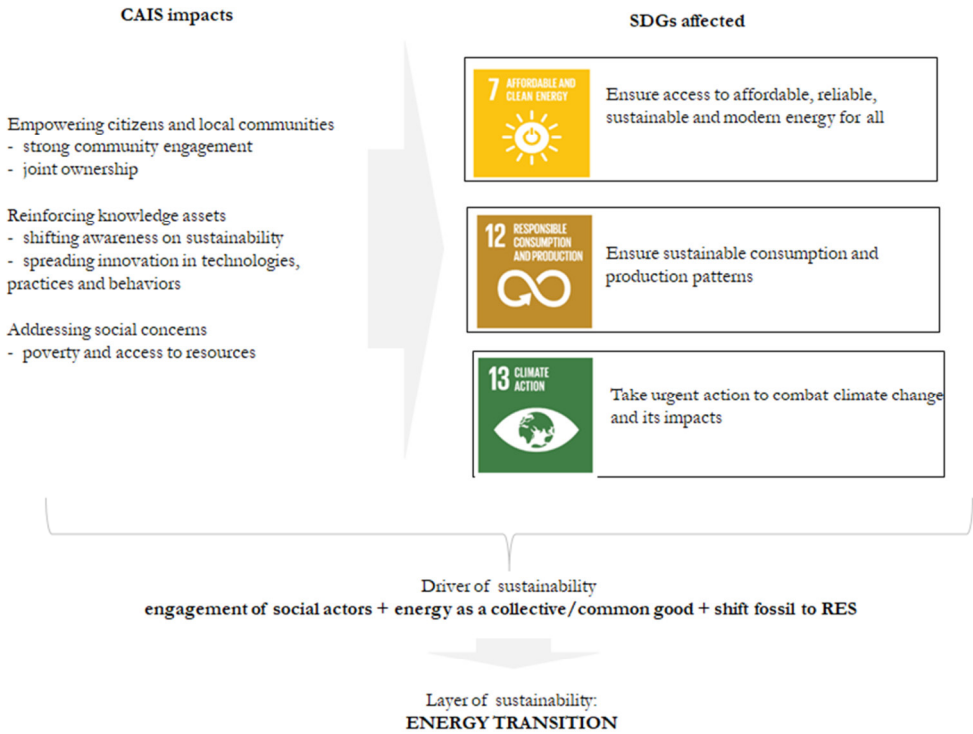


Figure 3: The Energy layer of Sustainability : related SDGs and CAIs impacts

Interesting examples that highlight the activation of these mechanisms on the energy transition include the following:

Cloughjordan Energy Collective (The Young Foundation). Founded in 1999 by a group of Irish individuals concerned about the climate, the aim was to create an ecovillage community where living more sustainably. The strong engagement of local communities played as a pre-requirement and was noticeable reinforced. They formed a collective, sold memberships to raise money and developed a three-pronged renewable energy strategy: low energy housing,

minimizing person vehicles, and district heating. The collective then reached out to university faculty and politicians and invited them to serve on the board to provide a greater oversight of the sustainability aspects of the community and to expand the impact and awareness. The collective was supported by the Sustainable Projects Ireland Ltd. (SPIIL), which linked it to the Global Ecovillage Network (GEN) and the Transition Towns project. The village struggled with the great recession but still remains.

Solar Community Bologna (Italy), a collective mechanism to promote local renewable energy generation. It was founded between 2010 and 2014 through about 150 residents in 6 neighboring towns and promoted by the municipalities, key industries, and the University of Bologna. The initiative finances new solar PV projects in the region. Relying on pre-existing solar communities, the Solar Community reinforced the engagement of citizens and, through communication campaigns, it promoted a shift in changing energy behavior and awareness targeted to adult education.

GoiEner (Spain) was founded in 2012 as a non-profit citizen cooperative. Largely based on volunteers taking part in the decision making towards implementing renewable energy systems, it scaled up to over 5000 partners that have the opportunity to purchase (contractually) renewable electricity from GoiEner. Although the change in energy tariffs experienced in Spain reduced investor incentives in renewable energy, though the cooperative is still confident that the model can be duplicated throughout Spain. Based on an initial group of volunteers, GoiEner fostered the engagement of citizens in the energy Learning from other examples and members gaining expertise in the energy system improved cohesion and empowerment within the community through shared experiences and through the adoption of a governance based on neighbor/peer participation. The joining of a large number of enterprises gave the collective the innovative power to trade energy in the Spanish market.

A class of CAIs experiences that is gaining momentum in the energy field is referred to the “prosumer” groups supported by many energy policies. Funds, skills and resources can be pooled, and the increasing normalisation of collective prosumers means it is no longer seen as risky. (Ford, et al). The collaborative nature of CAIs as prosumer collectives is gaining traction, but the lack of collective commitment is oftentimes a major barrier. The shift from the individual to the collective level requires social cohesion. The drivers, barriers and enablers for CAIs prosumers are summarized in Figure 4 (Ford et al.,).

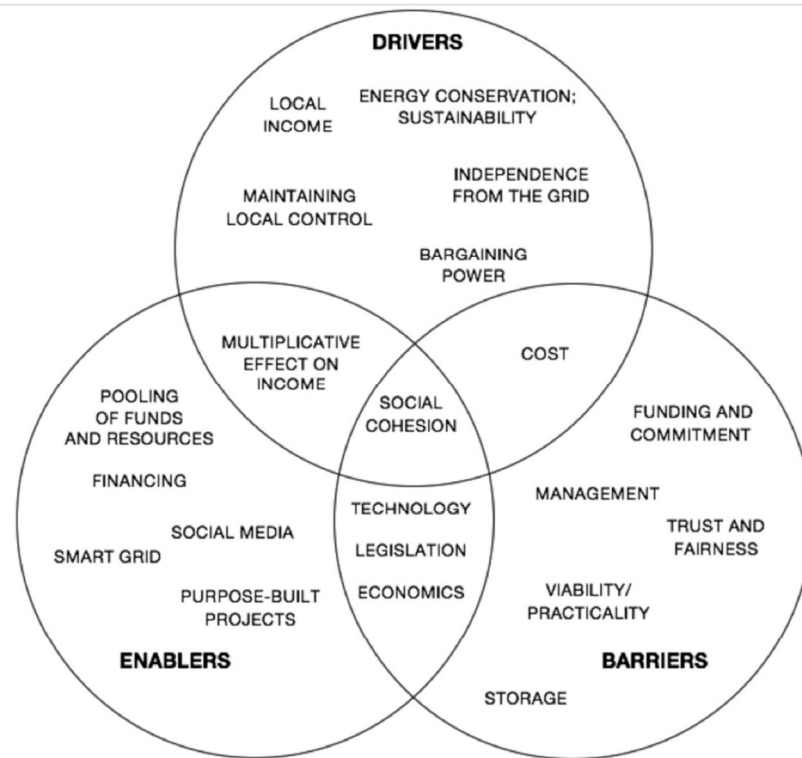


Figure 4. Overview of drivers, barriers, and enablers of collective prosumerism. Source: Ford, et al.

2.3 The local dimension of sustainability

If one agrees that the current unsustainability comes from the central role played so far by deterritorialized forces, in the transition to sustainability at the local level should play a role which should be complementary and instrumental to the national, international and global levels. No 'local' is immune to the negative effects of the environmental crisis, nor is exempt from the efforts aimed at reducing its causes. The local dimension might play a crucial role in defining and implementing strategies for a strong sustainability. At the local level, in fact, is it possible to detect the coexistence of many conditions that are crucial for solving problems collectively.

CAIs may help in taking the local dimension into account by making the territories where they act more resilient and self-sufficient (SDG11), thus also reducing the territorial inequalities within a country (SDG10). Such outcomes could more easily come from the enactment of participatory processes (SDG16) aimed at increasing knowledge and skills (SDG8), and by addressing the needs of disempowered individuals or groups (SDG3).

Climate change is an important driver for collective action in the energy sector, but surveys reveal that community energy security and affordability (saving energy and saving local expenses) may act as stronger motivators for community energy projects. (ISABEL) Collective action to foster sustainability projects empower local communities not only to generate and export their own energy but also to reinvest part of the profits into the community. (ISABEL)

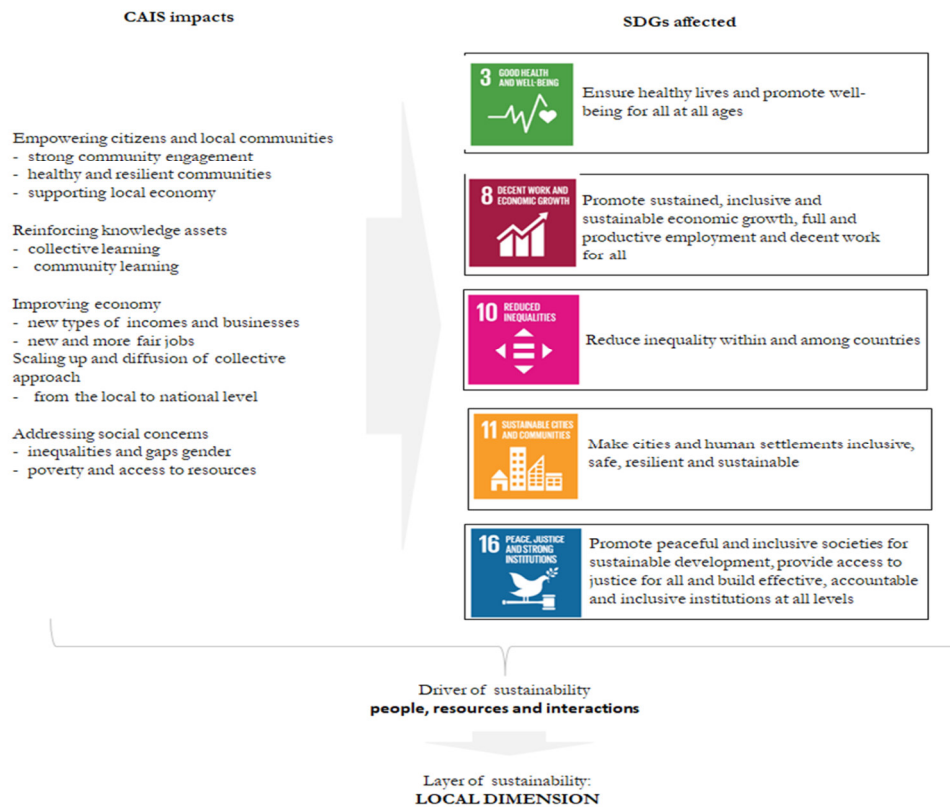


Figure 6: The Local dimension layer of Sustainability: related SDGs and CAIs impacts

The following examples showcase CAIs innovation and commitment to people and community, demonstrating the power of solving problems collectively.

The municipality of Güssing, Austria. This small town is a model example of collective action in terms of “energy autonomy” and “energy-village”. a consistent commitment to renewable energy provided a boost to the local economy. In the early 1990s, Güssing was characterised by high unemployment, as well as economic and demographic decline. The community decided to establish an energy system based on renewable sources, mainly from local biofuel. However, the town’s renewable energy project was initiated by local citizens, who noticed that the wood that was decomposing in the nearby forest could be used as an energy source. (KUNZE & BUSCH) By 2010 Güssing become a net energy producer - generating more energy from renewables than it uses - and a net exporter of its energy. This resulted in the sum of 35 million Euros that would have otherwise been spent annually to import carbon-based energy, helping to create new jobs as it was locally re-invested.. (KUNZE & BUSCH)

Kauai Island Utility Cooperative (KIUC), United States, is a not-for-profit electric cooperative that generates, transmits, and distributes electric power on the island of Kauai. The co-op serves 29,000 members/owners, and employs 150 people and is owned by its members and governed by an elected board of directors. In an effort to reduce its power cost and its use of imported fossil fuels (around 90% in 2010) and increase the amount of energy generated from Kauai’s own renewable resources, KIUC has launched a strategic initiative to generate 70% of its electricity from renewable sources by 2030. In 2019, 55% of KIUC's electricity is generated through renewable sources: biomass, hydropower and solar. (KIUC)

Community Power Network (CPN), United States, is a national initiative that grew out of Washington, DC Solar United Neighborhoods (DC SUN), built on early experiences working with neighbors across DC to refine its community-led solar cooperative model. CPN adheres to the cooperative model and works with local community partners to disseminate information about the cooperative model, create excitement about solar, and recruit residents to attend information sessions. (FAIRCHILD & WEINRUB)

Energy Solidarity Cooperative (ESC), United States, is a start-up in Oakland, California, that designs and builds community-driven, cooperatively owned solar energy projects and political educational programs. ESC focuses on building relationships with such groups as community-based organizations, schools, and places of worship in communities of color and with low income residents. The ESC model is comprised of worker members, consumer members and sustainers. Worker members are energy practitioners who offer technical services to support the development of community power projects. Consumer members are individuals and organizations who collaboratively own and operate renewable energy systems. Sustainers are community investors who directly enable the development of clean community power, while their investment is repaid with interest as the project earns revenue. (FAIRCHILD & WEINRUB)

3. Summary and outlook

Collective Action Initiatives (CAIs) have been gaining relevance for the past several decades as an innovative actor of the energy system e.g., in the forms of energy communities, energy cooperatives, prosumer and purchasing groups. In this chapter we demonstrate the potential of CAIs in the energy field as a trigger for implementing a strong sustainability paradigm at the local and global levels. This potential has been investigated through the impact that CAIs might have on the fulfillment of a subset of the UN Sustainable Development Goals (SDGs), considered as an attempt of operationalizing the strong sustainability paradigm, by covering the many diverse dimensions of sustainability and by claiming the need for their joint fulfillment.

On the basis of a wide literature review on CAIs components and development (requirements and impacts), and through the analysis of a limited number of case studies we found that, in addition to the direct impact on specific indicators, CAIs development might create the conditions for supporting SDGs through the provision of relevant social and economic changes:

- Empowering citizens and local communities;
- Reinforcing knowledge assets;
- Improving economy;
- Scaling up and diffusion of collective approach;
- Addressing social concerns.

We explored the effect that these changes might have in addressing three layers of sustainability (long-term horizon, energy transition and local dimensions) to which specific subsets of SDGs have been assigned. For each layer, the mechanisms activated by CAIs implementation were present and may play a role in achieving sustainability, although a measure of the relevance of this role was far beyond the objective of this work.

Now, as the planet's ecological limits are becoming ever more apparent, we collectively are becoming more cognizant of the world's global common resources and the services they provide.

We also reconsider what it means to provide economic well-being to citizens and communities and what means are available to promote social cohesion. Because the health of the modern economy is so intrinsically linked to the energy sector, CAIs in the energy sector could be a catalyst to the transformation to a strong sustainable paradigm, where sustainability is intrinsically incorporated into our society.

Given the relevance of CAIs potential to support the ambitious UN sustainable goals, the valuable lessons learned suggest considering the possibility to introduce specific SDGs and targets in the future that highlight how CAIs contribute to the agenda.

References

- BAUWENS, T., GOTCHEV, B., HOLSTENKAMP, L. (2015) What drives the development of community energy in Europe? The case of wind power cooperatives. *Energy Research & Social Science*
- COSTANZA, R. AND DALY, H. (1992) 'Natural capital and sustainable development', *Conservation Biology*, 6 (1): 37–46.
- DALY, H. (1991) 'Elements of environmental macroeconomics', in R. Costanza (ed.) *Ecological Economics: The Science and Management of Sustainability*, New York: Columbia University Press
- DECC (2014). *Community Energy Strategy: Full Report*. HM Government, London, Available at (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275163/2014_0126Community_Energy_Strategy.pdf).
- DIETZ, S., NEUMAYER, E. (2007). 'Weak and strong sustainability in the SEEA: Concepts and measurement', *Ecological Economics*, 61, 617-626.
- DRAGON DREAMING: <http://www.dragondreaming.org/dragondreaming/what-is-it-exactly/>
- ECOVILLAGE: <https://ecovillage.org/about/about-gen/>
- ELSTER, J. (1985) Rationality, Morality, and Collective Action. *Ethics*, 96, 1, 136-155.
- EUROPEAN NETWORK FOR COMMUNITY-LED INITIATIVES ON CLIMATE CHANGE AND SUSTAINABILITY (ECOLISE). Community-led initiatives and the Sustainable Development Goals. http://wiki.ecolise.eu/index.php?title=Community-led_initiatives_and_the_Sustainable_Development_Goals#cite_note-67
- FADER M., CRANMER C., LAWFORD R., ENGEL-COX J (2018) Toward an Understanding of Synergies and Trade-Offs Between Water, Energy, and Food SDG Targets, *Frontiers in Environmental Science*, 6, 112
- FAIRCHILD, D. & WEINRUB, A. "Energy Democracy: Advancing Equity in Clean Energy Solutions" Island Press. 2017
- FORD, R., WHITAKER, J., STEPHENSON, J. (2016) "Prosumer collectives: a review. A report for the Smart Grid Forum."
- FRIENDS OF THE EARTH EUROPE, HEINRICH BOLL FOUNDATION (2018) *Energy Atlas*, available at <https://www.boell.de/en/european-energy-atlas-2018>
- HALL, S., FOXON, T.J. and BOLTON, R. (2016) Financing the civic energy sector: How financial institutions affect ownership models in Germany and the United Kingdom. *Energy Research & Social Science*, 12, 5-15.

- ILO (INTERNATIONAL LABOUR ORGANISATION) (2013) *Providing clean energy and energy access through cooperatives*. Geneva. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_233199.pdf
- ISABEL EUROPEAN COMMISSION H2020-FUNDED PROJECT REPORT. “Social Innovation and Community Energy best practices, methods and tools across Europe” April 2016
- KAUAI ISLAND UTILITY COOPERATIVE (KIUC). <https://website.kiuc.coop/about>
- KUNZE, C., & BUSCH, H. (2011). The Social Complexity of Renewable Energy Production in the Countryside. *Electronic Green Journal*, 1(31)
- MIOLA A., BORCHARDT S., NEHER F., BUSCAGLIA D (2019) *Interlinkages and policy coherence for the Sustainable Development Goals implementation*, JRC Technical Reports, available at https://publications.jrc.ec.europa.eu/repository/bitstream/JRC115163/sdg_interlinkages_jrc115163_final_on_line.pdf
- OLSON M. (1965) *The Logic of Collective Action*. Boston, MA. Harvard University Press.
- OOMS, M., BIJNSDORP, S., HUYGEN, A., RHOMBERG, W., BERGER, A. (2016) Social Innovation in Energy Supply: Case Study Results Policy Field Energy Supply. Deliverable 7.3 in *SI-Drive- Social Innovation: Driving Force of Social Change*,
- RAPPAPORT, J. (1984) Studies in empowerment: Introduction to the issue. *Prevention in Human Services*, 3, 1–7.
- REISMAN, D. (1990) *Theories of Collective Action*. Downs, Olson and Hirsch. Houndmills. Palgrave Macmillan.
- ROSENTHAL A.M. (1998) Two Collective Action Problems in Spinoza's Social Contract Theory. *History of Philosophy Quarterly*, 15, 4, 389-409.
- SCHERER L., BEHRENSA P., DE KONINGA A., HEIJUNGS R., SPRECHERA B., TUKKER A. (2018) Trade-offs between social and environmental Sustainable Development Goals, *Environmental Sciences and Policy*, 90, 65-72
- SEYFANG, G., HIELSCHER, S., HARGREAVES, T., MARTISKAINEN, M. and SMITH, A. (2014) A grassroots sustainable energy niche? Reflections on community energy in the UK. *Environmental Innovation and Societal Transitions*, 13, 21–44.
- STINCHCOMBE, A.L. (1980) Is the Prisoners' Dilemma all of Sociology? *Inquiry*, 23, 187-192.
- TILLY, C. (1978) *From mobilization to revolution*. Reading: Addison-Wesley.
- TRANSITION NETWORK - Transition Towns <https://transitionnetwork.org/about-the-movement/what-is-transition/>
- WALKER, G. and DEVINE-WRIGHT, P. (2008) Community Renewable Energy: What Should It Mean? *Energy Policy*, 36, 497–500.
- WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1987) ‘Our Common Future’, Oxford University Press, Oxford.