Local Communities and Social Innovation for the Energy Transition

Workshop Booklet

Event Organised by the European Commission - Joint Research Centre

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Abstract:

Local communities have a huge and often neglected potential for the development of social innovation initiatives that can foster the energy transition. This disregard is mainly due to how current research and policy approaches dealing with this transition mostly aim to substitute technologies and change individual behaviours. In this way, they miss taking into account the huge opportunities generated by jointly dealing with supply and demand, notably by a more democratic and holistic re-organisation of (energy) production and consumption practices and, more in general, of social practices related e.g. to mobility, shopping, eating, housing, etc.. Despite the usually quite limited energy impact of single initiatives, community-led social innovation initiatives can contribute to exploit this potential in important ways. They can overall foster decarbonisation on the large scale through innovation actions that are highly diversified and that can in principle flourish all around the world even without being specifically designed to target energy production and consumption. The present workshop aims a) to study the local communities' social innovation potential for the energy transition under both a theoretical and practical lens and b) to formulate policy and research recommendations allowing better exploiting it. The event is organised by JRC Unit C2 (Energy Efficiency and Renewables Unit).

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Introduction

Local communities take with them a huge and often neglected potential for the development of social innovation initiatives that can foster a radical transformation towards renewables. The reasons for this disregard have to be mainly found in how current research and policies approaches dealing with this transformation are mostly based on a principle of technological substitution and modification of individual behaviours around technologies. Energy inputs are their almost exclusive target. Either they focus on a reduction of CO2 emissions or also acknowledge the necessity of combining CO2 emissions reductions with energy efficiency improvements, they devise interventions assumed to mostly affect amounts and types of used energy inputs without substantially affecting energy outputs (i.e. without substantially affecting what people do and how they organise their daily life through energy end-use technologies). Due to their one-sidedness, they miss taking into account the huge opportunities represented by a transition to renewables as achieved by jointly dealing with supply and demand (i.e. by jointly dealing with inputs and outputs), notably by an active and more democratic re-organisation of energy production and consumption practices and, more in general, of social practices related e.g. to mobility, shopping, eating, housing, etc.

Being highly distributed and mostly linked to land, renewables can re-define energy sources and equipment ownership and re-compose demand and supply in new ways through the active participation of local communities. Renewables can in principle allow to partially or totally (re)conduct consumption-production cycles under the responsibility of the people who they serve. A large number of synergies between reductions of CO2 emissions and improvement of social well-being can in principle be identified and exploited in this way. Researchers and policy makers are becoming increasingly aware that economic, technical and quantitative considerations concerning substitution or reduction in the consumption of non-renewable energy inputs cannot be the only starting point to design and implement actions for wide scale decarbonisation. They are realising the important contribution to decarbonisation coming from local initiatives undertaken by communities to increase energy sustainability by changing the way in which these communities provide for their needs and wants. Generally speaking, market economies cannot for example presently guarantee that a transformation towards renewables will not serve to boost a multiplication of useless end-uses that will make this transformation unsustainable in the long term. Similarly, they cannot guarantee that this transformation will not result in increased social injustice and centralization. A transition to renewables can therefore represent an invaluable opportunity to re-discuss social well-being thanks to local communities devising new strategies to achieve it more sustainably by managing energy supply and demand.

Local communities' social innovation initiatives for higher sustainability can however greatly contribute to the energy transition even without being specifically designed to target energy production and consumption. Despite the usually quite limited energy impact of single initiatives, they can significantly foster decarbonisation on the large scale through innovation actions that are highly diversified and can in principle flourish with own specificities all around the world. These initiatives include for example wind energy, community supported agriculture, social technologies, car clubs, repair cafés, participatory design, agro-ecology, eco-housing, recycling, shared machine shops, rainwater harvesting, complementary currencies, credit unions, socially useful production, seed swapping, community energy cooperatives, garden sharing, community forestry, green spaces and many, many other ideas and practices. These initiatives are usually much more situated in history and in the contexts where they develop and often represent a way to re-discover pre-existing old social practices whereby people have organised production and consumption in given geographical areas.

Their local character and the high level of diversification over the geographical areas where they develop represent however an important challenge when it comes to understand how they can be supported and fostered. They typically are innovation niches and the possibility that they can survive and/or diffuse and that they can be integrated or displace so-called incumbent socio-technical regimes depends on a variety of factors which are often contingent. Nevertheless, their thriving depends principally on questions of innovation governance. It depends on how questions of power and fairness are dealt with, on how the different interests, assumptions and frameworks carried out by involved human and not human actors are addressed within innovation initiatives, on how new ideas about energy sustainability can be discussed and explored, on how existing social innovations niches are possibly supported and allowed displacing or being stably integrated within incumbent regimes whenever this can be beneficial.

Finally, it has probably to be pointed out that local communities' social innovation initiatives should not be considered as a panacea. A large scale energy transition cannot e.g. generally take place without energy redistribution and the implementation of the technical solutions enabling it. In a way that is very similar to what is assumed to happen within globalised market economies, it is exactly the redistribution of energy generated from local renewable energy sources within complex networks that is supposed to make the energy transition possible while generating the benefits typically associated with it. The question is therefore also how and whether local communities' social innovation initiatives can contribute to generate the organised complexity[1] and the level of energy systems resilience and flexibility that is needed for this transition to happen.

Structure and Expected Outcomes

The present workshop aims a) to study the local communities' social innovation potential for the energy transition under both a theoretical and practical lens and b) to formulate policy and research recommendations allowing better exploiting it. It will discuss how this potential generally derives from existing possibilities to re-combine demand and supply cycles in a variety of economic sectors in a way that allows in principle higher and more democratic participation and involvement of people. Moreover, it will discuss existing barriers to and conditions fostering the expression of this potential as well as alternative and new innovation governance approaches needed to allow the thriving, consolidation and diffusion of local communities' social innovation initiatives. The workshop will then focus on the specificities of local *energy* communities. In this respect, it will first

[1] On the concept of organised complexity, see Jacobs, J., 1961. *The Death and Life of Great American Cities*, New York: Random House.

discuss their achieved level of recognition within EU regulations and how their diffusion can be fostered at the EU policy level. Then it will focus on some main existing examples of local energy communities' initiatives being developed in the EU while highlighting associated innovation potential as well as specific barriers to and factors fostering their development. In doing so, special attention will be dedicated to the important role that can be played by municipalities both as local energy communities and as facilitators and enablers of social innovation initiatives that can be developed on their territories.

Workshop participants will be 35 maximum and will include invited speakers and JRC researchers active in the field. These speakers will be acknowledged researchers and policy analysts working on the targeted topics, representatives of the European Commission dealing with local energy communities, representatives of local energy communities' aggregators and organisations supporting their diffusion at various levels.

Speakers have been requested to provide extended abstracts describing their contributions. These extended abstracts will be distributed among participants before the workshop takes place. Information included therein together with workshop conclusions and research and policy recommendations produced by discussants will be summarised in a report that will be published by the JRC after the event.

EXTENDED ABSTRACTS

Community Innovation for Sustainable Energy: Theoretical Lenses

Transforming European energy systems into more secure, sustainable and affordable configurations by the middle of the 21st century has become a priority in the European Union. Commitments in lowering carbon dioxide emissions as well as increasing concerns over energy security have triggered changes to current energy systems. Three main trends support these energy transitions: decarbonisation, decentralisation and digitalisation (e.g. Di Silvestre et al., 2018). Although current development show positive signs of energy systems in transition, policymakers, academics and civil society actors agree that these transitions need to further accelerate to meet the Paris Agreement (Creutzig et al., 2018; Rockström et al., 2017). In particular, academics and civil society actors have drawn attention not only to technological advancements but also to the widely neglected social dimensions of sustainable energy transitions (Miller et al., 2013; Hirsh and Jones, 2014). Efforts to reduce energy demand, improve energy efficiency, diffuse renewable energy technologies, and develop smart energy systems all occur within highly institutionalized European energy systems. These consist of a wide range of entrenched rules, regulations, norms, beliefs and practices (Biresselioglu et al., 2018), which will need to change profoundly to move towards sustainable energy systems.

In this context grassroots innovations for sustainability are attracting increasing policy attention. Demonstrations of grassroots innovation have been displayed at all the major conferences on sustainable development, from Stockholm in 1972 to Rio 20 in 2012 (Ely et al., 2013). Indeed, international policy under the latter has increased elite interest in the grassroots markedly in recent years (Smith and Ely, 2015; World Bank, 2012). Much high-level policy interest is instrumental: grassroots innovation provides an engaging means towards the end of development as understood by policymakers. Interest rests in scaling-up and rolling-out preferred models of interest to policy but derived from grassroots initiative. Whilst not all grassroots innovation is committed to principles of sustainable development, this presentation is interested in an area of activity that does, namely, the recent flourishing of community energy (CE) initiatives in the UK.

My presentation will mainly draw on the work conducted by a team of researchers from the University of Sussex and the University of East Anglia (including the Tom Hargreaves, Gill Seyfang and Adrian Smith) as part of the community innovation for sustainable energy project that was conducted between 2010-2013: https://grassrootsinnovations.org.

Sabine Hielscher, University of Sussex, UK, is interested in the politics, processes and materialisations of grassroots innovations and the dynamics of everyday (sustainable) consumption patterns, particularly the relationship between people and technologies. Analysis tends to be interdisciplinary, drawing upon theoretical frameworks from variety of disciplines, but especially social practice theory and transition theory. Sabine joined SPRU as a Research Fellow in October 2010. Her work has focused on studying grassroots innovations which are novel activities derived from groups in civil society, for instance, community energy initiatives (CISE 2010-2013) and community-

I will present three dilemmas that grassroots innovation currently face when developing their visions and activities. Depending on the local, regional and national energy systems, CE initiatives can be faced with enabling and impeding conditions for CE that aid (or not) their survival, growth, replication and spread over time. Over the past decade, CE initiatives have been able to develop workable and replicable innovations (such as energy cooperatives). But they also struggle to make other CE innovations survive and spread (such as energy efficiency activities), amongst others due to the lack of long-lasting financial and organisational models (Hargreaves et al., 2013). Moving beyond the initial development stage, Smith et al. (2014) have highlighted three challenges that CE initiatives have to tackle, as they face the risk of their goals being captured by dominant institutions, potentially diminishing the change they can bring about: 'Attending to local specificities whilst simultaneously seeking wide-scale diffusion and influence, being appropriate to existing situations that one ultimately seeks to transform, and working with project-based solutions to goals that fundamentally require structural change'

Moreover, three distinct analytical perspectives will be presented: strategic niche management (SNM), niche policy advocacy, and critical niches to examine grassroots innovations, linking to different ways of conceptualising niche-based theory in socio-technical transitions. Whilst the first and second perspectives appear to explain policy influence in grassroots innovation adequately, each also shuts out more transformational possibilities. I therefore argue that, if grassroots innovation is to realise its full potential, then we need to also pursue a third, critical niches perspective, and open up debate about more socially transformative pathways to sustainability. The perspectives will be illustrated with reference to case studies on community energy in the UK.

Each perspective sheds some light onto the different processes and forms through which CE has been influential. Analysing the evidence through the perspectives, it is possible to explain the ways CE has attracted policy attention through the development of workable solutions that have been shown to matter for prevailing energy policy discourses. The basis of this attention was explained best through the SNM and policy advocacy perspectives. As CE develops along a trajectory that allows it to win influence from policy-makers and energy utilities, so it takes on more professionalised, micro-utility, and energy service forms. As CE changes further through partnerships, hybrid models, and attempts to scale (Strachan et al., 2015), it becomes important not to lose sight of what CE has done well and does differently, such as explorations of alternative values for developing energy in society and working on issues of community development

based digital fabrication workshops (Transit 2013-2015, CIED 2013-2015 and DRGL 2015). Since 2015, Sabine has also taken a Research Fellow position at the Centre for Technology and Society (ZTG), Technical University of Berlin, where she continues her work on civil society activities and smart energy transitions. Prior to joining SPRU, Sabine completed an EPSRC funded PhD in Art and Design at Nottingham Trent University.

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A critical niches perspective helps keep in view the more challenging pathways for sustainable energy transformations. Curiously, the critical niches perspective links back to some original features in SNM. SNM was conceived as convening space for experimentation that valued different cognitive frames and conceptual assumptions, and some of the more critical implications of niches for prevailing institutions. Application of SNM since then, however, has tended to emphasise the more pragmatic, technical lessons about how to make sustainable innovations fit into and better conform with prevailing regimes (Raven et al., 2015). Calls for radical rethinking will always struggle when criticising the social structures reproducing vested economic interests, positions of political authority, cultural privileges, social norms, technological designs, and research agendas.

Nevertheless, retaining a critical edge is vital. In the case of CE in the UK, this means not solely focusing instrumentally on drivers and barriers to the evolution of the sector into micro-utility form, nor how CE initiatives might gain influence through closer alignment with the particular political imperatives dominating the moment. Rather, research needs to open up discussions about how CE initiatives embody new ways of thinking about and acting upon energy questions. CE practitioners might be understandably wary, and policymakers institutionally uneasy, about such critical approaches. Nonetheless, analysis suggests that making the most of community energies demands an agenda that looks beyond instrumental imperatives and explores how socio-political programmes can develop that are more transformational than those currently prevailing in energy regimes.

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Local Energy Communities and their Social innovation Potential for the Energy Transition in the EU

An energy community allows citizens to come together on a collective level, to take democratic ownership and control over the production, storage, consumption and sale of renewable energy, to provide energy services, or to operate energy infrastructure. With the technological advances that are taking place, and with costs of such technologies dropping at an increasing rate, citizens are increasingly interested in engaging in the energy sector. Citizen involvement has a number of benefits for the consumer, the energy system, the economic and social welfare of the local community and, the climate.

For REScoop.eu, the European federation of renewable energy cooperatives, an energy community is not created simply by involving local citizens in some type of technological innovation in the energy sector. It is the commitment to social innovation that defines an energy community as a distinct market actor apart from other traditional commercial energy companies.

The aim of the presentation will be to highlight how energy communities can be distinguished from traditional market actors in the energy sector, and the opportunities and challenges associated with these differences.

Local energy communities are best distinguished from other commercial energy companies, based on concrete operative principles integrated by the legal entity of the community, which is reflected in its founding statutes, namely:

- Governance characteristics of the legal entity which reflect democratic decision-making, typically with equal voting rights
- Voluntary and open economic participation and membership to local citizens and final users

Josh Roberts, serves as **Advocacy Officer of REScoop.eu**, a federation that represents citizen cooperative and energy initiatives around Europe that work on renewable energy, energy efficiency, and other clean energy technologies. Josh is in charge of coordinating REScoop.eu's input into the negotiations on the EU's clean energy package legislation. A qualified lawyer in California since 2010, Josh has been actively involved in the European energy policy since 2012. As climate and energy lawyer for ClientEarth, an environmental law NGO, he has focused on internal energy market, renewables, infrastructure, and community/citizen

- Autonomy and independence, whereby the undertaking is controlled by the members or shareholders who are participating as final users; outside investors or undertakings participating in the community must not have a controlling position within the board
- As its purpose or aim, a concern for its members and/or the local community (in terms of economic, social or environmental benefits), rather than having a primarily profit-driven purpose

These distinguishing characteristics have a deep foundation in the seven International Cooperative Alliance (ICA) principles, or Rochdale Principles. The integration of these elements into an energy community is what creates the potential for social innovation in the energy sector. REScoop.eu, a federation that has about 1,500 members across 12 different EU Member States, represents community energy initiatives that perform a range of activities across the energy sector.

While member REScoops reflect a range of legal forms, they all share the same commitment to the seven ICA Principles. Relying on the ingenuity of the members and the context of local needs, REScoops have been able to devise a number of social innovations covering:

- Energy poverty/solidarity;
- Encouraging energy savings & building renovations;
- Local economic revitalization;
- Investing in local infrastructure;
- Local participation/ownership; and
- Other socio-economic priorities, depending on local needs

The adoption and commitment to the above principles inherently place energy communities in a factually and legally distinct position as market players. Specifically, by integrating these principles local energy communities limit their market growth potential, ability to raise finance, and decision-making efficiency (i.e. internal governance). Furthermore, the fact that energy communities are usually small and 'local' further inhibits their ability to operate under traditional market frameworks (e.g. wholesale markets and auctions and tenders for renewables support).

participation issues. Josh earned his Juris Doctorate from McGeorge School of law, and he has an LL.M. in Environmental Law & Policy at University College London. He is also a member of the World Commission on Environmental Law.

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Energy communities most often also rely on volunteers or part-time staff, which may or may not be energy sector professionals, making it difficult to navigate already complex regulatory and administrative procedures. The old regulatory system, which relies primarily on capitalistic, free market principles, at the very least implicitly discriminates against energy communities.

Lastly, energy communities have largely operated under the radar of traditional decision-making and regulation, signifying a largely under-represented stakeholder class. Therefore, even in countries with a long energy community tradition, there is still a significant lack of understanding of the challenges, but also the potential value, of energy communities.

If the above challenges can be addressed, there are already a plethora of social innovations that have the potential to be replicated throughout Europe. The Renewable Energy Directive, and potentially the new Market Design Initiative, are already laying the foundation to provide a supportive framework for such new and innovative business models such as energy communities. The added value of provisions on energy communities, however, will be dependent upon political commitment by national governments to put in place supportive policies and legal frameworks that support community ownership.

Pooling Economy, Tech Justice and Urban Experimentalism for a Human Rights-based Approach to the Sharing Economy

In recent years the sharing economy is deploying all its hidden potential. It is becoming a relevant economic phenomenon, intimately related to the urban dimension. So far it has been rather under-investigated the disruptive social implications that mainstream sharing economy initiatives are producing at the local level, as well as the important role that other non-mainstream sharing economy initiatives can play in reinforcing community empowerment and realize urban justice goals. More thought, especially legal thought, is indeed needed to deepen and illustrate the existence of such dichotomy, focusing the attention on the social aspects of the sharing economy, often underestimated. The analysis of several legal concepts and public policies such as the EU legal principle of self-organization and self-production, the Opinion of the Committee of the Regions of the European Union on *The Regional and Local Dimension of the Sharing Economy,* articles 15, 16, 17 of the Proposal for a Directive of the European Parliament and of the Council on Common rules for the internal market in electricity, as well as articles 21 and 22 of the Proposal for a Directive of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Sources will constitute the bedrock of the analysis to build and verify this theoretical hypothesis. These legal principles and public policies represent the starting point for an emerging role of a society-based version of the sharing economy, the so-called **pooling economy**, as opposed to market-based sharing economy initiatives.

To verify such hypothesis the analysis needs to move on exploring community-based sharing economy initiatives and policies implemented falling into the field of energy production, broadband connectivity and urban mobility, which reflects the economic and technological potential of social innovation taking place in cities, as an exemplary test bed where the competition between the priorities of the market and the rights of individual or local communities as collectives are constantly in struggle. The empirical observation of these sectors and examples offer an exemplary array of the development of technological solutions, platforms and/or policies that could help carve the distinction between *sharing* and *pooling* and thereby

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interpret the digital transformation of cities as the driver for a process that could trigger a shift from the Internet of Everything to the **Internet of Humans**.

Finally, the Internet of Humans shall be tested as a conceptual grid through which it could be possible to establish whether the role of community-based sharing economy initiatives in cities and policies enabling such initiatives might be a way to guarantee the respect of the fundamental human right to have access to basic urban tech-based services such as energy, broadband connectivity, housing, mobility, etc. rather than relying entirely on market – based approaches. This approach is intimately tied to the legal morphology and policy landscape of the city, triggering the necessity to start a reflection on how to carve within EU law an urban EU law branch built around the conceptual pillar of **tech justice** implying the right of city inhabitants and local communities to use and have access to the digital infrastructure of sharing economy initiatives, the right to use the data produced or accumulated by existing market sharing economy initiatives in the city and ultimately the right to co-produce with the city and/or own some of these sharing economy initiatives.

Community Energy as a Commons

What were the commons in the past?

From the 15th-20th century tens of thousands of powerful individuals, aided by state institutions, enclosed and privatized commonly-held land managed by local communities around the world. This process displaced hundreds of millions of small-scale farmers who, to a great degree, lost their autonomous means of sustenance and were forcibly cast into urban labour markets. This enclosure of life-supporting common land has been a vast revolution of centralizing of the rich against the poor. In many areas of the global South this private appropriation of community-based commons is continuing.

What are the commons today?

A commons approach means equitably, sustainably and democratically sharing essential resources, regenerating what is common instead of extracting and enclosing for private use. It means creating abundance with immaterial knowledge goods while wisely governing scarce natural resources. It means opening up access to resources with clear rules to avoid depletion and free-riding. It strives to nurture local community culture, economy and environment while working toward inclusive bottom-up, horizontal participative processes and livelihoods that are neither dominated by the market nor the state. It means considering the common good both socially and ecologically beyond borders, classes or species. It is about universally inclusive collective rights that prioritize our connection with the natural world, combined with a profound respect for gender, ethnicity and individual diversity. It is not an ideology nor does it pretend to be an all-encompassing narrative. Gradual change in defence of the commons can adopt pragmatic hybrid forms that attempt to overcome some of our contemporary dualisms like public and private, society and nature, reason and emotion, expert and non-expert.

David Hammerstein Mintz (Commons Network) was a member of the European Parliament from 2004-2009 as a member of the Research and Energy Committee, representing the Spanish Green Party

For the last 40 years he has been an active member of environmental, scientific and citizens organizations working on open access, access to medicines, urban transport, air quality, climate change, disability rights and the protection of biodiversity, among other issues.

From 2010 to 2015 he worked as a senior advocacy officer for the Transatlantic Consumer Dialogue in Brussels and Geneva focussed on international trade, access to knowledge and the right to read for blind people. Since 2016 he has worked for the Commons Network of which he is a co-founder.

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The Commons in the EU

According to a report adopted by the European Committee of the Regions *“a commons-based approach means that the actors do not just share a resource but are collaborating to create, produce or regenerate a common resource for a wider public, the community. They are cooperating, they are pooling for the commons”.* This means helping people and communities to regenerate urban, cultural and natural commons as active citizens, producers, designers, creators, care-takers, local organic farmers and community renewable energy promoters. It also means embracing a knowledge-sharing economy based on the principle of “design globally, produce locally” or “what is light global, what is heavy local”, while promoting the internet as a digital commons based, universal open access to scientific/technological advances, flexible intellectual property rules, decentralized energy and telecom infrastructures as universal services and democratic governance.

The EU and the real tragedy of the energy commons

Climate change and many other ecological problems caused by the use of fossil fuels are an example of the *tragedy of the commons* because the essential common resources of the air, water, soil and biodiversity are over-used, over-extracted and over-exploited in the context of very few or ineffective rules to prevent their deterioration and depletion. These problems are also paradoxically the result of a *tragedy of the anti-commons* because they are the result of the unbridled and intensive enclosure, extraction and the privatization of common resources. The influence of enormous energy companies on the EU and its member states through corporate regulatory capture, revolving and strong lobbying strategies both prevents strong regulation of our climate-energy commons and preserves the extreme protection of private rights of companies with dominant positions over key energy infrastructures and services.

It is quite evident that in the past EU policies have mainly favoured the tragedy of the anti-commons. The EU could be a much more enlightened voice and a more ambitious leader on global climate and energy commitments. While large energy centralized private companies are starting to invest more and more in renewable sources, they are often not best suited for alleviating our social-ecological dilemma, primarily because they have little incentive to reduce overall energy consumption nor to prioritize the social engagement of local communities in their commercial operations nor to share their technology with the Global South nor make it affordable for local energy poverty. The more energy they sell and the more energy is consumed, the more profits they make.

At the same time, some climate technologies that can play an important role in energy transition are often not shared as quickly with developing countries as they could be. This is again partly due to intellectual property protections and a resistance to sharing know-how. In this conflict, the EU fights to enclose climate technology knowledge within United Nations forums.

In general, the EU's energy strategy is oriented primarily toward enormous energy companies promoting large gas pipelines, giant energy infrastructures, and modest CO2 reductions (still far away from fulfilling global climate needs). Despite more and more Europeans producing their energy locally or at home, most proposed European market regulations do not prioritize in their financing community controlled or self-produced renewable energy, do not offer sufficient financial risk facilities for community based energy, nor do they sufficiently defend the right to sell electricity to the grid. While EU policy proposals are often unsupportive of community-based feed-in tariffs or flexible grid infrastructures to support local renewables, little is being done to eliminate massive direct or indirect subsidies to large gas, coal and nuclear projects.

There is a surprising over-confidence that the same centralized energy model that got us into this mess is also going to get us out of it. Instead it should be evident that without major social change in the relations of power between large energy companies and the common good, there will be no paradigm shifting energy change.

A much larger part of the EU energy budget should be earmarked for community renewable projects and compatible infrastructures, with broad citizen participation. This would help optimize resilient and more flexible energy supply costs through more efficient, short, and visible distribution loops while promoting flexible local energy autonomy. With this approach the EU could "commonify" a generally decentralized energy as opposed to the current principal strategy of "commodifying" a centralized one.
The commons approach points at a number of problems and principles concerning renewables and fight against climate change.

1. **Technology will not save the world.** The current almost exclusive focus on technological solutions and energy efficiency cannot alone alleviate our major social-ecological emergencies. In order to mitigate and adapt to climate chaos we need to focus on social and political strategies that prioritize solidarity, sufficiency and limits. In our current energy model an exclusive focus on technological

efficiency will not suffice for the needed reduction of total volume of energy produced and consumed. In fact, as the Jevons “rebound effect” shows, efficiency alone without absolute limits on material growth, can even accelerate and disguise further climate and ecological deterioration. **Increasing the production of less-CO2 rich energy for economic growth and more consumption will only worsen unsustainability and social injustice.**

2. **The natural commons is both the source and the sink of our energy model.** No one can claim ownership of the sun, the wind, the sea or the air. While it belongs to no one we need to strongly and democratically regulate its use in a socially equitable matter with the aim of maintaining a sufficient level of sustenance of human and natural life.

3. **Energy sobriety is a prerequisite of energy justice.** In the finite carrying capacity of our climate commons without alleviating energy obesity of most people in wealthier countries there is no sustainable way of alleviating energy poverty of people. If energy is mainly considered a commodity (and not a commons) to be controlled by large private companies there is little incentive to reduce energy consumption on which there profits depend. When energy is governed as a common resource that is pooled by a given community resilient sufficiency coupled with efficiency can take priority over expansion, growth and profits. Local stakeholders usually have different interests from corporate shareholders.

4. **Appropriate technology.** Over-dimensioned, large scale, centralised, long-distance and privatized energy technology (usually high-technology) is often not appropriate for the real needs, the human scale of the democratic control of a visible, circular and resilient local economy. Ever increasing capacity, volume and scale of energy production fuel the insatiable quantitative growth that permeates our mental and economic obsessions with environmentally destructive expansion and extraction. Appropriate technology, in contrast, is dimensioned at aimed at satisfying basic social needs that respect limits, boundaries and universal sharing.
Appropriate energy technology and knowledge developed with public money also needs to revert back into the regeneration of the energy commons by local communities through open source technology transfer or socially responsible licensing instead of being patented and privatized by private companies.

5. **Move EU policies from considering energy as a commodity to promoting community energy commons.**

If we think in an out of the box manner the focus of EU and EU member state energy policies should be the creation of "sustainable energy utility" or similar institutions such as those suggested by Byrne: " *The Sustainable Energy Utility (SEU) constructs energy–ecology-society relations as phenomena of a commons governance regime. It explicitly reframes the preeminent obese energy regime organization—the energy utility—in the antithetical context of using less energy. And, when energy use is needed, it relies on renewable*

sources available to and therefore governable by the community of users (rather than the titan technology approach of governance by producers). In contrast to the cornucopian strategy of expanding inputs in an effort to endlessly feed the obese regime, the SEU focuses on techniques and social arrangements which can serve the aims of sustainability and equity[2].

This means a paradigm shifting change towards co-governance, transparency, distributive technology transfer, adaptation to local contexts and conditions and the design of a decentralized grid adapted to prosumers.

6. **Support community trust, involvement co-ownership and co-responsibility**

As opposed to the technocratic expert-based control, the commons approach to renewable energy suggests citizen stewardship, social fairness and energy frugality can be the product of a process that tries to overcome the dichotomies/conflicts between experts and non-experts, users and producers, entrepreneurs and consumers, nature and society.

7. **The renewable energy commons is happening already.**

Hundreds of local energy cooperatives, solar justice movements[3], renewable production distribution networks (like Som Energia in Spain[4]), wind commons experiences in rural communities[5], urban renewable commons controlled by public-civic trusts[6], muncipal/civic solar companies[7] and many more.

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[2] Relocating Energy in the Social Commons Ideas for a Sustainable Energy Utility, John Byrne, Cecilia Martinez, Colin Ruggero, 2009

[3]https://www.solarcommons.org/ https://www.facebook.com/ruralrenewableenergyalliance/?eid=ARCmL3YjlprVtd7WPvfo2Vlc_tSXBlEs4thW_F7kHQ-UjbDw-SiNwzlUVItKLFHVmEbOauwH3G3X3JZn

[4] https://commonsfilm.com/2018/09/24/girona-spain-cooperative-breaks-the-mould-to-provide-renewable-energy/

8. A legislative example: **The EU can strengthen community renewable energy in its Electricity Directive and Regulation**

This new EU legislation should accept the definition of “energy as a common good” that is best defended by decentralised local production as well as recognizing the right to form “renewable energy communities” and to be “renewable self-consumers”, the right to participate in a self-governed energy community, the right to peer to peer energy sharing of all citizens, the right to sell energy back to suppliers and the acknowledgment of the importance of local renewable commons in reducing energy waste, over-consumption and meeting air quality and climate commitments.

9. **The EU can be a partner in promoting a new participatory energy commons**

Beyond new legislation the EU should take energetic anti-monopoly measures against the dominant position of energy companies by means of structural unbundling of energy extraction, production, distribution and commercialization. As well, the EU should forbid all direct and indirect subsidies of fossil fuel mining, energy production and consumption. EU trade policy should have strict conditionalities.

“Citizens Energy Conventions” that involve a cross-road of citizens should be organized by the EU, EU member states and local-regional authorities in order to propose concrete initiatives to promote energy justice, reduce CO_2 emissions locally and globally and to promote decentralized community control of renewable energy production, distribution and consumption.

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[5] Governing the Wind Energy Commons: Renewable Energy and Community Development (Rural Studies) Paperback – July 1, 2019

[6] https://www.shareable.net/blog/3-examples-of-locally-based-shared-renewable-energy-infrastructures

[7] https://www.lasexta.com/noticias/ciencia-tecnologia/barcelona-energia-empresa-electricidad-municipal-que-apuesta-renovables-ciudad-condal_201806305b37ee900cf2998c37aa7797.html

Against and with the Wind: Local Opposition to and Support for the German *Energiewende*

As a preliminary end of a long-standing political conflict on the energy system of the future, a conservative-liberal federal government decided immediately after the 2011 Fukushima nuclear power disaster event to phase out nuclear power in Germany by 2022. Together with the then already ambitious climate policy goals and instruments, this decision makes up the so-called German energy transition (*Energiewende*).

While a majority of Germans (about 90% in most studies, also in ours) supports this new energy policy from 2011 onwards at a general level, concrete projects, especially wind energy, are facing growing local resistance. This local protest is in its forms ironically informed by the experience of the anti-nuclear movement of the 1970s/80s, the protagonists of which today heavily support (and in part: realize) the *Energiewende*. In their view, this local resistance against wind projects can be reduced to the so-called NIMBY syndrome: You profit from the major effects of a technology the side-effects of which you do not want in your back yard. In our research (and in the international literature, cf. Wolsink, Devine-Wright) we found this to be a rhetoric figure of only minor explanatory value—if at all. While one can indeed find people that think this way, a substantial (and locally varying) part of the resistance is motivated by other drivers and arguments. In order to be a NIMBY one needs to support something in general, but reject it locally due to its (perceived) negative side- effects. But many local opponents to wind energy doubt the benefits of wind power or the whole *Energiewende* in general. Local opposition does not contradict global acceptance, but is a mere consequence of it.

But NIMBY has another shortcoming. It is not only an explanatory attempt, it is also a moral marker, designed to discredit people's protests as selfish and dumb. Whether wind power or the *Energiewende* at large is a good thing or not—if people are convinced that it will damage

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their health, their property or ‘their’ landscape, they perceive their protest as a legitimate self-defense. Especially in capitalist market societies the pursuit of ‘egoistic’ interests is not only seen as legitimate, but as the basis of society (cf. Adam Smith). What is wrong with NIMBY, then?

In addition to that, local protesters are usually outraged at being accused of following purely egoistic interests. Quite to the contrary in their own perception many anti-wind activists perceive themselves as the few remaining representatives of the common good—be it the integrity of the landscape or public health—while local politicians, farmers or energy cooperatives simply follow their personal profit interests and sacrifice the common good on the altar of wind power.

The talk will illustrate these and other aspects of local opposition to wind power (a backbone of the German *Energiewende*) by a small case study from Baden-Württemberg, located in the Southwest of Germany. The case study has been undertaken during a BMBF (German research ministry) funded project called Energy Conflicts (www.energiekonflikte.de) and highlights the need for a in the first place impartial study of conflicts—although we did start our project as acceptance research, an imprecision, if not a failure not only from a strategic, but also from a scientific point of view.

The presentation of the case will also highlight the necessity of multi-method and dynamic case study designs that are able to capture the complex and dynamic social developments in a conflict region.

Of course the question remains whether these perceived (self-) stylizations of protest actors are ‘correct’—a tricky, but necessary question. Many activists claim that wind turbines kill birds or bats, and they try to substantiate their claims by all kinds of documents, studies, websites etc. How can we decide whether this is a credible claim or only an advanced assertion? If the statistics of bird or bat death causes reveals that habitat destruction by new roads for example is a major cause compared to wind power, then person A is credible because she also protests against the new road in the region, while person B is not because she has never been visiting any such other protests, but only blames wind power. But what about the argument of landscape integrity or scenic beauty? This seems to be a very subjective, thus debatable aspect. The talk will argue that a public debate about landscape integrity, beauty, and landscape (or rural) development in general needs to be supported and will give some hints from other projects on how this issue can be dealt with.

Given the rise of right-wing populism in Europe the whole issue of local resistance against the energy transition has gained a new, very risky momentum. In our project we found that more than 40% of those who oppose the German *Energiewende* would vote for the populist party AfD (Alternative for Germany) if there were general elections. Although AfD is heavily opposing the German *Energiewende*—and denies anthropogenic climate change—, the party became popular recently mostly due to its opposition to the migration policy of Chancellor Angela Merkel. Up to now AfD has not yet really catered to the themes and motives of local protesters, but things can change rapidly. In this case we can expect an intensification of local protests together with an ideological re-charging of local conflicts.

While there are local conflicts arising from opposition to renewable energy projects, Germany has also quite a long tradition of renewable energy cooperatives and successful examples of—mostly rural—renewable energy self-sufficiency. This is an important trend given the growth of regional disparities in the country. While most urban regions grow, many remote rural areas are being left behind in terms of economic development and public infrastructure. This disparity is an important driver of growing populism, as electoral analyses can show.

For this reason, cities do play a key role in the *Energiewende*. Usually conceived as huge energy sinks, they have an enormous untapped potential for renewables, e.g. solar PV or heat pumps, but also for energy efficiency, and last but not least for energy saving. A massive increase in urban renewables together with more efficiency and sufficiency alike would thus release the pressure on rural areas to generate energy. Protagonists of renewables highlight the 'infinity' of energy availability, but they sometimes forget that space (or landscape) is the major limiting factor for renewables. For this reason, the talk will at its end highlight a running urban real lab project termed KliB, Climate Neutral Living in Berlin (https://klimaneutral.berlin). 100 private households try to reduce their personal carbon footprint by participating in this lab for one year. They get feedback in terms of a weekly carbon tracker, tips, and energy consulting at home. The project does not only address the consumer, but also the citizen, with energy and climate policy preferences and activities of participants being an important building block of the project.

The talk ends by linking the two thematic complexes and discusses ways to counter a lurking growing influence of right wing populism on European energy and climate policies.

Citizens Ownership and Multilevel Policies for an Energy Transition to 100% Renewable Energy Systems

1. Introduction

In the Danish transition to 100% renewable energy, public regulation has to deal both with short term goals such as cost and price efficiency, security of supply etc., and the long term green transition from sectorised fossil fuel systems to integrated smart energy systems based on energy conservation and renewable energy. Making this combination of short and long term regulation efficient requires a multilevel regulation where both economic incentives and organizational changes are needed. In my talk I will focus upon the combination of economic incentives and a revitalized citizens ownership model.

On both a short and long term basis citizens ownership furthers a drive for both low costs and low prices, and thus is **the** price efficient organization for natural monopolies in the energy system. In the Danish municipality and consumer owned electricity distribution system this has resulted in electricity prices that are 25% lower than average EU prices, despite that Danish prices includes subsidies to the green transition. Citizens ownership therefore seems, by means of low prices, *to give economic space for the transition* to Renewable Energy Systems.

In my talk I will deal with the following issues:

- What is an electricity system and the green transition.

- Citizens ownership, public regulation, energy prices and energy transition.

- Revitalization of Citizens ownership of distribution system operators - a Danish case.

- Citizens ownership, multilevel public regulation, transaction costs and the radical transition to integrated smart energy systems.

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2. Transition to a 100% renewable energy based electricity supply system

In the Danish case wind power already in 2017 produced electricity equivalent to around 40% of the Danish electricity consumption, whilst solar and biomass based electricity was around 12% of total electricity consumption.

The official Danish energy policy goals of 100% renewable energy in 2050 and no fossil fuels for heating and electricity after 2035 represent a radical technological change from STORED fossil fuel technologies that can be used when we want it, to FLUCTUATING renewable energy sources that have to be harvested when we have wind, sun or waves. We are approaching a situation when renewable energy becomes the dominant energy source with fossil fuels as only a supplementary fuel.

So the value-added transition from fossil fuel systems to renewable energy based systems is illustrated in figure 1.

Figure 1 illustrates that the value-added chain of REC technologies clearly differs from the value-added chain in a fossil fuel based electricity supply system. The main characteristics of the value-added in this renewable energy system compared with the fossil fuel system are:

a. *In the renewable energy based value-added chain, the fossil fuel resource value-added has disappeared and has been replaced by investment in renewable energy capital equipment which is produced by organizations outside the direct electricity supply system.*
b. *In this system of factory produced electricity "automatons", the maintenance functions, at least at the decentralized and consumer levels, will be performed by the manufacturers of wind turbines, solar cells, wave energy plants, hydrogen production systems, the electricity battery charging system, etc. The need for a specific power production organization will be reduced considerably or disappear entirely as the day-to-day work on the power plant has been replaced by automatons requiring maintenance from the manufacturers outside the electricity supply system.*
c. *As a consequence, distant employees at the coal mining and coal power plant level are replaced by nearby employees at the renewable energy equipment factory and the factories making components to the integration infrastructureThe value-added in the Direct Electricity Supply system (including fuels) consequently has been reduced from 53.3% of the consumer price to the 17.9% value-added in the electricity distribution and transmission system or by 66%.*

http://vbn.aau.dk/en/persons/frede-hvelplund(0e7e6b36-1e4e-483b-a317-3438f30029d6)/publications.html. Link to the Sustainable Energy Planning group at Aalborg University is http://www.sep.aau.dk/

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d. *The consumption at the on site level in this case has been reduced by 27.3% and altogether the value-added to be supplied from the direct electricity supply system has been reduced by around 75%.*

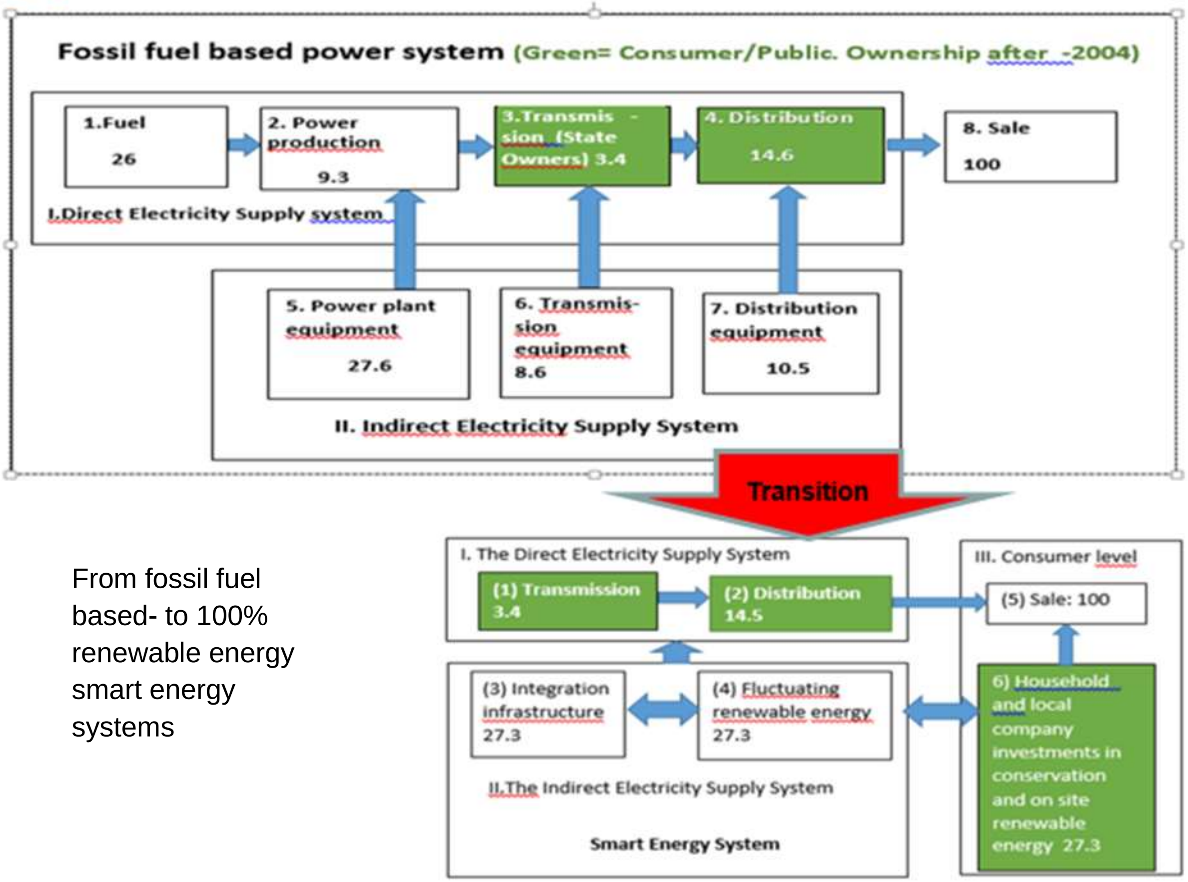

Figure 1. The change in value-added profile connected to a transition to renewable energy systems

A short way of expressing this change is that electricity in a 100% renewable energy system is produced by automatons in the indirect electricity supply system and not by power companies in the direct electricity supply system.
What can we learn from the discussion of the above described shift in both value-added percentages and character and location regarding its influence upon the transition to smart energy systems?

a. As we can see in point a,b,c, above, a large share of the value-added is shifted *from a consumer distant- to a consumer near value-added.*

b. This change makes increased consumer ownership increasingly interesting, and also requires more local and regional coordination.

3. What is a governance system for the electricity sector

Historically the 60% of the heat consumption supplied in district heating systems, and the whole Danish electricity supply system including all power plants, transmission and distribution have been consumer and municipality owned. At the same time, this ownership model has supplied a stable electricity supply at prices that have been around 25% below the EU average, as shown in figure 3[8]

The distribution (DSOs) and transmission networks are natural monopolies, and cannot be regulated at a market with different suppliers, as there is only one supplier available. They therefore must be regulated in other ways than through price competition.

These 4 dimensions of power linked to the DSO are shown in figure 2.

But how should the governance balance between these 4 dimensions of consumer power be designed in a natural monopoly system linked to the DSO value-added share of around 15% of the electricity price?

[8] In the same source it can be seen that the Danish electricity prices for households are comparatively higher, which is due to a high electricity tax, and not to high costs in the electricity system.

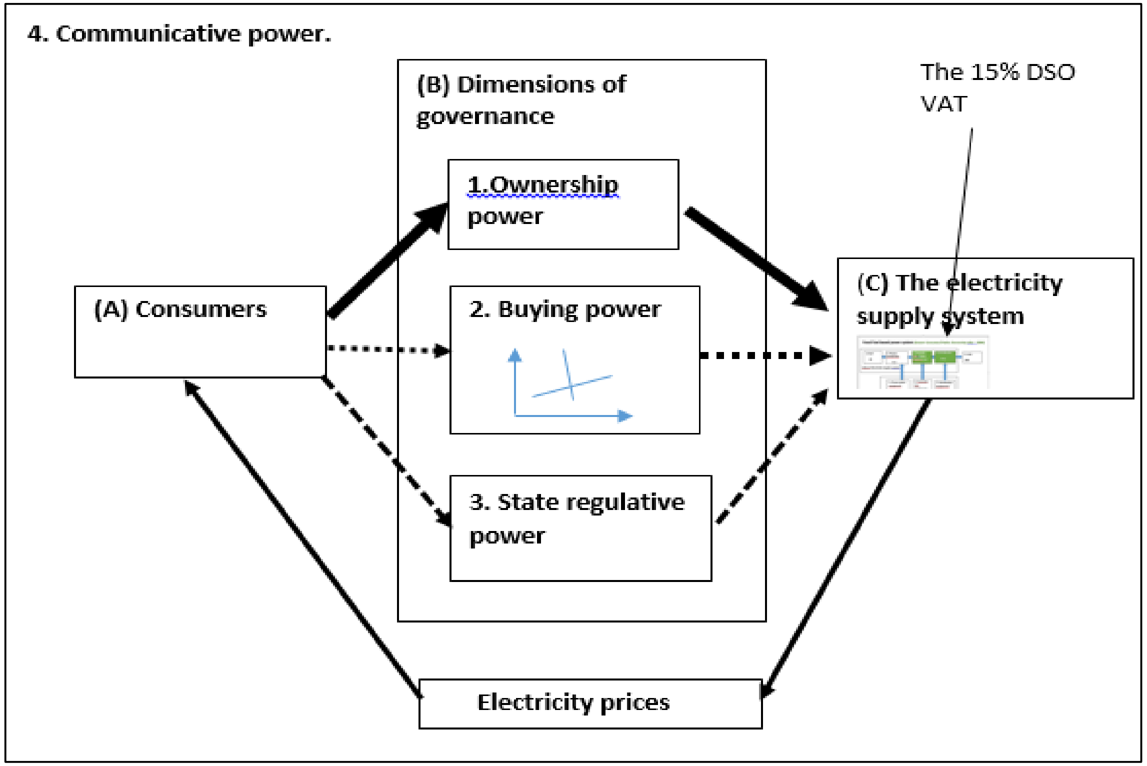

Figure 2. The four dimensions of power in the DSO part of an electricity supply system.

Figure 2 shows by means of the thick arrows how strong the consumer power has been executed in the Danish electricity system, which historically has been municipality and consumer owned. And that the buying power regulation is very weak in a natural monopoly, shown by the dotted line and only executed by means on influence upon the tariff structure. The state regulation has been a framework regulation, where the state by legislation required a non profit regime.

This regime historically *has been price efficient due to the non profit public regulation* ***in combination with*** *the consumer ownership regime*. The nonprofit term is in fact misleading, *as consumer owned companies within a* *nonprofit regulation regime,* still wants to lower the costs and benefit from this by means of lower consumer prices. So a better term for this "non profit" regime would be to call it a "consumer profit regime".

The result of this governance regime is that Denmark since the 1980ties has had electricity prices which are much lower than average EU power prices and around 50% of the German electricity prices. Only Sweden and Norway, with their high share of hydropower, had cheaper electricity. This is illustrated in figure 3 for 2017.

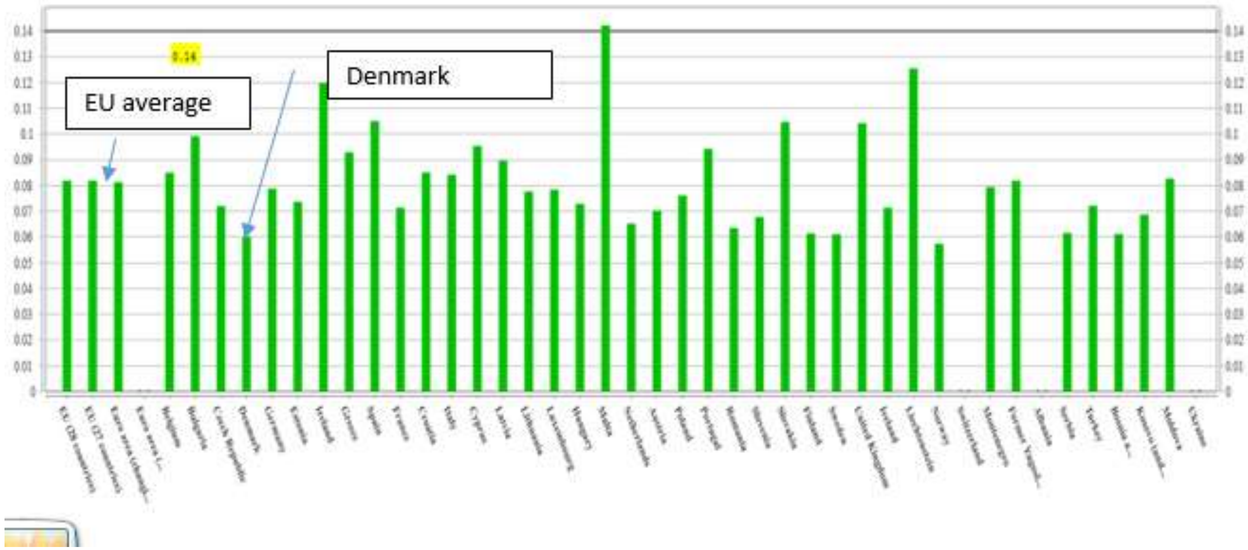

Figure 3: 2017 electricity prices for small and medium sized industry in Denmark[9]

The price in figure 4 includes Public Service Obligation (PSO) paid to the development of green technologies in the Danish energy supply system.

[9] Reference: http://ec.europa.eu/eurostat/tgm/mapToolClosed.do?tab=map&init=1&plugin=1&language=en&pcode=ten00117&toolbox=types

a. A Citizen (consumer/municipality) ownership system combined with a non profit public regulation give**s a ”consumer profit” system with low prices and innovation.**

b. **This makes earlier introduction** of renewable energy economically viable.

c. In natural monopolies, consumer/municipality ownership in a ”non profit regime”, paves the road for renewable energy under the economic point of view (1975 and onwards)

4. Regulation and the transition from stored fossil fuels to fluctuating renewable energy systems.

From our value-added analysis we have seen that the ongoing regulation of the electricity system should be seen in relation to the ongoing transition from fossil fuel based to renewable energy based systems.
The main characteristic of ongoing technological change will be the increase of the value-added share of the indirect electricity supply system, and the reduction of the share of the direct electricity supply system.

4.1. The technical transition to integrated smart energy systems

The point of departure technological base is a consumer and municipality owned district heating infrastructure.

The integration infrastructure is called a smart energy system and for instance consists of:

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1. Low temperature district heating.
2. Wind power for district heating in combination with heat pumps and hot water storage.
3. Geothermal energy
4. Solar energy for heat (and cooling) in combination with season storage systems.
5. Low temperature industrial heat.
6. **40% -50% Heat conservation**
7. Wind to gas systems.
8. Wind-transportation infrastructure

All these technologies **are much closer to the consumers** than the coal mines– shipping systems- and the central power plants they replace.

4.2. Multilevel policies and citizens ownership in the transition to smart energy systems

When integrating electricity and heat, consumer distant supply systems are replaced by consumer nearby activities. This consumer nearby integration infrastructure is in reality replacing the distant storage facility of fossil fuels by the integrative facility of smart energy systems.

Development and implementation of these systems requires policies within the areas of economy, organization, area planning and the political process. These policies both should support the development and implementation of renewable energy technologies, and the integration infrastructure investments. This is illustrated in figure 4.

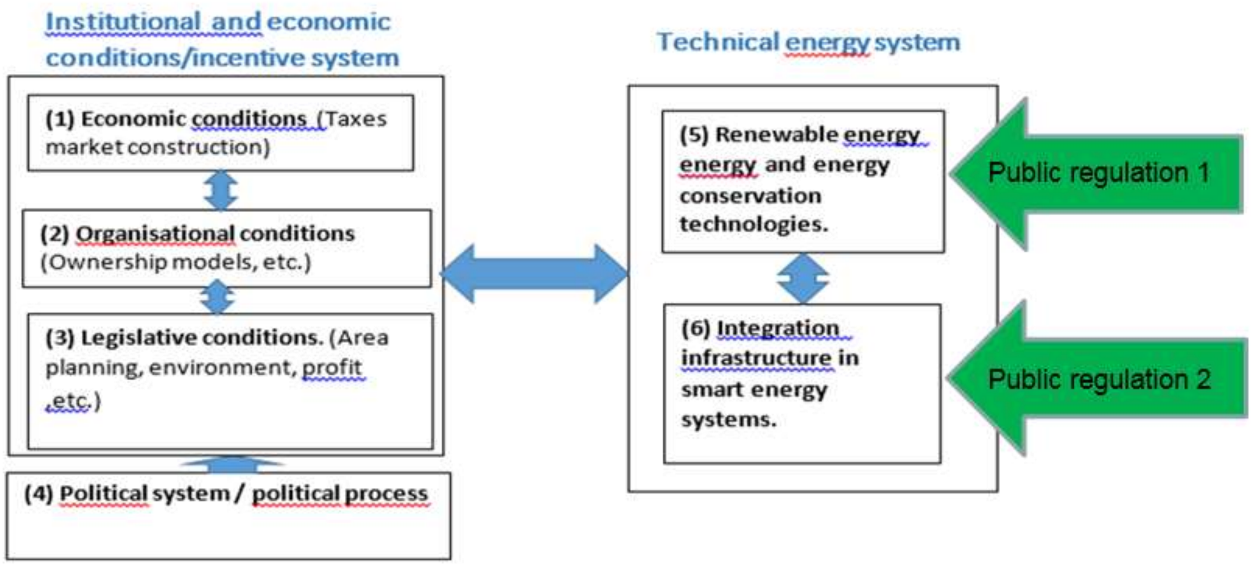

Figure 4: The two public regulation areas.

Under technical energy systems, the transition from stored fossil fuel systems to fluctuating renewable energy systems makes it is important both to look at the development of single technologies (figure 5 box 5) and the integration infrastructure that is needed to handle the fluctuating energy sources (figure 5 box 6). Both these areas are subject to regulation.
Here I want to emphasize that it is necessary to apply a holistic approach when describing the conditions that support or hinder a concrete technological development. These conditions are a consequence of concrete policies at the municipal, national and EU levels (box 4, fig. 4).

4.3. Smart energy systems and the need for consumer/municipality ownership

Smart energy systems need a multilevel governance system that supports investments and operation and management of integration technologies. This encompasses investments in district heating, heat storage systems (Ridjan et al., 2013), heat pumps, solar heating etc. , and that all these technologies should be dimensioned so that they can handle large shares of fluctuating renewable energy technologies. This should be combined with "in time" investments in energy conservation.

The change from distant coal extraction and large coal fired power plants to consumer near inter energy sector integration requires coordination and collaboration between owners of wind turbines, the TSO (Transmission Supply Operator), district heating companies, power distribution companies, and the municipalities and the central legislative authorities. This coordination is much more multifaceted than "just to" to import and burn coal, and require new organizational models that can develop, implement, coordinate and manage these many transaction activities both with regard to long term investments and day to day management. It is difficult to handle this high degree of complexity from a distance.

It therefore is a valid hypothesis that, due to its closeness to the consumers, the complex co-ordination and integration tasks both at the investment and operation and management level in smart energy systems may have lower transaction costs in a decentralized than in a centralized governance model.

In addition to transaction cost theory in the Coaseian tradition (Coase, 1937)(Coase, 1988), this hypothesis may also be inspired by the arguments against central planning in the Austrian tradition (Hayek, 1937)(Hayek, 1945). As the complexity of coordination increases, the costs of conveying the adequate level of information to a distant central planning agency may increase considerably.

Large companies therefore may be handicapped by relatively high transactions costs in a transition to smart energy system solutions. This is due to amongst others the following reasons:

- They would need to buy the local consumer- and municipality owned district heating systems. This would be very difficult, as these companies are subdued to a nonprofit or consumer profit regime.
- They would have to invest in the right size of heat pumps and heat storage systems linked to district heating systems owned by municipalities and consumers, or to make sure that these investments are implemented.
- A multitude of co-ordination activities should be developed, dimensioning investments in the different technologies so that they supplement each other's, and concurrently establish the right amount of energy conservation "in time" with a conservation level that supports the right low temperature district heating systems. It seems probable that it will be much easier for the owners of houses, district heating systems, etc. to implement and operate and manage these technologies, than for distant foreign companies.
- It is difficult for distant owners to establish onshore wind power in Denmark, as local citizens want influence and benefits from energy plants to counterbalance inconvenience from such plants. Therefore a large local ownership share is mostly requested.
- Building onshore and nearshore wind power may result in political conflicts, as distant potential owners like the Swedish power company Vattenfall, pays no local taxes and supplyis no profits to local actors. Local inhabitants in distant owner models will get the noise and visual disadvantages, and no benefits from the projects. An ongoing case is the conflict between the Swedish state owned power company Vattenfall and the local community (Olsen, 2016).

Due to the complicated regulations and communication task, it therefore seems difficult for large distant power companies , both to design and dimension the right investments and to operate these in an efficient way living up to local wishes, capabilities and technological conditions. These distant companies do not have the initial ownership governance power of the smart energy system technologies, and not either the decentral multitude of information needed to adopt efficient strategies and tactics. Consequently, they are comparatively handicapped as actors in the development of a decentralized smart energy system based on renewable energy.

As a consequence, large distant energy companies may tend to support other more centralized solutions, where their comparative advantages are stronger.

5. Conclusion and some policy suggestion

Integration of fluctuating Renewable Energy Sources should be placed as close to the energy consumers as socio-economically feasible/possible.
Transmission lines (interconnectors) should only be built after implementing economically feasible local and regional smart energy systems integrating fluctuating renewable energy today interconnectors are built without

examining local and regional integration possibilities. Moreover, there are EU subsidies to interconnectors but not to the local and regional integration infrastructure.

Ownership and management of smart energy systems should be placed as close to the consumers as socio-economically feasible/practical/possible (this would accelerate the implementation of renewable energy systems). In Denmark and other parts of the EU the transition from fossil fuel to renewable energy systems has come to a turning point. It is not any longer possible just to build new renewable energy capacity. It also is necessary to develop and implement the infrastructure around the fluctuating renewable technologies.

At present there are institutional hindrances to the implementation of these integrated smart energy systems. Hindrances within taxation, where for instance in Denmark tax on wind power for heat are high and tax on biomass are zero. And regarding interconnectors that are getting substantial subsidies and TSOs that by legislation are not designed to find the optimized balance between investments in local and regional integration in smart energy systems and investments in electricity interconnectors.

A major policy principle in Denmark and in the EU could be that economically feasible local and regional integration solutions should be developed and implemented before investments in transnational transmission lines. And that local and regional citizens ownership should be supported where socially and economically feasible.

This could be manifested in an EU subsidiarity directive bot dealing with an ownership and an investment subsidiarity principle for the establishment of smart energy systems that can integrate increasing shares of fluctuating renewable energy, and summarized in the box below.

Some suggestions for EU policies for green energy transition

1. Implementation of an energy subsidiarity principle.
2. Same level of subsidies to local and regional integration as at present to interconnectors.
3. Clear EU acceptance of policies that supports local and regional ownership of majority shares of renewable energy systems.

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Non-hierarchic Polycentric Regimes Facilitating Intelligent Distributed Energy Systems: The Common-Pool Resource Nature of Renewables

Introduction

State-of-the art *social acceptance* (SA) *of energy innovation* research (Gaede, Rowlands 2018; Wolsink, 2018b) shows that the original definition of social acceptance (Wüstenhagen et al., 2007) must be tightened up. This contribution will do so, based on:

(1) The coverage of multiple levels, and institutional frameworks as the major factors of SA;

(2) Focusing on crucial characteristics of the renewables' innovations, e.g. *distributed energy systems* (DES), as the major elements of the object of SA.

Beside distributed generation (DG), DES also includes *distributed storage*, systems of *internal demand response* (DR), and adjacent *infrastructures connecting and regulating* the DES. This not simply implementing new hardware, the crux is that DES is based on entirely different organizational principles than the existing centralist and hierarchical system of electricity supply.

Distributed Energy Systems

The development of power supply based on renewables is heavily depending upon the rapid emergence of DES. At the same time all elements of DES, including the infrastructures for power generation based on renewables, are facing many problems: social acceptance (obstruction, resistance, lack of cooperation etc. among many actors), perceived low potential (limited cognition, paradigmatic and cultural lock-in), and perceived low economic attractiveness (based on paradigmatic and market-structure lock-in). All these factors are associated with high policy risk, as a result, for actors actually willing to invest social capital as well as economic resources.

On the other hand these factors themselves are risks created by existing policy frames, to a large extent. Low acceptability, low economic viability, and also perceived limited potential

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Topics:

- Social acceptance of renewables' innovation;
- Renewables' deployment in Distributed Generation and Intelligent Grid developments;
- Energy policy, particularly with regards distributed generation with renewables, and infrastructure decision making;

are often resulting from institutional conditions that must be considered the result from policy frames. In terms of innovation theory, the *social-technical system* (STS) is highly locked-in (Unruh, 2000). Although DES cannot be simply classified as decentralized but also based on entirely different organizational principles, most obstructions for deployment are associated with the currently dominant *centralized power supply system.* This is leading to impediments for initiatives to establish DES, as current decision-making frames create investor reluctance, inflexible and flawed spatial decision making, and the tend to reproduce hierarchic, uniform and inflexible policy frames (legislation, policies, culture, incumbent organizations, etc.).

Social Acceptance 2.0

The object of SA of renewables' innovation is complex and multidimensional. For that reason, in the original conceptualization of SA a distinction is made between three dimensions, community acceptance, market acceptance, and socio-political acceptance (Wüstenhagen et al., 2007). All three are characterized by different *processes*, with partly different *actors* – some operating in more than one dimension –, and also distinguished *objects*. The most important objects of socio-political acceptance are the *institutional changes* required for the transformation of the power supply system, e.g. the abandonment of the centralized, hierarchic system, and the establishment instead of a polycentric, hybrid, flexible, and adaptive system serving the deployment and development of DES. This requires the establishments of intelligent grids (IG) with strong variety and resilience. Scaling up to intelligent grids with a large amounts and huge variety of DES units requires new organisational principles and structural changes (Wolsink, 2012), for example, institutional changes in spatial planning.

SA is a bundle of complex, dynamic, and interdependent processes, and even the main object itself, innovation, is a process. The innovation literature highlights that innovation is neither invention nor diffusion of technology, but rather the development of new ideas materialized in products and services that become accepted in society, replacing other products and practices.

The process character of SA has been the purport of distinguishing between the three principal dimensions of acceptance: community, market, and socio-political, but in further elaboration of the concept of SA it has been recognized that the three dimensions are also a manifestation of multiple layers (fig.1)

- Environmental conflict and environmental justice in infrastructure decision making (energy, waste, water, green space);.

Latest papers (open access): *Social acceptance revisited: gaps, questionable trends, and an auspicious perspective*. https://doi.org/10.1016/j.erss.2018.07.034. *Co-production in distributed generation and landscape values.* http://www.tandfonline.com/doi/full/10.1080/01426397.2017.1358360

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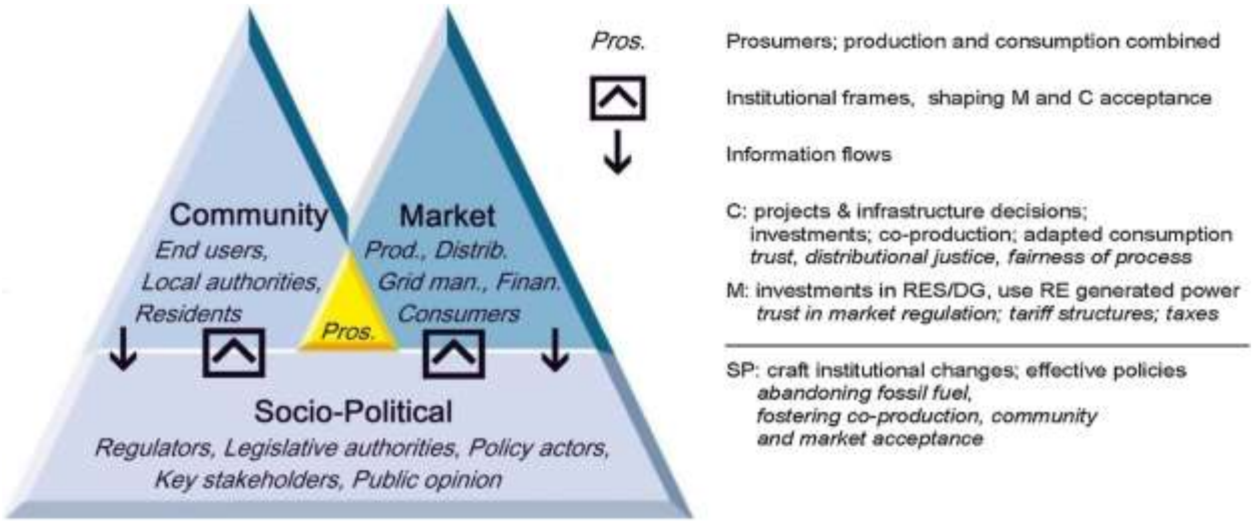


Figure 1: Three multi-layered dimensions of SA, with significant actor groups (Wolsink, 2018b).

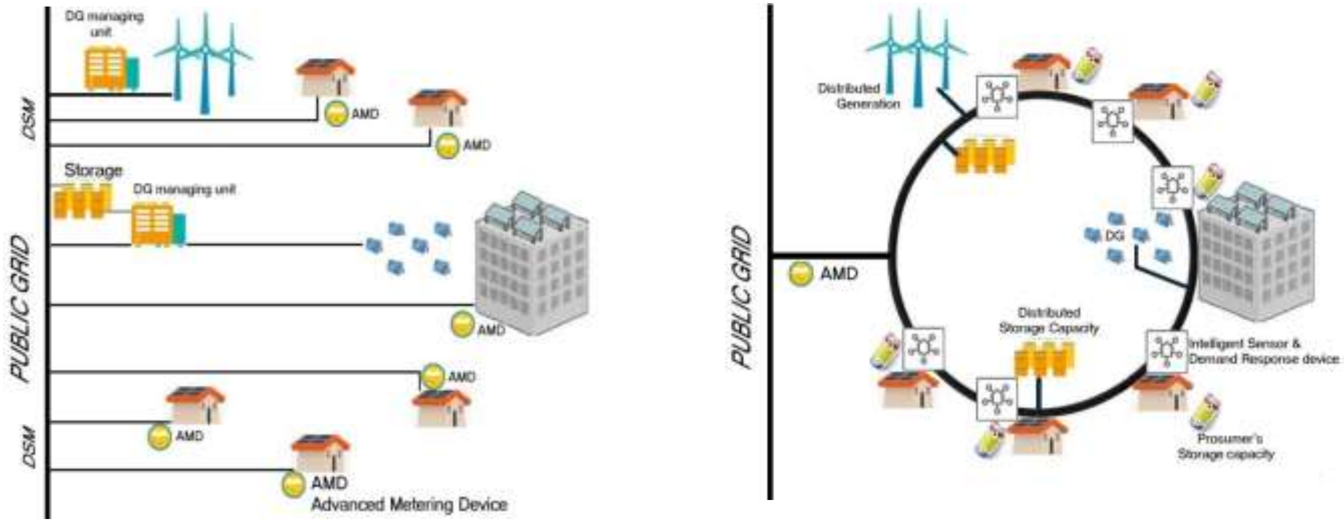
The multi-level configuration of SA processes emphasizes that conditions set within the socio-political layer (e.g. defining market conditions, or empowerment of local actors) are affecting acceptance processes in the two other layers. For example, the literature widely agrees about the notion that institutional frameworks generally should foster stakeholder and community engagement (participation, inclusiveness, co-production, empowerment) in projects. DES deployment asks for co-production in establishing the new STS infrastructure, which is co-production in investments and making space – the prime scarcity factor of renewables – and coproduction in generation and management of energy (Wolsink, 2018a).

Example: coproduction in DES microgrid

The imaginary implementation of renewables ‘replacing’ central power plant generation in the current public grid is schematically pictured in figure 2A. Advanced Metering Devices (AMDs) are measuring consumption and production of renewables’ generation units located decentral at consumers’ rooftops, ground based PV and wind farms, and Demand Side Management is possibly applied to balance the grid.

The alternative in terms of DES for the same spatial configuration is shown in fig.2B. Here the consumers manage their own generating capacity in large variations of micro-grids (Wolsink, 2012) based on community co-production (Koirala et al., 2018; Wolsink, 2018a). Moreover, they do so with control over their own generation units, storage capacity and they use demand response (DR) with monitoring and control systems (real 'smart' meters, expressly distinguish from the ADM (fig.2A) which is currently claimed to be 'smart') to balance their consumption optimally to the power generated, stored, and re-loaded in their own system. Peer-to-peer deliverance becomes essential, because of the utilization of jointly placed and jointly managed infrastructure, and balancing with the micro-grid (Wolsink, 2012; Mengelkamp et al. 2018; Tushar et al., 2018). This way DR and individual and communal storage are serving the feasibility of coproduction of DES, and simultaneously the exchange of power to the public grid is reduced, helping to solve the capacity issue there, by reducing peak demands from, also and peak feed-in to the public grid.

Figure 2. A: Renewables located decentral, in centrally configured and managed public grid;
B: Same community; DES controlled and microdrid-managed by co-producing prosumers.



Institutional theory: CPR

There should be full recognition of the essence of the acceptance object – which is anything related to innovation power supply STS. The most prominent implication is the acceptance of necessary conditions for stimulating innovation processes, of conditions needed for implementation, and of the consequences of such implementation. This implies acceptance of *institutional changes:* restructured markets, new taxing systems, education systems, spatial planning processes, energy governance frames, redefined properties in power supply, etc. It even concerns acceptance of 'creative destruction', like dismantling infrastructures, and disempowering dominant actors.

Whereas most applied theories in SA research only cover one layer/scale focusing upon static positions (one-shot case studies), highlighting one specified actor group (e.g. the "public"), this presentation will discuss the rapidly increasing recognition (Wolsink, 2012; Melville, 2017; Gollwitzer et al., 2018; Acosta, 2018; Wolsink, 2018a) of the relevance of common pool resources (CPR) theory (Ostrom, 2009). This institutional theory covers the management of social-ecological systems with regards to natural resources in natural as well as human-made – infrastructures – social-ecological systems (fig.3). It starts with fully characterizing any system in terms of variables defining four subsystems and their interactions. A social-technical system for sustainably harvesting and using renewable energy can be analyzed with this theoretical framework.

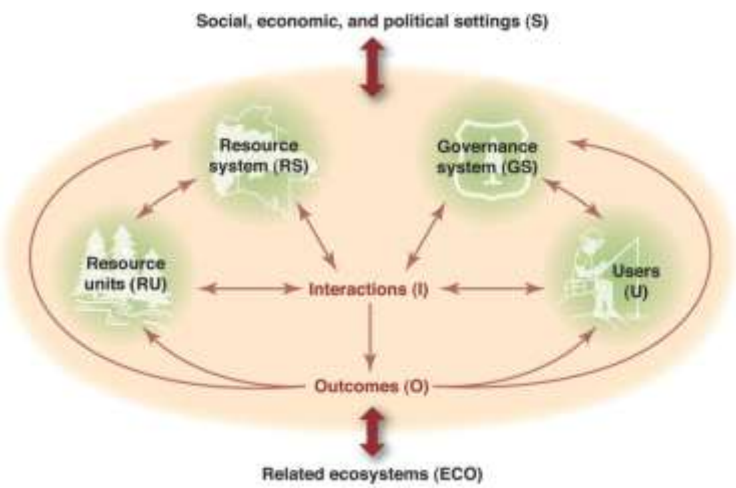


Figure 3. Social-ecological system for sustainable use of a natural resource (Ostrom, 2009, p420).

CPR theory provides a sound alternative rooted in empirical evidence from many other natural resources studies. It is, as requires for studying SA, multi-level. For this workshop we will focus upon socio-political acceptance. Socio-political acceptance mainly concerns such institutional changes rather than a conception that renewables' innovation would call for central direction from above. However, CPR studies have strongly falsified the assumption that organization itself of systems generating public value requires central direction (Ostrom, 1999). In power supply, as part of the lock-in, this idea still seems to be dominant. To avoid suggestions that the three layers (fig.1) imply any kind of hierarchy, socio-political acceptance should not be positioned on top, but it must be considered as a foundation at the bottom. Processes of institutional change are apparent in all three levels, but formally changing the rules of the game, like redefining the choice sets in markets or effectively empowering citizens for co-production of renewables, is mainly the object of socio-political acceptance. It concerns, for example, changing strong legislation favouring centralized power supply over newly emerging, but strongly obstructed initiatives of co-production by prosumers, which is in fact an overlap of market and community acceptance which is important for renewables (yellow, figure 1). In terms of socio-technical systems and transition, it is particularly about structurally change regimes, with high resistance among institutional power.

Policy relevance will be revealed concerning:
- the locked-in biases of most current social acceptance studies and policies alike;
- the multi-layer perspective of polycentric management of DES in intelligent grids;
- the significance of institutionalized regime changes fostering co-production.

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Integrated Community Energy Systems

There are around 3000 local energy initiatives in Europe. In the changing energy landscape, these community based local energy initiatives are posed to play significant role in the energy transition. In this context, Integrated Community Energy Systems (ICESs) are emerging as a modern development to re-organize local energy systems allowing simultaneous integration of distributed energy resources (DERs) and engagement of local communities. Some of the characteristics of ICESs are locality, modularity, flexibility, intelligence, synergy, citizens engagement and efficiency. ICESs can be further categorized based on their activities, location, scale, grid connectivity as well as topologies.

With the emergence of ICESs new roles and responsibilities, business and governance models as well as interactions and dynamics are expected in the energy system. Although local energy initiatives are rapidly emerging due to community objectives, such as cost and emission reductions as well as resiliency, assessment and evaluation of the potential value that these systems can provide to both local communities and the whole energy system are still lacking. The value of ICESs is also impacted by the institutional settings internal and external to the system. Current energy trends and the associated technological, socio-economic, environmental and institutional issues also affect the values of ICESs. Often multiple values need to be stacked and strategic exchanges with multiple markets and sectors are needed to have a viable business case for ICESs. The technical and social innovation becomes inevitable as the social, economic and institutional relations between different actors change in the complex socio-technical setting of the community energy systems.

With this background, this presentation utilizes a conceptual framework consisting of institutional and societal levels in order to understand the interaction and dynamics as well as potential values of ICESs implementation. Optimal planning and operation of ICESs and their performance based on economic and environmental metrics is assessed. For the considered community size and local conditions, grid-connected ICESs are already beneficial to the alternative of solely being supplied from the grid, both in terms of total energy costs and CO_2 emissions, whereas grid-defected systems, although performing very well in terms of CO_2 emissions reduction, are still rather expensive. ICESs ensure self-provision of energy and can provide essential system

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services to the larger energy system. The added value of ICESs to the individual households, local communities and the society is also demonstrated.

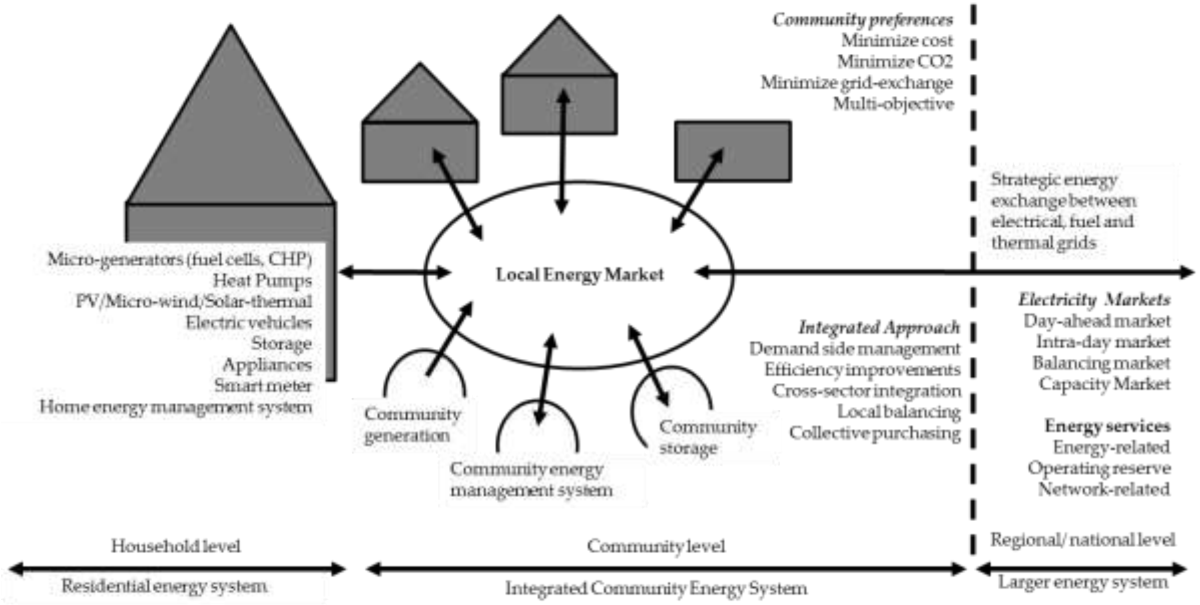

Figure 1: Functions and Interactions of an ICES.

A comprehensive institutional design considering techno-economic and institutional perspectives is necessary to ensure effective contribution of ICESs in the energy transition. The social and technical innovation in ICESs should be aligned through investigating the innovative potential of local energy initiatives in terms of technology, social embeddedness and normativity as well as the innovative potential of emerging sustainable energy technologies, including their social and normative dimensions.

Two case studies of local energy initiatives which are being jointly implemented by local communities, citizens, companies and the government are presented to offer as an example that different energy system actors can work together for a sustainable and decentralized energy future. First, in Benedenbuurt, Netherlands, the local community is developing a sustainable district heating system. It consists of 470 households. The initiative is now supported by ‘van gas los’ subsidies from the Dutch government. Second, Gridflex Heeten project, a smart microgrid consisting of 2.2 MW solar park and sea-salt batteries is being implemented with the subsidy from Top-sector energy program of Dutch government. We present the comparative analysis of these two distinct cases of local energy initiatives.

Through these cases, we also highlight techno-economic and societal barriers from regime and landscape level in practice. For example, in the case of Benedenbuurt, the ECOVAT thermal energy storage technology despite being sustainable and well-accepted by the local communities, could not be implemented because that would mean the retrofitting of the residential high temperature network as the ECOVAT operates on an low-temperature district heating network. Similarly, in the case of Gridflex Heeten , the standard battery management systems needed to be aligned with the technical characteristics of the sea-salt batteries.

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Renewable Energy Communities and EU legislation

In November 2016, the European Commission published its proposals for the so-called Clean Energy Package. This set of legislative and non-legislative texts lays out the European regulatory framework for the energy transition in the next decade. It was built on three pillars: the energy-efficiency-first principle, Europe as a global leader in renewables, and consumer empowerment. An energy system in which consumers can play a greater role, for instance by reacting to price signals or by generating their own energy, is expected to bring multiple benefits: it makes the energy system more flexible, helps mobilise private capital for the energy transition, and can increase the public acceptance of renewable energy projects. Community-ownership seem particularly effective in reducing public opposition and does so without increasing the levelised cost of electricity compared to utility-owned projects, partly because citizens expect a lower return on investment than companies.

The key provisions on consumer empowerment are found in two proposals. The revised Electricity Directive regulates active consumers and local energy communities and the revised Renewable Energy Directive regulates renewable self-consumption, joint renewable self-consumption and renewable energy communities. Whereas local energy communities and renewable energy communities are legal entities with their own ability of contracting, for instance non-profit associations, jointly acting renewable self-consumers do not need incorporated. They are based on a contractual relationship between two or more renewable self-consumers living in the same building who agree how to jointly consume, store or sell the electricity they have generated. The Electricity Directive provides roles and responsibilities for market actors in the electricity system. The Renewable Energy Directive is broader than the Electricity Directive and covers all types of energy. As far as renewable electricity is concerned, both directives overlap and therefore have to be coherent.

With the proposal on the renewable energy communities, the Commission wanted to anchor the concept of energy communities in legislation. Recognising energy communities in such a manner should help spread best practices across the Union and enable citizens to come

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together to form communities also in those parts of Europe where communities are not yet established. To do this, the Commission proposed a definition that had to meet different criteria. A key criterion for instance was local control, which should help increase the public acceptance of the renewable energy projects. Furthermore, the Commission proposed that Member States had to take into account the characteristics of renewable energy communities when designing their support schemes. It did not, however, oblige Member States to grant specific privileges to these communities.

The political agreement that was found between the co-legislators, *i.e.* the European Parliament as the representative of European citizens and the Council of the European Union as the representative of the Member States, contains a single definition for renewable energy communities, according to which a renewable energy community is a legal entity which

> *"in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity*".

The agreed definition therefore maintains the elements of open participation and local control of the Commission's proposal. This was considered important to ensure that communities can actually deliver the expected benefit of increasing public acceptance by linking the community to the local level from which otherwise most opposition arises. The term 'proximity' is however not further defined but it would make sense to understand it as the area that is most affected by the renewable energy project.

Renewable energy communities are further defined as entities "*whose shareholders or members are natural persons, SMEs or local authorities, including municipalities*". Membership is therefore not limited to citizens but can also include small and medium enterprises as long as their membership in the community is not their primary economic activity, as the article states. It can also include municipalities that might contribute to the energy transition, for instance by installing solar panels on the roof of a school. Finally, the "*primary purpose is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits*", which underlines that renewable energy communities are not looking to maximise profits for their own sake.

According to the agreement found between the co-legislators, renewable energy communities will be allowed to produce, consume, store and sell renewable energy. They will also be allowed to share the electricity that it produces among its members. This is a new possibility which was introduced because new models for electricity sharing are expected to develop in the coming decade, and the co-legislators did not want to preclude its development. Furthermore, the co-legislators added an ‘enabling framework’. Among other things, Member States have to reduce the administrative barriers for energy communities, provide regulatory and capacity-building support, and ensure that they are not subject to discriminatory treatment. Additionally and in order to address social concerns, Member States also have to ensure access to finance and that low-income households and vulnerable consumers can also participate in energy communities.

These provisions will enter into effect in July 2021, giving Member States enough time to transpose the provisions of the directive. The negotiations on local energy communities as defined in the proposed revision of the Electricity Directive have not yet been concluded. It is still an open question for instance if local energy communities should be subject to the same obligations as other actors on the electricity market or if any exemption should be granted to them so that regulations are proportionate to their size and professional capacity. Should any exemptions be granted, it will be important to ensure that energy communities do not become a tool to circumvent regulation. The adoption of the final legal texts is expected for the end of 2019.

Representing Energy Communities Interests in EU Policy

The new special report by the Intergovernmental Panel on Climate Change (IPCC) on limiting *Global Warming* to a *1.5°C increase* again highlights the urgency to rapidly decarbonise our societies. It shows that keeping global temperatures below 1.5°C is technically and economically possible, but requires fundamental changes from all countries on an unprecedented timescale.

The EU proclaimed its political will to enact these changes with its signature in the Paris agreement. The EU Clean Energy Package should be the main driver of the ambition to replace conventional centralised energy systems run by few large players with a decentralised energy system based on energy efficiency and renewable energy which empowers a range of smaller actors from citizens to utilities.

To deliver this ambition, the EU legislative framework must encourage both the large-scale fast deployment of renewable energy and energy efficiency measures, and specifically the rapid uptake of smaller-scale, local citizen and community owned renewable energy installations.

Small-scale renewable installations are considered to be the backbone of a smart, decarbonized and increasingly distributed energy system that empowers energy consumers, communities and territories (e.g. households, hospitals, public buildings, hotels) with a clean and sustainable energy supply.

A recent study by CE Delft[10] estimated how many citizens could be producing and consuming their own electricity in the individual Member States and in the EU as a whole by 2030 and by 2050 provided that the right legislation is in place.

The study determined that over 264 million European citizens (half of the population of the EU) could be producing their own energy by 2050. These energy citizens could be producing 611 TWh of electricity by 2030 and 1,557 TWh by 2050. Therefore, by 2030, energy citizens could be delivering 19% of the EU's electricity demand and 45% by 2050. The study also found that near to 37% could come through involvement in energy communities. This is a significant

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[10] CE Delft, 2016. The Potential for Energy Citizens in the European Union, available at bit.ly/energycitizenstudy

contribution to achieving the EU's 2030 renewable energy target and moving towards a 100% renewable energy system.

To encourage citizens to create energy communities and invest in smaller-scale renewable projects, legislation must create the necessary investment incentives and business models.

The new Renewable Energy Directive and Governance Regulation for the next decade recognise this necessity and enshrine the rights of European citizens, local authorities, small businesses and cooperatives to produce, consume, store and sell their own renewable energy without being subject to punitive taxes or excessive red tape.

Within the ongoing Trilogue negotiations on the design of the new electricity market however, positions within the European Council introduce the possibility to place an unfair financial and administrative burden on small-scale renewable and high efficiency cogeneration installations, demonstration projects and energy communities. These positions would allow Member States to remove priority dispatch and exemptions on balancing responsibilities without any pre-condition related to market-readiness which would put small-scale players at an extreme disadvantage in comparison to well-established utilities and undermine the crucial uptake of these installations in Europe.

Policy makers must acknowledge the specificities of smaller-scale renewable and high efficiency cogeneration installations as well as demonstration projects by strengthening the European Commission's proposal on exempting them from balancing responsibilities and by supporting priority of dispatch for small installations.

Exposing smaller renewable and high efficiency cogeneration installations to the same market and balancing requirements as utility-scale generation will result in heavy technical, administrative and consequently financial burdens, which prove prohibitive for smaller actors including energy communities who wish to engage in the energy transition.

Most small installations are owned by households and small businesses for which market-based dispatch would entail excessive technical and administrative burdens.

Operators of demonstration projects and small-distributed installations should not be considered as identical to large-scale actors in the electricity system. Moreover, electricity markets are evolving in different ways in different Member States. Keeping the current priority dispatch and

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access regimes for small installations is fundamental for investors’ security as they will bear the costs for changes in the regulation of electricity markets.

An unconditional ‘blanket’ phase-out of priority dispatch at EU level which ignores the specificities of the different European countries, is likely to stall the uptake of small renewable and cogenerated energy especially in countries where there has been little progress so far.

Balancing and aggregation markets do not yet function in a way that can fairly expose small installations to balancing risks.

Considering the particularity of business models for smaller installations, imposing balancing responsibilities will increase both administrative costs and burdens for citizens and energy communities engaging in this business as they will need to contract a third party (e.g. aggregator) to access balancing markets. Such requirements will hinder the uptake of small installations and new business models alike as long as electricity markets do not provide efficient contracting of balancing and aggregation services, which is still the case in several EU Member States.

Current energy markets in the European Union are not yet a level-playing field for market actors. Generally, they are characterised by an over-capacity from nuclear, gas and coal power stations, which are protected by capacity markets. Fossil and nuclear energy still receive direct and indirect subsidies. Their energy price does not internalize external costs such as pollution, health issues or the impact on the climate. Moreover, the European Emission Trading System (ETS) is not functioning to provide real incentives for an energy transformation.

Negotiations on the Clean Energy package might be finalised by the end of 2018 and would conclude with the development of legislation for a new EU electricity market design. The main challenge remains to achieve coherence with, or even enhance recent EU legislation on renewables (Renewable Energy Directive II and Governance Regulation) in order for the EU to fulfil its commitments under the Paris Agreement.

Decision-makers involved in the Trilogue on the new EU electricity market design need to ensure that the definitions of energy communities and their right for market participation provide energy communities with an enabling framework and to access all suitable markets on equal footing with large players. In addition to the positions of priority dispatch and balancing responsibilities mentioned above, energy communities should have the right to become a DSO and to establish, lease, own and/or manage both public distribution systems and community networks.

Upon the entry in to force of the legislation on the EU Energy Union, it will then be up to national governments to implement this European law to enable energy communities to take a very active role in Europe’s energy transition.

The first test of the Member States' commitment and support for this new actor will be the development of national energy and climate plans.

The new governance process requests national governments to draft, with an initial public consultation process, national plans by the end of 2018. The Commission will assess these plans and will provide recommendations by mid-April 2019. After that, governments will finalise their plans by the end of 2019. During this drafting process governments are obliged to organise public consultations for the development of these national plans and long-term strategies.

In order to promote energy communities and represent their interests, the important task now is to communicate these new opportunities to citizens across Europe and make sure that they can understand and actively use the new rights which they have been granted.

In this respect, governments, cities and local authorities will have some flexibility since the new Renewable Energy Directive does not entirely ease the set up process for renewable energy communities, and indeed there are a lot of new and unanswered questions to address.

Notably, certain cities and local authorities have already realized the economic, social, environmental and sustainable benefits of energy communities for their development and despite unfavourable conditions, some energy communities have been successfully created in various parts of Europe.

Renewable energy associations, NGOs, consumer protection organisations as well as local and national governments and authorities should highlight best-practice examples of successfully installed energy communities through information and capacity building workshops for its citizens during the public consultation process to encourage their participation as energy producers.

The European Commission could actively promote this through a large dissemination campaign. After all, it is in European legislation where these rights are enshrined. In a time of increasing Euroscepticism, pro-European decision-makers should highlight this achievement as a true added value of the EU for European citizens: energy communities are a tool to create local wealth, to modernize Europe's economy and to democratize its energy system.

Microgrids Integration and the Role of Distribution Systems Operators

1. Introduction

The penetration of distributed energy resources (DER), mainly distributed generators and flexible demand, is increasing worldwide and is expected to increase further encouraged by environmental policies and decreasing costs. The presence of DER in the electricity network (with their high degree of dispersion and small size) poses significant challenges in the operation of the power system, especially at the distribution level, where DER are typically connected. Distribution networks are transformed from passive networks to active systems and Distribution System Operators (DSOs) are assuming increased responsibilities and new roles in the evolution of current energy networks towards smart grids. They act as neutral market facilitators and guarantee distribution system stability, power quality, technical efficiency and cost effectiveness as key enablers for the on-going energy transition.

The aggregation of DER in Microgrids and their coordinated control allows the full exploitation of their advantages. From the grid's point of view, a Microgrid can be regarded as a controlled entity within the power system that can be operated as a single aggregated load and, given attractive remuneration, as a small source of power or ancillary services supporting the network. Microgrids can provide additional benefits to the DSO by providing dispatchable power for use during peak power conditions and alleviating or postponing distribution system upgrades. They can also provide network support in times of stress by relieving congestions and aiding restoration after faults. Investments in Microgrids can be done in multiple phases by different stakeholders: end consumers, energy suppliers, DSOs, etc.

It should be noted that due to their large number and spatial dispersion, DER's effective integration into the operation of electricity markets is a complex and demanding task. Moreover, their relatively small size makes their direct individual participation in the electricity market, although theoretically possible, highly impractical. To this end, in compliance with the EU energy legislation, the regulatory framework in most countries foresees some form of entity that

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undertakes the task of managing DERs and representing them to the market procedures. Based on that, three models can be distinguished wrt the operation and ownership of Microgrids:

- Integrated Utility or DSO owns and operates the Microgrid, if regulation permits.
- Market Aggregators (ESCOs) maximize the value of the aggregated DER participation in energy markets – profit driven.
- Prosumers own and operate Microgrids to reduce their electricity costs or maximize revenues (Local Energy Communities) – value driven.

Local Energy Communities (LEC) in particular, are highly encouraged by EU policies (Winter package), since they foster customers' active participation in electricity markets, facilitate the energy transition, particularly in promoting the wider uptake of renewable energy and provide new energy services at the citizens' level. Microgrids are the basic technical infrastructure for the operation of LEC, however LEC is one of the models and thus they are not equivalent.

This talk focuses on the integration of DER in the Electricity Markets through the study of the three models: in the first one the DERs are centrally managed and dispatched in a central market, in a way similar to conventional generation units, while in the other two models, an intermediate entity (Aggregator or LEC) represents the DERs in the market procedures. The models are mathematically formulated as optimization problems (the first as a single-level problem and the second one as a bilevel problem), while three DER cost scenarios are considered. The results of the simulations attempt to provide answers to the questions: What is the most effective way to integrate DERs in the electricity system? How are the other market players affected? What is the role of the DSO?

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2. Models

2.1 Centralized DER management

Centralized management of DERs is performed by the Market Operator during the Day-Ahead Scheduling (DAS) through the market clearing process. The aim is to maximize the total social benefit. All forms of resources are remunerated at a uniform price, the System Marginal Price (SMP). The DERs are seen as another form of resource (similar to the central conventional units) and are dispatched accordingly.[11]

The centralized model is, thus, formulated as a linear programming problem solved by the Market Operator (Figure 1).

Figure 1: Conceptual framework of the centralized model.

[11] In an actual electricity market, this scheme for incorporating the DERs would be highly inefficient and complex due to the multitude of the DERs. However, its examination is of theoretical significance, as it serves as a reference for drawing comparisons between the models.

2.2. Decentralized DER management through LEC

Decentralized management of DERs through a Local Energy Community (LEC) is performed by an entity independent of the Market Operator that acts as an intermediary between the DERs and the Market. The LEC aims at minimizing the procurement cost for serving the load under its responsibility. The DERs are considered an asset of the LEC, which – as a value-driven entity – issues set-points per Dispatch Period. The DERs are remunerated/charged at the declared price (Pay-As-Bid (PAB) remuneration scheme).

The LEC participates in the market procedures through the submission of properly formulated Production Offers and Demand Bids. Any charges or remuneration of the LEC are performed at the SMP.

The market clearing process, in turn, is under the responsibility of the Market Operator. The Market Operator solves the DAS problem taking into account the cost of the central production units as well as the Production Offers and Demand Bids submitted by the LEC.

The mathematical equivalent of this model is a bilevel programming problem comprising two levels of decision-making (Figure 2): the upper level describes the LEC problem and the lower level describes the market clearing process as performed by the Market Operator.

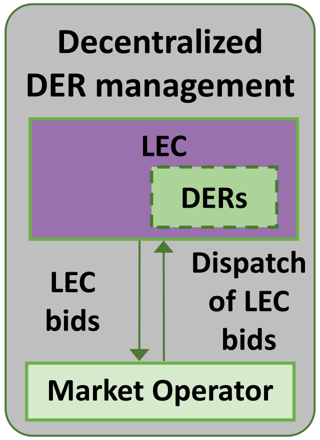

Figure 2: Conceptual framework of the interactions of the entities in the decentralized model with LEC.

2.3 Decentralized DER management through Aggregator

Decentralized management of DERs through an Aggregator is performed again by an entity independent of the Market or System Operator that acts as an intermediary between the DERs and the Market. The Aggregator, however, is a profit-driven entity. This means that the Aggregator does not simply decide the dispatch of the local resources under his responsibility. Contrary to the Decentralized-PAB model, the Aggregator decides the uniform retail price for remunerating the energy injected by local production units and charging the energy demanded by local flexible load (Pay-As-Cleared (PAC) remuneration scheme).

The Aggregator participates in the market procedures through the submission of properly formulated Production Offers/Demand Bids and any charges or remuneration of the LEC are performed at the SMP.

The DERs are considered clients of the Aggregator: they receive price signals to which they respond by adjusting their production or consumption levels.

The market clearing process is performed by the Market Operator through solving the DAS problem taking into account the cost of the central production units as well as the Production Offers and Demand Bids submitted by the LEC.

The mathematical equivalent of this model is a bilevel programming problem comprising two levels of decision-making (Figure 2). The upper level describes the Aggregator problem. The lower level describes the market clearing process as performed by the Market Operator and the decision-making process of the DERs.

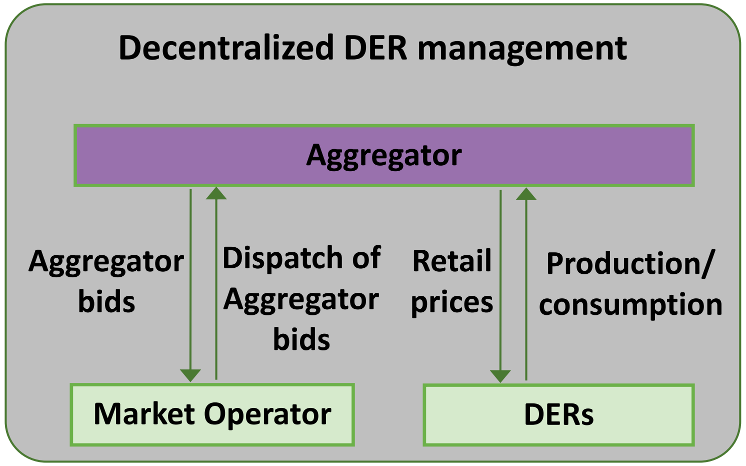

Figure 3: Conceptual framework of the interactions of the entities in the decentralized model with Aggregator.

3. Implementation – Scenarios

A modified version (without hydro generators) of the IEEE 24-bus test system is employed comprising 26 conventional units (unit cost between 34,6€/MWh and 145€/MWh, total capacity 3,1GW), 10 local generation units (unit cost between 95€/MWh and €104/MWh, total capacity 398,9MW) and 10 local flexible loads (unit cost between 33€/MWh and €82,5/MWh, total capacity 614MW). The simulations correspond to a one-year period, which is represented by 14 load scenarios, each weighted by its occurrence frequency.

Each model is examined considering four DER cost scenarios: Basic, -50% (with prices lower by 50% with respect to the Basic Scenario) and +50% and +150% with prices higher by 50% and 150% with respect to the Basic Scenario.

All models are solved using CPLEX 12.5 under GAMS [1] running on an Intel®CoreTM i5 at 3,30GHz with 4GB RAM. The relative termination criterion is set to 10^{-8}. The centralized model comprises 2.591 equations and 2.577 variables. The decentralized PAB model comprises 9.185 equations and 6.315 variables, while the decentralized PAC model comprises 10.865 equations and 7.183 variables. All models are solved within less than 1sec.

4. Results – Conclusions

In the decentralized management models, the local production units are committed and dispatched (even though this deteriorates the specific cost component of the LEC/Aggregator), while the conventional production units are dispatched to a lesser degree, thus, resulting in reduced SMP (a fact that improves (decreases) the cost component of the LEC/Aggregator related to the energy imports from the System). The reduced SMP leads to an improved Average Load Serving Cost (ALSC)[12].

In summary:

- Decentralized management benefits in all examined cases the consumers, since it results in lower ALSC.
- The PAB model (LEC) accrues higher benefits for the consumers so long as the local generation units are expensive (+150% cost scenario). By contrast, the uniform pricing method of the local production units in the PAC model (Aggregator) renders the specific resource expensive and reduces its dispatch and, by extension, the flexibility capabilities of the Aggregator.
- In the intermediate and low cost scenarios (-50%, Basic, +50%) the two decentralized management models result in identical results.

[12] Weighted averages of the SMP using the total load per bus (flexible + inflexible) as weight.

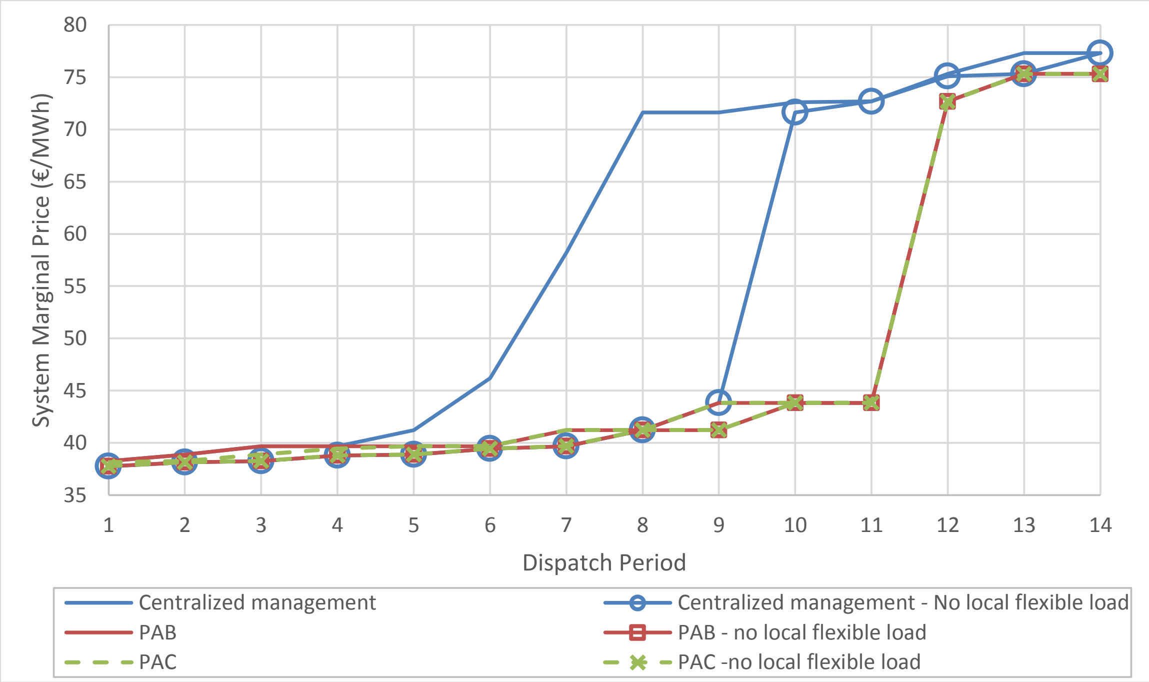

Figure 4: SMP per Dispatch Period for the three models with and without local flexible load (Basic cost scenario).

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[1] GAMS Development Corporation, *General Algebraic Modeling System (GAMS) Release 23.8.2,* Washington, DC, 2012.

An Insight into Community Oriented Approaches in EU Demand Side Management Projects

Anna Mengolini works for the **Energy Security, Distribution and Markets Unit of the Joint Research Centre**. She conducts research on socio-technical analysis and modelling of emerging energy systems, consumer active participation and the evolution of retail energy markets. Her research interests also include energy poverty, vulnerable consumer and energy justice and how these issues should be addressed to build an inclusive energy transition. She has a background in Chemical Engineering (MSc, University of Bologna), a European MSc in Environmental Engineering (Politecnico of Torino and Oxford Brookes University) and she holds a PhD in Energy Systems (Politecnico of Torino). She has recently completed a BSc (Hons) in Psychology.

The functioning of the emerging electricity systems will rest on the interaction of a multiplicity of social players who operates as independent decision-makers driven by personal goals and attitudes as well as social interactions. Evidence suggests that for their successful deployment it may not be sufficient to address the complexity of the needed behavioural change with an individualistic approach. The social dimension of consumer behaviour and engagement equally needs to be carefully taken into account [1-4].

This is particularly true in the demand side management (DSM) domain, where consumers play a fundamental role. In this field however, the current debate still focuses mainly on technological issues and economic incentives, mostly addressing energy demand issues with an individualistic approach to attitudes and choices [5-7]. This traditional approach concentrates primarily on individual feedback mechanisms, neglecting the complex social dimension of shared practices, goals and attitudes associated to energy consumption [8, 9]. This individual-oriented approach appeals to the consumer *self-enhancing* values, and reflects a key concern with one's individual interests and well-being.

A more recent stream of research is investigating ways to activate consumer's response by leveraging more on collective dynamics, suggesting a shift from an individual approach to energy management to a collegial one where consumers are seen and approached in their social context. This approach builds more on *self-transcendent* values and reflects a key concern with collective interests; it aims at building a sense of community and of shared values and goals. Growing attention is given to strategies to promote active participation of end-users at community level, and on the role that communities can play in the transitioning energy system [10-12].

Community-based energy initiatives can produce energy, reduce energy use, manage energy demand and purchase energy; they may therefore play an important role towards self-sufficiency and sustainability. These collective actions can develop solutions to meet local needs involving local people while contributing to energy security, reducing greenhouse gas emissions and keeping costs down for consumers. Some authors [10] view these initiatives as "social niches" capable of introducing social innovations in the electricity market resulting in new forms of organizations, business models and institutions.

The collective dimension of energy use is increasingly recognised also at European level. According to the European Commission, European consumers engage more and more in self-generation and cooperative schemes in order to better manage their energy consumption. Regional and local energy initiatives are seen as facilitators of consumer participation in the energy market and in the effective governance for the Energy Union.

The transition to a more participatory energy system however, requires a shift from an approach based on individual-oriented strategies to a more comprehensive and integrated approach based on community-oriented strategies where inclusivity and a collective sense of purpose and values are the drivers to transition [13-15]. A more integrated approach, that leverages on collective dynamics and on the integration of different actors and sectors (such as electricity, water, gas, heating and cooling), can indeed enhance consumer participation [16].

In this context, my intervention presents how a more collective dimension of energy use is reflected in the design and development of DSM pilot projects in Europe [17]. Pilot projects provide an important means to monitor the direction Europe is taking and to understand what works and what doesn't in real-life experiences. Since 2011, the Joint Research Centre of the European Commission has been publishing an inventory of EU smart grid projects, assessing current trends and developments in the field. The JRC inventory represents a valuable tool to explore the changing role of consumers in the evolving energy system. 67 DSM projects were identified in the JRC smart grid database. For each project, additional information was collected on the project's scope and on the engagement strategies used to address the individual and social dimension of energy consumption. The scope of the projects was investigated to see to what extent projects take into consideration the multiplicity of actors and factors having an impact on consumers' attitudes and consumption habits. The analysis further focused on the consumer engagement strategies used to activate consumer's response and the dynamics on which they are grounded, to verify if a trend exists from an approach focused on consumers as individual agents to an approach that addresses consumers as socially situated individuals, part of a wider community.

The analysis shows that DSM projects are increasingly being designed and developed having in mind a collegial approach to energy consumption, where consumers are considered in the wider socio-economic context in which they live and operate. Although the evidence of this new trend is still fragmented, there are signs of a more inclusive approach, increasingly based on community dynamics, both in the projects' scope and in the engagement strategies used therein. The diversification of involved organizations, with an increasing number of local organizations participating in DSM projects, underlines the emerging interest of DSM projects in building on existing local partnerships to reach and engage a wide range of consumers. Local organizations, having a good knowledge of the local environment and benefitting of a high level of trust, are indeed the best suited parties to engage with local communities. DSM projects also increasingly include different end-use sectors (residential, commercial, industrial and public sector) in the scope of the project, promoting the idea of a larger community effort fostering social and economic benefits for all the actors involved. Furthermore, a growing number of projects integrate multiple services (electricity, gas, water, heat and cooling) in the project proposition, thus building on the concept of a multi-stakeholder, municipally-based partnership that can maximise benefits and opportunities for consumers.

The increasing use of engagement strategies and tools addressing the consumer as part of a wider community indicates that attention is given to the wider context in which consumers live and to the social dimension associated to energy consumption are also found in. An emerging trend exists from an approach that aims at changing individual behaviours - such as the provision of consumption feedback appealing mainly to the economic self-interest - to an approach more focused on changing community’s behaviours towards goals that benefit the community at large. Many projects try to mobilise consumer's response using a more participatory approach that builds on a sense of community and of shared values and goals.

While the projects in the JRC database resort to different combinations of partners, end-use sectors, services and consumer engagement strategies and tools to increasingly engage consumers, an integrated approach is still missing. These projects are still testing a variety of interventions which play out in an interactive way according to concrete local circumstances. It is therefore not yet possible to disentangle the effects of one intervention from the contribution of other factors and to link these trends to project results, thus supporting the conclusion that initiatives characterized by a more inclusive and community-oriented approach deliver better results. Further research and analysis are needed to explore this link, as well as the scalability and replicability potential of community engagement projects.

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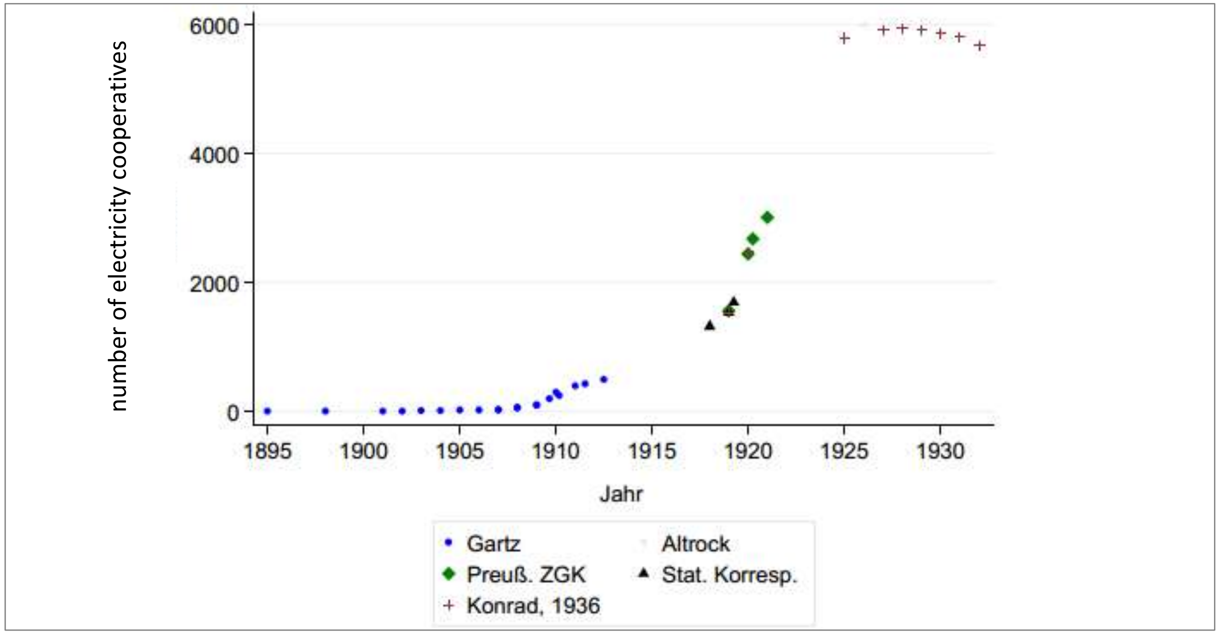
Opportunities and Challenges Associated with the Development of Local Energy Communities in Germany

Germany looks back at a two-part history of community energy. The roll out of electrical infrastructure in the late 19th century was also the beginning of modern community energy. Particularly in rural areas, which were largely neglected by commercially-run electricity providers, communities themselves stepped in and founded their own power companies. Researchers have shown that up to 6,000 energy cooperatives existed in Germany by the late 1920s (Figure 5).

Figure 5: Electricity cooperatives in the German Empire and the Weimar Republic 1895-1932



Source: Holstenkamp (2012).

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Most of these cooperatives did not survive the various regime changes that Germany experienced. After the Second World War, all electricity providers in East Germany were nationalized. In West Germany, the energy system came to be dominated by four major energy companies: E.ON, RWE, Vattenfall and EnBW. These four later took over the former GDR transmission (and many distribution) grids after reunification.

With the rise of the environmental and anti-nuclear movements in the late 1980s and early 1990s, many initiatives started experimenting with renewable energy to show that alternatives to fossil fuels, nuclear energy and centralized energy systems were possible. The first feed-in tariff for renewables, which later became known as the "Aachen Model,"[13] was passed by the city of Hammelburg in 1993. 40 other German cities followed by the year 2000. Similar energy revolutions took place with the grid infrastructure: After a decade-long fight to take control of their electricity grid, the "Energy Rebels of Schönau" succeeded in buying their district grid in 1996.

In the year 2000, a national feed-in tariff was established, transforming a community rebellion into large-scale investment in energy infrastructure. By 2012, investment by private individuals in renewable energy installations reached 5.1 billion euros, about 30 % of total investment (ReNews, 2014).

With the feed-in tariff, community energy experienced a revival, though still far behind the first wave of community energy in the 20th century. At the end of 2016, 1,747 community energy companies and cooperatives existed in Germany (Holstenkamp et al., 2017). Of these, the vast majority (87 %) were active in energy production, 15 % were involved in energy distribution and 12 % in heat networks. The cooperatives and companies not only managed to collect large amounts of capital but have also shown to be at the forefront of innovative business models as well as developing technologies for the energy transition. The next section presents some examples with truly innovative models.

[13] In the city of Aachen, civic groups (among them a solar and a wind energy association) proposed communal feed-in legislation to their council. But the city of Hammelburg became the first municipality to pass municipal feed-in legislation according to the "Aachen Model".

Examples of innovative community-based renewable energy

EWS Schönau is the product of the "Energy Rebels'" fight to purchase their local distribution grid. The initiative functioned as an informational and educational hub for many civil society organisations dedicated to energy democracy, and also for other community-based renewable energy companies. EWS Schönau produces electricity from Combined Heat and Power (CHP), hydro, solar and wind. With its "solar-cent program", the company offers a subsidy for privately-owned renewable energy installations. The company's most recent innovative project is a prosumer model based on block-chain technology. 29 users, producers and prosumers with photovoltaics, CHP, two fuel cells and three electric vehicles are connected via a peer-to-peer trading system forming an independent consumer-producer unit.

The **Heidelberger e.G.** was founded in 2010 by students of Heidelberg University. By 2018, the cooperative had 339 members. When feed-in tariffs were cut dramatically, the HEG reacted to the end of the PV business model by developing a so-called "tenant electricity" business model, exploiting a loophole in the electricity regulation. This model is exempted from certain electricity charges, allowing them to be competitive with the grid price. HEG has been a very innovative cooperative with several ground-breaking pilot projects. Their latest project is a sector-coupling energy project offering the inhabitants of an urban neighbourhood a full energy service package of tenant electricity, e-mobility, storage and load management.

Inselwerke e.G. is an energy cooperative that was founded in 2013 on the island Usedom in the Baltic Sea. It is special to some degree as the co-op not only addresses energy production, but also mobility and energy efficiency. For example, the co-op has engaged in an energy service business model by replacing the municipal street lamps with LEDs. The cooperative's investment is paid back from the energy savings. The co-op currently maintains 20 e-mobility charging stations on the island, most of them equipped with solar carports. The cooperative is active in the construction of a nation-wide network of e-mobility charging stations run by energy cooperatives throughout Germany.

Benefits of community-based renewable energy

Community-based renewable energy (CbRe) has a series of benefits (IZES, 2015). Firstly, it has a direct environmental benefit as financing is channeled into the energy transition. Secondly, CbRe has public benefits as community-based companies tend to create more widespread (though not all-encompassing) acceptance for energy infrastructure and the costs associated with the energy transition.

Besides the benefits related directly to the energy transition, there are also spill-over effects in other fields. Citizens' activity in these projects creates social capital: Individuals and groups experience self-efficacy and can transfer their social participation to other fields of social and political activity. They gain competence in dealing with public administration and acquire new skills, from business management to community organizing. Collective activities such as community energy projects create a larger community spirit.

CbRe delivers financial benefits to the citizens involved and the community as a whole. The return on investment flows to a broader group of investors, thus distributing income from the energy transition more widely.

In cases where private individuals invest in projects at or near their place of residence, the return on investment increases incomes locally rather than at locations far away from the infrastructural impact. Besides return on investment for investors, local communities can benefit in various ways from the investments, e.g. via land rents, job creation, tax and tenure revenues for their municipality, lower prices for electricity, hot water or heat. Private individuals in CbRe tend to accept lower interest rates than professional investors, partially because of the social character many projects have (Leuphana & Nestle, 2014). The lower interest rates that CbRE investors accept translate into reduced costs of the energy transition. In contrast to professional investors, many (though not all) CbRe projects are interested in creating benefits for their community and set up mechanisms that are based on fairness and opportunities for all, e.g. paying all landowners the same rent or hiring local construction companies. There are also social benefits: Many projects set up funds and foundations to assist socially vulnerable groups, for example subsidizing school field trips or school meals for children from deprived backgrounds. Figure 6 shows the investment motives stated in a survey among members of community energy companies.

Figure 6: Investment motives of community energy companies (cooperatives versus GmbH & Co. KG)

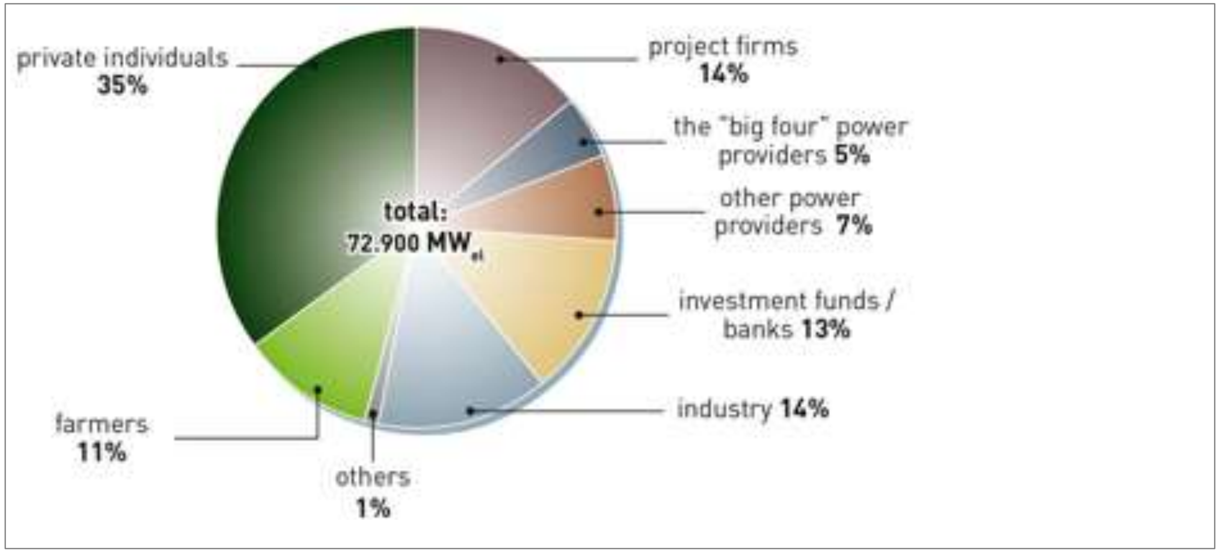
Scale: 1 = unimportant, 5 = very important

Source: own translation of Leuphana & Nestle (2014).

Death of community-based renewable energy?

In 2012, 46.6 % of the installed renewable energy capacity in Germany was owned by community energy companies, including individual owners and minority shares of citizens in energy projects (Figure 7).

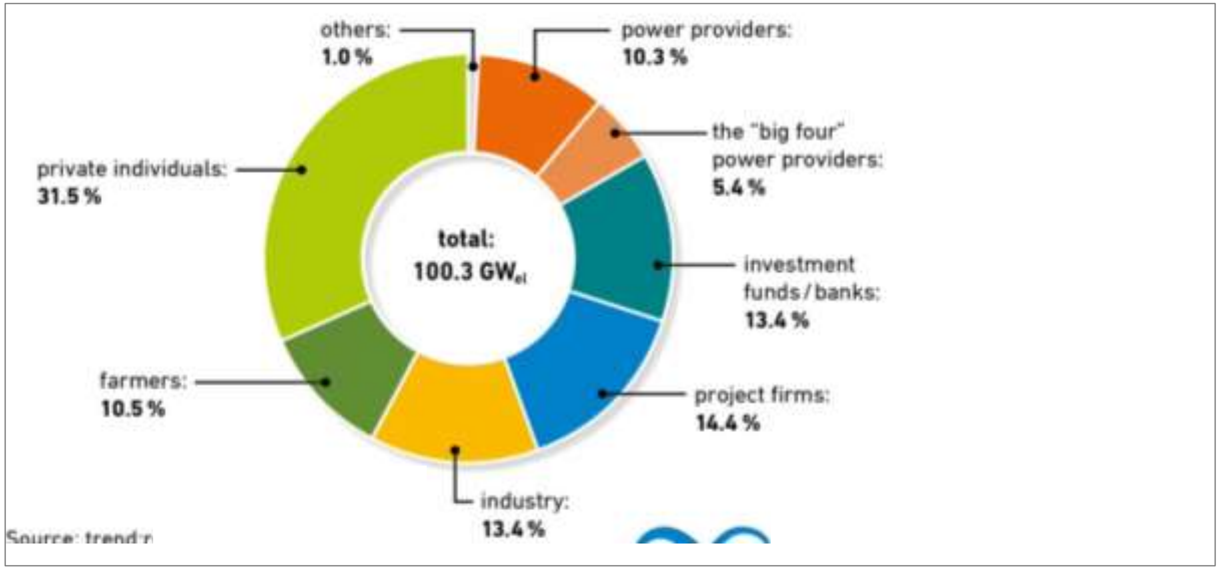
Figure 7: Ownership distribution of installed RE capacity for power production throughout Germany in 2012



Source: trend:research (04/2013).

By 2016, private citizens, energy co-ops and farmers owned just 42 % of the installed renewable energy capacity in Germany (Figure 8). Their share had dropped by four percentage points compared to 2012 levels (AEE trend:research, 2018). The shrinking share of CbRe can be explained by professional investors and institutional funds moving in to a more mature market, but also by a series of changes in the market playing field in recent years.

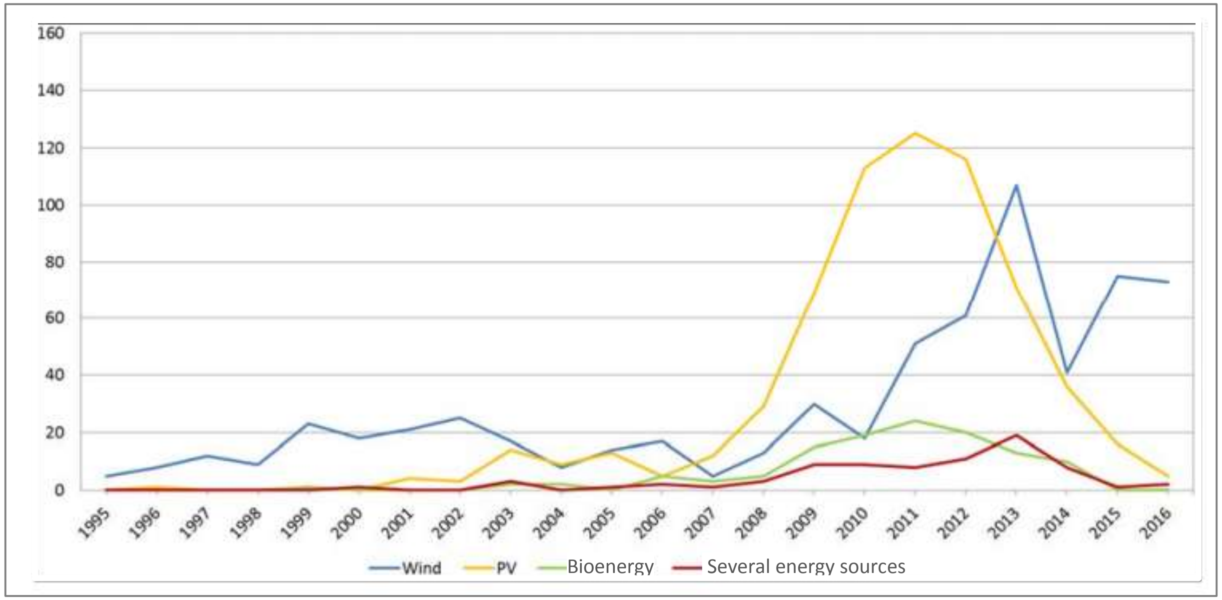
Figure 8: Ownership distribution of installed RE capacity for power production throughout Germany in 2016



Source: trend:research (12/2017).

The first major hit for CbRe was the dramatic cut in PV feed-in tariffs. The community energy companies that were founded between 2009 and 2012 were heavily focused on photovoltaic energy (yellow line in Figure 9). But in 2012, the CDU-CSU-FDP government cut the PV feed-in tariff to such an extent that business models based on feeding photovoltaic electricity into the grid were no longer viable. Since many community energy initiatives were based on this model, the founding of new initiatives largely came to a halt. By 2016, the number of new community energy companies focused on solar had practically dropped to zero. From 2012 onwards, most new community energy companies focused on wind (blue line in Figure 9).

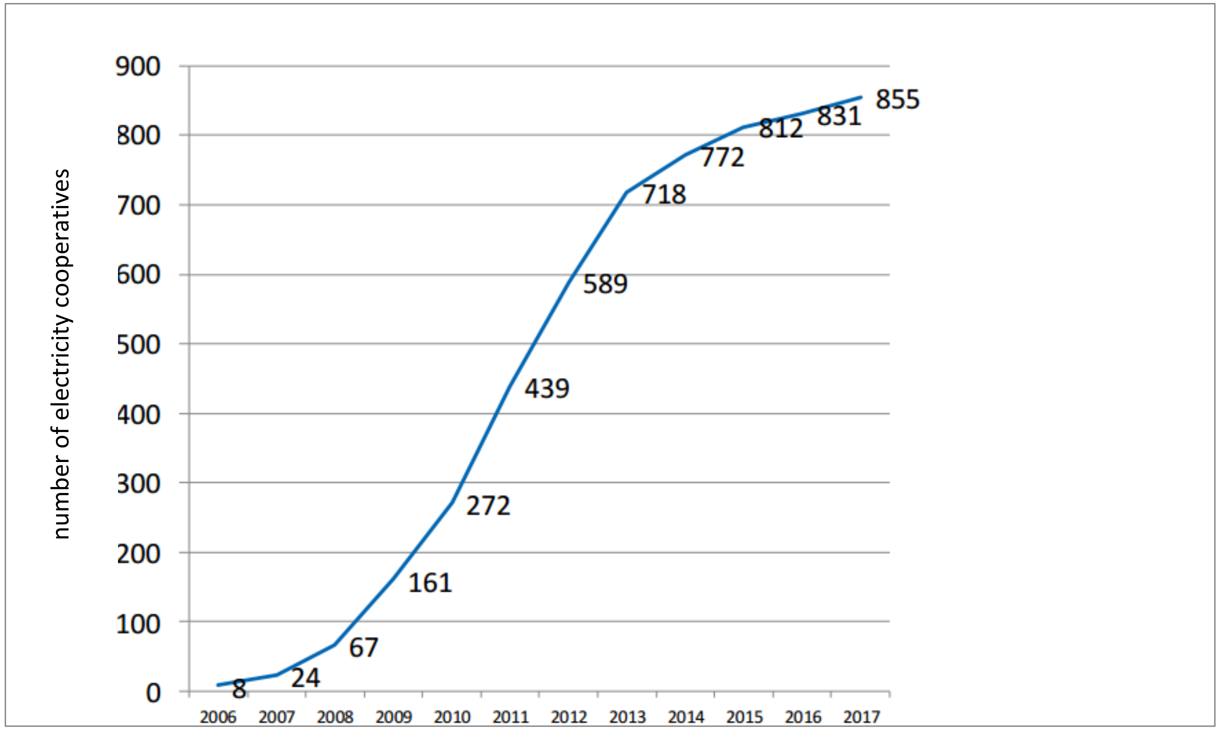
Figure 9: Establishment of new community energy companies by energy type



Source: Holstenkamp et al. (2017).

The end of the PV feed-in model can be considered the first significant blow to community energy in Germany. Between 2010 and 2013, there were 100 energy cooperatives founded each year. In 2017 it was just 24 (Figure 10).

Figure 10: Cumulative number of energy cooperatives founded (within the DGRV)



Source: DGRV (2017).

A second blow to community energy

The second blow to community energy came from the EU Commission in 2014 , with the passage of the Guidelines on State Aid for Environmental Protection and Energy (2014-2020). These guidelines led to the abolishment of Germany's feed-in tariff system. They introduced a 100 % auction system for wind energy and free-field solar. Auction models have proven to be a significant barrier for community actors, while feed-in legislation has been shown to create opportunities for collective citizens' investment to thrive.

Community renewable energy is unlikely to be competitive based only on price in auction systems. Research by Leuphana & Nestle (2014) showed that wind energy cooperatives mostly run only a single wind power plant (or even only own shares in one) due to the high capital requirements. Therefore, community energy companies cannot spread risks across a project portfolio nor can they generate economies of scale. Prior to the introduction of auction systems though, community energy proved to operate competitively. Taking into consideration the various co-benefits, a holistic estimation of the economic cost balance would very likely turn out a head of conventional investors.

With the introduction of the auction system to replace feed-in systems, German legislators at first included preferential treatment for community energy in the auctions, allowing them exemptions to the Federal Emission Control Act (BImSCHG) and a longer realization period of two instead of one year. At first it appeared that community energy had won an astonishing 99.2 % of the bids. Yet closer analysis revealed that many conventional investors had formed puppet community energy companies as a vehicle to benefit from the exemptions. After the fraud was uncovered, the German government stripped the legislation of any preferential treatment for community energy. It seems unlikely that community energy companies, particularly new ones often based on a single local project, can compete with international investors. With the worsening conditions for wind energy, community energy seems to have lost its last economically viable field for collective investment.

Discussion and lessons learned

Community energy in Germany can look back at two truly impressive decades of success. However, there are many signs that the 20th century could repeat itself, with community energy wiped out again. This would be the result of strategic policymaking. The German feed-in-legislation was altered, in a step-by-step process, in favor of large corporations and market concentration. After the end of solar and the introduction of auction systems, collective community investment is unlikely to defend its position and could soon be reduced to a niche phenomenon.

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Community Energy in Italy: Lessons from Existing Evidence

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1. Introduction

The degree of recognition of the potential contribution of citizens to the energy transition and the level of deployment of community energy (CE) initiatives still varies considerably across Europe. CE initiatives are more common in North Europe, particularly in countries such as Denmark, Germany and the UK, and far less developed in Southern Europe [1-6]. Most of the academic literature researching dynamics, drivers and conditions for implementation of CE initiatives tends to look at North European countries [2, 4-11]. This study focuses the attention on Italy, a Southern European country characterized by lower levels of CE sector development. A recent research looks into the role of Italian civil society in energy transition [12], but the literature on Italian CE initiatives is relatively limited and no contribution has to date provided a systematic review of the sector. To fill this gap, the presented study uses a qualitative and descriptive approach to search, analyse and present comprehensive evidence of CE initiatives emerged in the country within the last decade. As experienced in other northern European countries [2, 5, 13-15], they can take multiple forms depending on the level of citizens' financial involvement, ownership and co-determination implied by the initiative's legal structure and governance and the type of activity proposed. The objective of this study is to systematically map and present empirical evidence on Italian CE initiatives and to explore their heterogeneity.

The concept of CE is subject to different interpretations within the academic literature. The study takes a perspective quite common in the literature [5, 9, 14, 16-18] by focusing on CE initiatives:

1. which imply a form of citizens ownership or financing of an energy project, and control over the initiatives (along the process dimension);
2. where citizens directly benefit from the outcomes of the initiative (along the outcome dimension).

It does not focus on other forms of civic engagement in the energy service provision, such as green associations, collective purchasing of energy services and ethical consumerisms. The historical hydroelectric cooperatives constituted in Italian Alpine regions at the beginning of the twentieth century are also not included in the analysis. The study specifically looks at paradigms of citizens' financial and ownership involvement in energy initiatives which has begun appearing in Italy and the rest of Europe since late 2000s [2, 19]. They are mostly initiatives focused on development of renewable energy production facilities and, most of all, differentiate themselves from Italian historical cooperatives as they don't benefit of their special legal status and cannot own local distribution networks.

1.1 Data gathering

As a comprehensive database of Italian community energy initiatives is not existent, they have been identified through web based searches and grey literature, and contacting relevant Italian organizations and stakeholders. Once initiatives have been identified, data collection has been qualitative and longitudinal, through semi structured interviews with one to two representatives of each of them. Evidence has been gathered along the process and the outcome dimensions, in particular:

a. *Dynamics of creation*, including information on the timing, on the proponent and on the approach adopted for the development of the initiative. Under the bottom up approach fall those initiatives driven by citizens or other types of grassroots organizations. Under the top down approach instead is another institution (i.e. a local authority or a private company) leading the process, defining structural features of the project and facilitating the citizens' involvement.

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b. *Type of activity and economics*, including information on: their 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), projects investment cost, and geographical scope of the initiatives (in particular whether citizens involved are geographically close to the project (local) or spread over the national territory (national)).
c. *Organizational structure*, including legal form of the project (e.g. cooperative, limited company or other forms), instrument offered to the citizens (i.e. equity or debt), ownership and level of citizens' involvement, and financing structure (i.e. self-funded, bank loan, coop funds or a combination of those).
d. *Monetary benefits*, returns on investment offered, including potential saving on electricity bills.
e. Any *other services and benefits* accruing from the project (e.g. other energy or community services provided).

The data collection lasted just above a year, from March 2015 to May 2016 (data and information collection on Italian CE has been ongoing since and the database is in the process to be systematically updated).

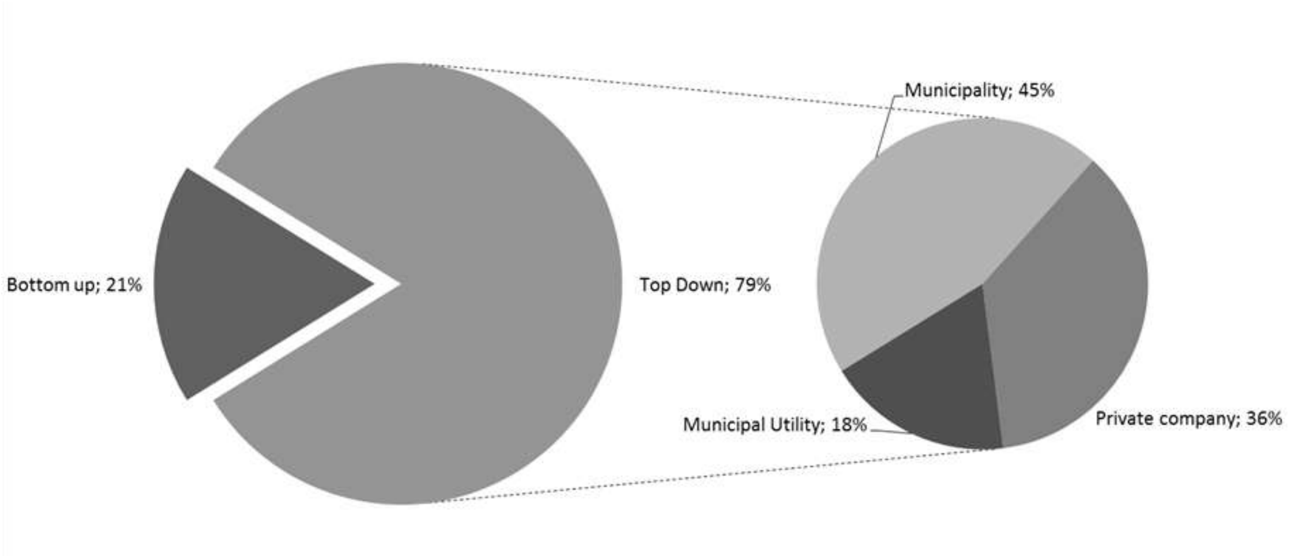
2. Results of systematic review of Italian CE sector

The systematic review has allowed identifying fourteen CE projects in Italy providing a level of financial and/or ownership involvement of citizens.

2.1 Dynamics of creation and organizational structures

The majority of the Italian CE initiatives have followed a top down approach, i.e. they have been proposed and led by an institution other than a community or a group of citizens (Figure 1). Among those, half have been proposed by municipalities and the other half by commercial actors, i.e. a company or a municipal utility. The first result emerging from this evidence is the role of local authorities: in several instances they have been a strong driver in facilitating or coordinating the project, or in providing the assets to develop the initiative, such as public building rooftops, or creating the local regulatory and financing framework conditions to allow it.

Figure 1: Dynamics of creation, proponent and approach



The legal structure adopted varies, including limited companies, non-profit associations and cooperatives, which account for about 60% of the sample (Table 1). Cooperatives are the legal form mostly used in the European CE sector. They encompass both the social and economic dimension in their scope, are characterised by a ‘one head one vote’ decision making process, and are deemed to provide high levels of co-determination [1, 2, 20-22]. The level of participation and co-determination of citizens is also determined by the level of citizens’ ownership (i.e. % citizens ownership in Table 1), as well as wider involvement and influence over the project development and management.

Table 1: Dynamics of creation and institutional structures

Project	Legal form	% citizens ownership	Proponent	Approach	Instrument offered to citizens
Sole per tutti	coop	100%	Municipality	Top down	Equity
Retenergie	coop	100%	Community	Bottom up	Equity/Debt
E' Nostra	coop	80%	Associations & Companies	Top down	Equity
Melpignano	coop	100%	Municipality	Top down	NA
Energyland	coop	~ 30%	Company	Top down	Equity
Masseria del sole	coop	~ 90%	Company	Top down	Equity
Fattorie del Sole	coop	Still open	Company	Top down	Equity
Società Ledro Energia - SO.L.E.	coop	NA	Community	Bottom up	NA
Comunità Energetica San Lazzaro	Association	100%	Municipality	Top down	Equity
Comunità solare	Associations	0.5%	Municipality	Top down	Equity
Kennedy Energia	Ltd company	100%	Municipality	Top down	Equity
Dosso Energia	Ltd company	100%	Community	Bottom up	Equity
Impianto eolico Monte Mesa	Ltd company	0%	Municipal Utility	Top down	Bond
Un ettaro di cielo	Ltd company	0%	Municipal Utility	Top down	Bond

Evidence shows that, apart from two initiatives offering the opportunity to finance a renewable project through the purchase of bonds, the majority of the initiatives offer participation to citizens through equity stakes (Table 1). However, among the latter, there is no clear correlation between the use of the cooperative as legal form and the implied level of participation and co-determination of citizens (see e.g. % citizens ownership in Table 1). For example Dosso Energia and Kennedy Energia are limited companies, but fully owned, financed and managed by citizens located close to the renewable generation plant [23, 24]. Vice versa, evidence show cooperatives among initiatives reaching lower levels of participation and co-determination. They are those developed by companies and/or with a strong top down approach, i.e. Energyland, Masseria del Sole and Comunità Solare. Overall, initiatives proposed by companies and with a strong top down approach have been developed with lower involvement of citizens and their organizational structure implies lower citizens' co-determination. This also emerge from the financing structure adopted: both the three cooperatives proposed by a company and the project proposed by a municipal utility have been initially financed through some form of project financing and then opened to citizens' financing in a second phase. Instead, initiatives promoted by communities and municipalities have been founded through direct financial contribution of citizens.

Thus, evidence presented highlights how the level and the forms of citizens involvement is not much affected by the legal structure chosen but rather by initiatives' objectives and by the dynamics of their development and implementation. In particular, initiatives promoted by commercial actors and with a top down approach tend to have lower levels of participation and citizens co-determination than those developed bottom up and based on stronger community logics.

2.2 Process: type of activity and timing

CE projects have been deployed since the second half of the 2000s, particularly since 2010 onwards. This timing coincides with the increase in distributed renewable energy capacity installation in Italy as a result of the implementation of renewable energy support measures, in particular feed in tariffs (FiT) schemes for photovoltaic (PV) systems [25, 26]. Electricity production from PV systems is in fact the primary activity across the whole sample (Table 2). PV technologies have been benefiting from generous and uncapped FiT schemes since 2008 [25], which have guaranteed fixed long term tariffs and net-metering to PV system owners. Such strong policy support, combined with remarkable reductions in PV modules and installation costs since 2010 [27, 28] has made PV investments quite profitable and relatively low risk in the wider context of the Italian energy sector. These favourable conditions have been a major driver for the development of Italian CE sector, opening a window of opportunity for the development of PV systems by proponents generally not equipped to deal with large, complex and high risk project development in the energy sector.

2.3 Outcomes: monetary versus non-monetary benefits

Returns on investment offered to citizens vary quite substantially, from 8% to about 1% (Table 2). Such variation is particularly striking considering that most initiatives have been investing in the same technology, PV systems (Table 2). This can be partly explained by the size and typology of the PV system: larger ground mounted plants allow higher economies of scale in the investment (both in terms of initial capital costs and transaction costs) and therefore higher returns than smaller roof mounted systems. However, what makes stronger impact on the monetary returns offered to citizens is the type of activity, the proponent and the dynamics of creation. Higher returns, around 5-8% (Table 2), are offered by initiatives having the development of a single renewable energy production plant as unique activity. The main logic behind their constitution is the maximization and the distribution among their members of the revenues accruing from the operation of a renewable generation project. Those promoted by companies are the most profitable (i.e. Energyland, Masseria del sole, Fattorie del Sole).

Lower returns on the investment, around 1,5-3%, are offered by initiatives which, beside fostering deployment of renewable generation plants, have also been deploying a wider set of energy and community services to citizens

(Table 2). These include domestic energy efficiency audits and consultancy, collective purchasing of energy services (for PV systems, storage, electric bikes and cars as well as wider services such as insurance, banking, internet provision) as well as wider community development schemes (such as information campaign or activities with schools). They tend to have more complex financing and organizational structures, and redistribute revenues from investments in renewable generation projects across a wider set of activities. They are explicitly constituted to enable citizens participation to energy transition in a wider sense, empowering communities to collectively change their energy, social and economic context [29, 30].

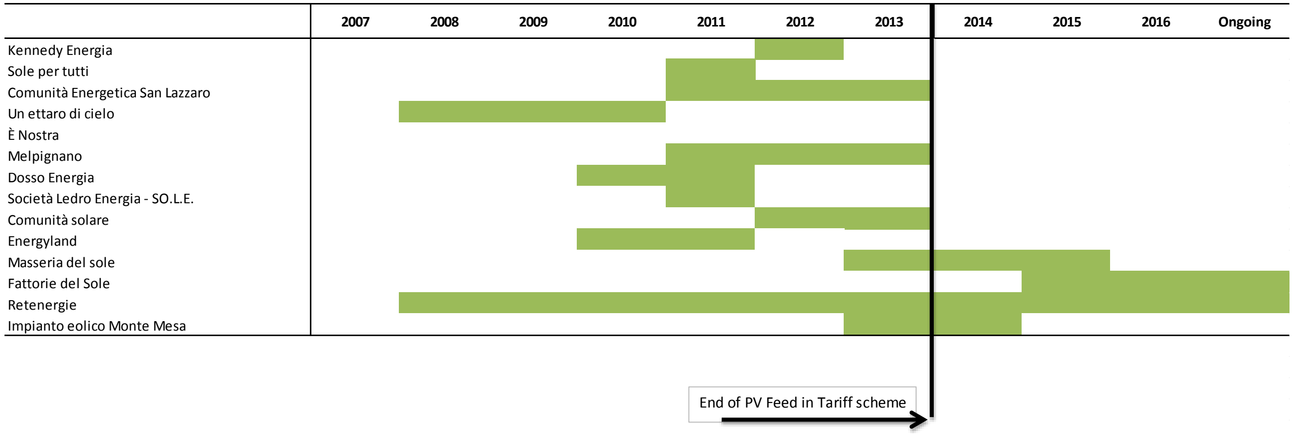
Table 2: Type of activity and outcomes

Project	**Primary activity**	**Technology**	**Plant size, kWp**	**Geographical scope**	**Returns on investment**	**Other monetary benefits to citizens/municipality**
Energyland	Electr. Production	PV	1,000	Local	6.5-8.8%*	Electricity bill savings for citizens (proportional to quota)
Masseria del sole	Electr. Production	PV	999	National	~8%	Electricity bill savings for citizens (proportional to quota)
Fattorie del Sole	Electr. Production	PV	999	National	Still open	Electricity bill savings for citizens (proportional to quota)
Kennedy Energia	Electr. Production	PV	100	Local	~6%	Municipality gets value of electricity bill savings
Sole per tutti	Electr. Production	PV	102	Local	~3%	None
Comunità Energetica San Lazzaro	Electr. Production	PV	20	Local	NA	Municipality gets value of electricity bill savings
Un ettaro di cielo	Electr. Production	PV	1000	Local	5,5% (7 years bond); 6,5% (12 years bond)	None
Impianto eolico Monte Mesa	Electr. Production	Wind	8,000 (4 windmills)	Local	6,5% (7 years bond)	Royalties to municipality (~100k€/year)
Dosso Energia	Electr. Production	PV	109	Local	~6%	Municipality get annual rent for school rooftop use
Comunità solare	Mix (Electr production & energy services)	PV	1,378 (56 plants)	Local	~3.5%**	Annual electricity bill discount of 50€ for 20years for citizens
Melpignano	Mix (Electr production & energy services)	PV	180 kWp (33 plants)	Local	Not applicable	None
Società Ledro Energia - SO.L.E.	Mix (Electr production & energy services)	PV	99 (2 plants)	Local	NA	NA
Retenergie	Mix (Electr production & energy services)	PV	630 kWp (9 plants)	National	1.5%-3%	Monetary benefits (in various forms) for citizens providing assets (e.g.
E' Nostra	Elect. Supply	-	-	National	2%	None

2.4 Brief discussion

The presented study depicts the Italian CE sector in 2016 and is in the process of being updated. Initial findings show little evidence of new CE initiatives in Italy in the more recent years. Italian CE sector has been clearly dependent from PV FiT incentives to date, as clearly shown in Figure 2. The majority of renewable energy plants have been developed between 2008 (date of implementation of first FiT scheme) and 2013 (date of discontinuity of FiT support to PV). The only CE initiatives still developing renewable energy plants after 2013 are those promoted by commercial actors or the larger initiatives with a national scope in their activities (i.e. Retenergie, Impianto Eolico Monte Mesa, Masseria del sole and Fattorie de Sole).

Figure 2: Timing of renewable energy plants development across CE initiatives



In order to foster further development of new CE initiatives some regulatory barriers need to be removed. For example, level playing field could be made by allowing collective self-consumption and provide the right for community energy projects to sell their electricity directly to third parties. This would increase profitability of investments in renewable plants and maximising the value of the electricity produced. New policy tools could be considered (which does not necessarily include economic incentives) in order to ensure projects' replicability and scalability. A favourable context may be defined with the introduction of new EU policies in the framework of the

Commission Winter Package, legal instruments such as the Renewable directive and the Internal market in electricity directive (still under discussion).

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Come Together – the History of Swedish Energy Communities

Community energy (CE) and grassroots innovations have been widely studied in recent years, but very little focus has been placed on Sweden. This paper describes the development and present state of several types of CE initiatives in Sweden and the aim of the paper is to describe and analyze the existence and characteristics of Swedish CE. Two research questions guide the analysis: (1) What are the history, scope, scale, characteristics and activities of Swedish CE?, and (2) How can Swedish CE be defined in terms previously used in CE literature?

The community energy and grassroots innovations literature often focuses on British cases and policies, although several studies from other countries have emerged. However, it becomes clear that the differences in institutional settings and energy regime and landscape are crucial in order to make further advances in the analysis. A crucial difference is that Sweden has made considerable progress in the energy transition: a steady transition began in the 1980s, and by 2015, 54% of total energy usage came from renewable fuels, increasing to 65-70 % in the heating and electricity sectors (Swedish Energy Agency, 2017).

The work presented in this talk was carried out using two methods: the mapping of existing data and interviews with CE representatives. The mapping generated a first database over the projects or organizations focusing on RE that have been started by citizen groups, communities, or small-scale cooperatives. This generated a list of 225 items. Based on this initial mapping we selected cases for the final list, which contained 160 initiatives, although not all of them active. Sampling was based on evaluating available information, such as websites, reports, or newspaper items. We also carried out 43 interviews, 38 of them with 36 CE initiatives (two organizations were interviewed twice), and five of them with umbrella organizations working with RE.

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We identified around 140 active CE initiatives, and around 20 previously active ones. This is considerably lower than in, for example, Denmark, the UK and the Netherlands. The total generating capacity of the organizations is 160 MW, most of which is from wind cooperatives, with a smaller amount coming from solar PV cooperatives. The largest number of CE initiatives are wind cooperatives, with 78 active and around 20 discontinued. The second largest group is eco-villages (32). Most of these are in rural settings, with only a few in urban areas. We identified 10 small-scale heating organizations and 9 solar PV communities. Eight rural communities run various forms of production with a local focus (hydropower, heat or energy-saving plans).

The development of CE started later in Sweden than in many other countries, around the time of the liberalization of the electricity market in 1996, and the sector's growth has been slow. One important explanation for this is the structure of the Swedish energy market. The Swedish electricity supply market is dominated by two centralized power solutions, hydro and nuclear power. District heating has been established in 283 of 290 municipalities. Sweden has a long tradition of municipal autonomy and local self-government, and local authorities are often the initiators and operators of environmental initiatives. This has contributed to a tradition where local authorities or energy companies take energy-directed initiatives. Local authorities and energy companies engage and enroll the citizens rather than the opposite, and it is rare that citizens take the initiative.

The CE initiatives in Sweden vary in many ways. The oldest type of CE were eco-villages and the first were started in the 1970s and 1980´s. They blend social and technical innovations based on the skills of the members to satisfy local prerequisites, and were in the early days started as a reaction to existing regime, in regards to for example nuclear power and consumerism (cf. Smith et al., 2016). Such initiatives also engage willingly in outreach activities today and welcome, for example, study visits. A few of the eco-villages that started in the 1990s were established by contractors. These had been inspired by the eco-village movement in general, but created their own version. However, the lack of involvement from future inhabitants watered down the concept (Berg et al., 2002).

The CE initiatives we have mapped differ when it comes to stated missions. Some projects, such as many of the wind cooperatives, have a stated mission that is mainly related to financial profits. The individual members may have other objectives in owning shares in a wind cooperative, but the official statements describe financial incentives and a goal to make cheaper electricity available to the shareholders. In comparison, eco-villages often have missions that are related to social values and a goal of developing a location in an eco-friendly way. The members of an eco-village are expected to engage in the local community in a totally different way than the shareholders in a wind cooperative. Rural communities is another category in our mapping. They are organization started by citizens in rural villages, that invest in renewable energy and reinvest profit in the local community, for example schools, facilities, or roads.

It is difficult to give a definition of CE, since the initiatives differ so much. The local aspect is always stressed, but although a project might have started out with a local perspective, many have grown and members are often spread throughout a region or, in many cases, throughout Sweden. This is seen most clearly with wind cooperatives, where some own wind-power plants outside of their own municipality.

The future of CE in Sweden may be uncertain. The amount of CE in several other countries has steadily grown, but the Swedish situation is in flux. Twenty wind cooperatives were liquidated between 2012 and 2016. We interviewed representatives of three of these, and examined relevant documents, in order to determine the reasons. Several factors led to the liquidations. First of all, low electricity prices led to lower profits, and thus lower economic returns to the members. This led to a decrease in interest for the organization as a whole, which catalyzed the second factor: ageing plants. Most of the organizations that were closed had been started in the 1990s, and the technical lifespan of the plants had in many cases been passed.

In contrast to for example Smith et al. (2016), we cannot see that CE in Sweden so far has been able to influence policy in any major way. CE is still, in a policy-making perspective, a fairly marginalized phenomenon. The fact that municipalities take an active role in the energy transition, as well as already high shares of RE in the energy system and historically centralized electricity systems, mean that incentives and room for alternative movements are smaller than in other countries.

The aspect of local connection needs to be evaluated from case to case, as all projects start in a local setting from the initiative of citizens, but in the case of wind cooperatives, for example, and to some extent solar PV cooperatives, they often grow from a local project, and subsequently attract members throughout Sweden. In other cases, such as rural communities, the projects are clearly focused on solving local issues and the participants take the development into their own hands. In such cases the project focuses on benefiting the community – practically or economically.

Future research may more deeply examine the cultural embeddedness of CE initiatives, and the personal abilities that locally engaged volunteers must have, to be able to navigate in the complex socio-technical landscape.

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The Case of Ghent Municipality

Ghent Municipality

Ghent is a city and a municipality in the Flemish Region of Belgium. It is the capital and largest city of the East Flanders province, and the second largest municipality in Belgium, after Antwerp. The city started as a settlement at the confluence of the Rivers Schelde and Leie and in the Late Middle Ages became one of the largest and richest cities of northern Europe, with some 50.000 people in 1300. It is a port and university city. In the beginning of 2018 Ghent had 260.467 inhabitants. The city of Ghent is know as a progressive city as well as it is known for the stubborn character of its citizens.

One of the main goals of the city is becoming CO2-neutral. That is why the brand 'Ghent: climat city' got developed.

Sofie Verhoeven works for the city of Ghent in the service of environment and climate since 2014. She focuses on projects that include citizens in a participative approach. Her job is to stimulate, support and facilitate citizens from Ghent to develop and execute their own sustainability projects. Themes can vary from local food to energy production and everything in between. As a process facilitator, she goes searching for projects, she tries to establish links between people and projects and in some cases she helps searching for financial means and building structures to enable projects to be carried out.

The policy approach of Ghent to support initiatives from citizens

A city can't become a 'climat city' on its own. Everyone must contribute: citizens, companies, schools, associations, etc.. We're convinced that if people combine their powers, the results will be bigger and more sustainable.

The stubborn progressive character of the citizens of Ghent results in lots of initiatives set up and executed by citizens. We know the willingness and the competences our available out there. The question is how to reach / stimulate / support these initiatives.

In 2014 the city started with a new project line: 'sustainable neighbourhoods'. In a first step regulations were set up for a new subsidy 'sustainable neighbourhoods'. With this subsidy local communities can execute all kind of projects with the aim reducing CO2. From projects against food waste to projects that experiment with new ways of building in the city. To be able to receive the subsidy, the project must be set up by a group of citizens of Ghent who aren't family of each other. The project must be open to other interested citizens who want to join/participate. The projects get a maximum of 12.000 Euro in order to cover costs regarding consultancy, communication (max. 20%) and materials (max. 10%). Because of this subsidy, some projects were able to have a kickstart and developed to a larger long-term project.

For example, thanks to this subsidy, two different local communities were able to develop and execute these two projects:

- Labland: some citizens in Ghent grouped themselves because they wanted to think about new ways of building in the city. They thought too little possibilities are investigated and they were convinced other options are possible. With the subsidy these volunteers of Labland developed a business plan to experiment with new ways of building in the city. To be able to do so, they worked together with different kinds of experts (researchers, construction firms, companies that sell building materials, etc.). As a result of this business plan, they were able to get subsidies from the province to execute 4 experimental building projects.

Since June 2018 she is coordinator of the LIFE BE REEL!-project (Renovating for Energy Efficient Living) for the city of Ghent. 'Neighbourhood power' is a part of this project, as well as collective renovation in neighbourhoods.

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- Wijkwerf (‘neighbourhood yard’): with the subsidy ‘substainable neighbourhoods’ some neighbours of the neighbourhood Macharius-Heirnis hired the energy cooperative for renewable energy EnerGent to develop a system for collective renovation of individual houses in their neighbourhood. EnerGent developed a system of a customized group purchase and communication strategy in order to convince people to execute energetic house improvement. In the meanwhile, Energent was able to mobilise 5 different neighbourhoods. This resulted in more than 200 house improvements (roof, isolation, windows).

Besides that, the city is constantly searching for new projects and stimulating people to develop and concretize new ideas into concrete projects. How do we do that?

On one hand we organise collective brainstorms (climate arenas) and bring people together so they can meet and inspire each other. On the other hand, we give individual support to people or groups with concrete ideas.

There is no fixed format how we do that. We search, experiment, tease, … and depending the outcomes we see what is the best way to handle the projects.

A perfect example for that is the project Neighourhood Power, as described in the following part.

Example: The project Neighbourhood Power

Households with a roof unfit for solar can invest in solar panels on schools / companies / houses or other buildings in their neighbourhood who do have a roof that is suitable for solar.

In order not to destabilize the distribution network, the electricity generated by these solar panels will be as much as possible immediately used in the neighbourhood.

To reach that goal, households as well as companies will be stimulated to consume more electricity on the moments the neighbourhood solar panels produce more electricity. Neighbourhood power is the Belgian testing site of the tools developed in the European Horizon2020 WiseGRID-project. The WiseHOME and WiseCORP applications will help us testing if people are willing to change their behaviour as a result of differentiated electricity prices (cheaper when the sun shines). They will also do some tests with batteries and experiment with smart charging systems for electric cars.

The result is that undesirable tops are peaked off and the consumption is more aligned with the pattern of the produced renewable energy. Smart meters will help the participants to get insight in their electricity consumption. These same smart meters provide data on which research can be done (which actions are effective, which actions are less effective).

This project wants to approach three goals in the neighbourhoods where executed:

1. Ecologic: an optimal use of the renewable energy potential
2. Social: stimulating participation and reducing energy poverty. Also people who don't have a lot of money must be able to benefit of solar power.
3. Technical: minimalizing the net load by adjusting production and consumption to one another

In this project theoretical models are tested in real life. Because never before such an integral approach on such a scale has been used in a project, this project has a big importance for future projects and for future legislation. That is why the university of Ghent is involved in the project.

Construction of the project Neighbourhood Power

The idea for a collective solar project was launched by a citizen of Ghent (living in the neighbourhood of Sint-Amandsberg) during a transition arena in 2014. As a follow up of this idea, the municipality of Ghent gathered a group of experts, including two cooperatives: one local and one with lots of experience. This group worked on the concretisation of the project during 3 years under the name 'steering committee Neighbourhood Power'. The person who launched the idea was the chairman of the steering committee.

The moment the project got really concrete, the municipality asked the participating experts:

- which role they saw themselves taking in the project;
- the extra support they needed to be able to fulfill the project;
- under which entity they wanted to execute the project. The group choose not to construct a separate legal entity

With this input the municipality searched for:

- legal ways for a project structure implemented by a consortium with these members: city of Ghent, EnerGent, a social neighbourhood-based organisation Samenlevingsopbouw, University of Ghent and the distribution grid operator EANDIS.
- financial means

The *cooperative for renewable energy EnerGent* executes the project by setting up financial structures, recruiting investors, recruiting participants for the demand response management, coordinating the installation of the solar panels / batteries / loading infrastructure, monitoring of the data (production versus consumption of electricity), etc.

– *The social organisation Samenlevingsopbouw* who works with target groups is responsible for the personal support of people in the area that are willing to join the project but who are not able to participate without support.
– The *University of Ghent* is involved in the project to do the monitoring, to perform real experiments regarding the balancing of the distribution net and to make up policy recommendations.
– The *distribution grid operator EANDIS* is a partner in the project because of the importance of the outcomes of the project for the future developments of their net.

The role of the municipality in the project

The municipality as a facilitator

In the start- up phase of this project the City of Ghent acted as the project coordinator and facilitator and built up a partnership with the different partners.

The municipality of Ghent facilitated the project by taking up following tasks:

- Bringing together experts and organisations;
- Facilitating meetings, providing practical support (e.g. secretariat);
- Giving (juridical) advice and guidance in elaborating the structure of the final consortium of organisations implementing the project;
- Financial input to hire expert advice (technical and juridical)
- Etc

The municipality as a partner

Since the consortium started, the municipality is an official partner of the project. The city picks up these tasks:

- Financial input: for the business NOT as usual and the risky parts. In return the project needs to report to the city (results + finances).
- Connect the project with other projects in the neighbourhood (projects that can reinforce the Neighbourhood Power project).
- Help with communication.
- Technical support (renovation advice, premiums, low interest loans, etc).
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Obstacles to Neighbourhood Power

The *most important obstacles* that we experience nowadays are *legal* obstacles. For the most optimal realization of this pilot, an adjustment of the current legislation is needed. Several laws obstruct a collective solar project. For example:

- The law that says one must not put solar panels on the unused roof of a neighbour and use the energy that is provided by these solar panels. This law has the consequence that putting solar on neigbouring roofs is impossible.
- The law that arranges the tariffs of electricity that private individuals sell to the grid. These tariffs are so low that solar panels are only interesting if the electricity they produce can be consumed by the ones who use the building.

As a consequence, lots of suitable roofs are (half) ‘empty’ at this moment and solar projects who make use of third party financing are too small to break through

The present Flemish minister of Energy shows openness towards our experimental pilot project. Several meetings have already taken place.

Another constraint is that we have to *find people and companies that want to join the project*: investors and people willing to change their electricity consumption pattern. Some profiles are really difficult to reach: house-owners who rent out their houses to people with less financial resources and people with few financial resources.

A Citizen Boosted Participative Process to Define Participation Spaces for Barcelona Energia

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The Network for energy sovereignty (Xarxa per la sobirania energètica, Xse) in Catalonia, has been boosting a participative process among all citizen actors in the city in relation to energy sovereignty, new government models and citizen empowerment with the aim of opening Barcelona Energia to the citizenship. The main objective is to convert the public electrical energy trading company in a real transformative space and move forward to a decentralized socially and environmentally respectful energy model focusing on caring for people and Earth. Both Xse and other citizen spaces are aware that public services will be a transformative leverage as long as the citizens, far beyond the institution, have their control. Thus, the energy strategy could be decoupled from electoral cycles and planned with a long term perspective.

Energy Democracy has been, from the very beginning of our network, a key point to be implemented in the new energy model that is coming. Our bet is for a public communal govern as an essential sovereignty tool. We understand this public communal government as a citizen cooperative space where diagnosis, proposals research and debate, as well as accountability, monitoring and audit are promoted to take place.

We claim for these spaces to be of institution and citizen co-responsibility, where citizens and institution are in equal conditions, both for the proposing initiatives and the binding decision-making.

With the aim of collectively thinking how this coproduction spaces should be, and at the same time, making a specific proposal for Barcelona Energia, we deeply believed in an open process of collective intelligence. Thus, we contacted people and collectives coming from a wide spectrum of citizen mobilizations and institutions working in the energy area and representing technical, ecological politics and economics points of view. We invited also people and entities who work on the democracy development, people and entities working at social enterprise models and people affected by the present energy model and its infrastructures[14].

As a starting point of the participative process, several energy democracy processes and public service governance models and common goods within the local, state and European scope were analysed15. This information was treated and used for brainstorming within a face to face debate session and within an on-line participative process[16].

Facilitation has been a crucial factor for ensuring equal participation of every participant and for enabling the extraction of the best of the collective intelligence convoked in both sessions.

Conciliation of working, familiar and social life of participating people was another factor that we were worried about and that keep on worrying us. This is undoubtedly a structural problem we should approach in parallel if we want to guarantee the radical democracy we defend. We have therefore set up the meetings adopting a time schedule that pays attention to people' working and households constraints, while trying to open child care spaces during the meetings.

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[14] A list of collectives invited to participate in the process: 350BCN, Aigua és Vida (AeV; Water is Life), Albirem, Aliança contra la pobresa energètica (APE; alliance against energy poverty), ATTAC Acordem, Azimut (renewable energy cooperative), Col·lectiu per un Model Energètic Sostenible (CMES; Collective for a Sustainable Energy Model), Comité de empresa de TERSA (TERSA work council decline the invitation), Col·lectiu Ronda (Collective Ronda, Coop57, Ecologistes en Acció (EeA; Ecologists in Action), El camino del elder (space facilitation), Enginyeria sense fronteres (ESF; Engineering without Borders), Federació d'associació de veïns de Barcelona (FAVB;Federation of Neighboroughs Association of Barcelona), Holtrop, Institut de Ciència i Tecnologia Ambiental (ICTA; Environmetal Science and Technology Insitute) from the Autononomous University of Barcelona (UAB), Institut de Govern i polítiques públiques(IGOP; Government and Public policies Institut) from the UAB, Laboratori per a l'Anàlisi dels sistemes socioecologics (ICTA-UAB; Socioecological Systems Analysis Laboratory), La Hidra-Fundación Comunes (Commons Foundation), Sustainability Science and Technology Master from the Polytechnical University of Barcelona (UPC) (process observers), members of the former Participative Energy Plan (PEP) from Sant Martí, Climate Justice Movement (MJC) , Observatori del deute en la globalizació (Globalization Debt Observatory; ODG), Observatori DESC (Drets econòmics socials i culturals; Economic Social and Cultural Rights), Plataforma Aire Net (Clean Air Platform), Plataforma per la Qualitat de l'aire (Air Quality Platform). Smartgrids, Som Energia, Taula de l'aigua de Terrassa (Water Table from Terrassa), km-ZERO, Xarxa d'economia solidària (Solidarity Economics Network; XES), Xarxa per la sobirania energètica (Network for Energy Sovereignty; Xse)

[15] Hamburg, Viladecans (Public communal government), Terrassa (water), Pamplona (cooperative) and the present TERSA.

[16] Through e-mail and forms to assess the sessions and contents. The forms were part of the Delphi methodology which allows to spur and accompany the process. This work has been performed by three pupils of the Master in Science and Technology of Sustainability from the Polytechnic University of Barcelona.

Four questions were prioritized during the process: 1) what do we want to decide about? 2) which participation spaces should there be? Which participation mechanisms? 3) who can/want/have to participate? 4) Which accountability, monitoring and audit mechanisms do we establish?

1) ***What do we want to decide about?***

We detect the need to decide the city energy policy in a co-creation space that should go beyond Barcelona Energy.

Anyway, and specifically as far as Barcelona Energy is concerned, we want to decide on:

- Whom we buy from and whom we sell to (to escape from buying and selling to the energy oligopoly).
- the generation sources. They should be renewables with a minimum social and environmental impact. Therefore, we also want to decide about the possibility of using incineration as an energy source due to its health impacts and with the aim of establishing sinergies towards a zero waste strategy.
- Energy tariffs, so as to promote a model alleviating energy poverty and boosting saving.
- How energy poverty is approached in Barcelona Energy (i.e. from a holistic perspective, from a solidarity point of view, by considering correlations among energy poverty, tariffs and buildings retrofits).
- Distribution as a key element to control the whole electric system.
- Energy needs, by thinking of energy from the social metabolism perspective and by taking into account how energy affects all the other aspects of municipality policy.

2) ***Which participation spaces should there be? Which participation mechanisms?***

As an indispensable request, binding-decision making spaces should be implemented, both for Barcelona Energy and public energy policies.

Citizen participation mustn’t be relegated, in any case, to a single space, but must be adapted to the different realities and needs of the groups, taking into account the possibility of their conciliation and territorial proximity.

Participation mechanisms should be defined according to a co-responsibility principle at every single level of decision.

Facilitation is key for the proper functioning of the space, to guarantee participation, inclusion and quality of the collective intelligence.

- ***Citizen queries:*** for strategic decisions, with binding-decision making
- ***Ágora***: Debate spaces are considered to be very important to define Barcelona Energia strategy. They should be empowerment, care and formative spaces. One agora for every neighborhood is proposed.
- ***Meeting:*** for debating strategic energy policies and assessing the general level of agreement. For electing the spokespeople in the representation space. This space should be opened to all citizens. Participants should have right to vote. An inclusive decision space must be implemented in order to complement the representative space, created to guarantee management efficacy.
- ***Representation space:*** To achieve a compromise between inclusion and management efficacy a representative space is proposed. Spokespeople will be elected in the annual meeting from different citizen profiles and for a period of 2/4 years. Participation in this space should be incentivized, not necessarily economically. Spokespeople accountability will be established by the annual meeting. Moreover, a declaration of absence of conflict of interests and impartiality will be also required. An observer-assessor of the city council will be present in this representative space. Its functions will consist in gathering proposals from the agoras, transfer meeting consensus to the management organ, and promote citizen queries around strategic aspects emerging from the agoras.

3) Who can/want/have to participate?

A wide spectrum of citizen must be represented within the participation organs, besides the users. Rights and responsibilities for every level of participation should be established. Excluded social collectives should be encouraged to participate. Motivation to participate can well be related to the agreement between the city council and with Barcelona Energia in order to take the proposals gathered in the debates into account. Non-profit entities as well as active citizens and related associations should also be included, as they represent critical thinking spaces. The conciliation between participation and care, personal and social life is essential. As already mentioned, existing time constraints should be taken into due account when planning participation. However, a deeper debate around time availability and distribution in our society must be addressed.

4) ***Which accountability, monitoring and audit mechanisms do we establish?***

We also detected the need to implement an external autonomous control organ with a budget to allow the audit of the public electrical energy trading company.

Disaggregated and meaningful data should be made available through economic, labor, social, gender, ecological and technical indicators. Indicators must have been previously and clearly defined in the co-creation spaces.

The main lawsuits must be then queried to the whole citizenry.

Organisation

This Workshop is organised by JRC Unit C2 (Energy Efficiency and Renewables Unit).

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