Energy cooperatives as social innovation processes in the energy sector: a conceptual framework for further research

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Abstract

With rising concerns over ecological sustainability as well as security of supply, the energy system has over the last years come under increasing pressure and various efforts have been made aiming at a transformation towards more sustainable systems of energy provision. At the grassroots level this has included the establishment of energy cooperatives and other forms of local or community based ownership of renewable energy technologies. This paper suggests a perspective on energy cooperatives as social innovations within the energy system and outlines a research approach as well as specific research questions to be pursued within an ongoing research project.

1 Introduction

As one of society's key technical infrastructures, the energy system is shaped by a variety of social, economic, technological and political factors. With rising concerns over ecological sustainability as well as security of supply, the energy system has over the last years come under increasing pressure and various efforts have been made aiming at a transformation towards more sustainable systems of energy provision. A broad range of policies at the regional, national and international level have been implemented, aiming, among other things, at the setup of R&D projects for developing more sustainable energy technologies, the provision of subsidies for the implementation of these technologies, binding targets for the share of energy generated from renewable sources or the development of emissions trading schemes.

However, efforts towards transformation processes in the energy system have not only taken the form of top-down regulations and programmes. Also grass-roots initiatives have played an important role in the process. On the one hand, the environmental movement certainly contributed towards bringing the issue of sustainable energy technologies on the agenda from the 1970s onwards. Beyond that, bottom-up pioneer groups experimenting with alternative energy technologies have sometimes also contributed substantially to technology development in the area of renewable energies, as has been well documented for the cases of self-construction groups in the area of solar thermal technology in Austria (Ornetzeder

2001) and wind turbine development in Denmark (Jørgensen & Karnøe 1995; Olesen et al. 2004). In some cases grassroots initiatives have also become market actors as energy producers themselves and set up locally owned and managed renewable energy production facilities, e.g. in the form of energy cooperatives.

This paper is based on the recently started research project 'energy cooperatives as social innovation processes', carried out jointly by the Research Institute for Co-operation and Co-operatives (RiCC) at the Vienna University of Economics and Business and the IFZ (see details in acknowledgements below). The paper will provide some background on developments in the area of energy cooperatives and provide an outlook on the research concept and research questions to be pursued in this project. The following section offers an introduction to energy cooperatives as (actual and potential) sources of innovation and transformation in the energy system. Section three then provides a brief overview of existing research in the field. This is followed by an outline of the conceptual approaches we suggest to draw upon for further research on energy cooperatives and, finally, an outlook on the research issues to be explored within the research project at hand.

2 Energy cooperatives as a source of innovation and transformation

A variety of different models of local ownership patterns can be found in different countries across Europe. Most prominently this includes cooperatively owned wind turbines in Denmark that, starting from the mid 1970s, constituted the dominant form of ownership up until the early 1990s and still contribute significantly to Denmark's overall wind power capacity (Olesen et al. 2004; Toke et al. 2008). However, also a number of other countries have seen activities sprout in locally and/or cooperatively owned renewable energy production facilities. For example, in UK policy there has been increasing attention given to 'community energy' projects in recent years, maintaining a rather broad understanding of the concept and thus encompassing quite a broad variety of local ownership models (Walker et al. 2006; Walker 2008). In Germany cooperatively owned wind turbines – both in the form of limited liability companies and in the actual legal form of cooperatives – also are very widely spread (Toke et al. 2008) and recent years have also seen an upsurge of cooperatives set up in the area of photovoltaics (Flieger & Klemisch 2008; Rutschmann 2009). Austria, on the other hand, has a strong tradition in cooperatively owned biomass heating district networks (Rakos 1998; Madlener 2007).

Energy cooperatives and related forms of local ownership of renewable energy technologies have thus introduced new forms of socio-economic organisation into the system of energy provision. While the classical regime of energy provision usually involved highly centralised energy infrastructures with 'end-of-wire captive consumers', locally and cooperatively owned facilities for energy production can constitute a substantially differing model of energy

provision and distribution. As such they can be seen as social innovations, in the sense of 'new ways of satisfying societal needs, in particular new forms of organisation, new regulations or new lifestyles' (Zapf 1989). From a normative perspective, local ownership of renewable energy technologies is therefore not only seen as a means to contribute towards greater ecological sustainability by increasing the share of renewables, but also as a favourable new form of setting up social and economic relations in the energy system, capable of fostering local control, empowerment as well as contributing to the local economy and/or identity (Kruse & Maegaard 2008; Warren & McFadyen 2010).

Apart from constituting social innovations in themselves, energy cooperatives and similar initiatives have also been important sites of technological innovation activities, as in the cases of self build groups around renewable energy technologies referred to above. Indeed, it has been argued that technologies emerging from innovative pioneer-communities may exhibit design variants and forms of implementation that may be quite different – and possibly better adapted to various use contexts – than technologies developed in the context of large government programs and business investments. In this vein Jørgensen and Karnøe (1995) and Kemp et al. (2001) suggest that the small-scale, stepwise form of wind turbine development, that was situated in Danish cooperatives and self-build groups, accompanied by gradually emerging policy support, lead to more successful design variants and diffusion patterns than wind turbine development in the US, notably California, driven by large-scale business investments and R&D programmes.

Over the last years the previously prominent role of energy cooperatives as sites of technological innovation may have lost some of its impetus, as more conventional R&D sites in research and industry have become increasingly engaged in renewable energy technology development. At the same time, however, liberalisation of energy markets as well as feed-in tariffs for electricity from renewable sources introduced in several countries have opened up new actor roles and markets accessible to them. With the possibility to sell their electricity to the grid as independent power producers or even to act as utility companies selling directly to customers spread out across an entire country, energy cooperatives have become market actors in their own right. Where the establishment of energy cooperatives has been driven by the environmental goal of contributing to an increased use of renewable energy technologies, their role can thus be seen in channelling 'green' consumer interests and in exerting their influence as market actors. From this perspective, the establishment of energy cooperatives encompasses a specific form of bottom-up governance that goes beyond mobilising and lobbying for particular goals (e.g. environmental issues) by actively engaging in the system of energy provision.

Summing up, it can be said that energy cooperatives and related forms of local ownership in the area of renewable energy technologies can be viewed as social innovations introducing

new forms of socio-economic organisation of energy provision and have also played a role as a site for technological innovation activities. As innovation sites, their activities may in many cases be part of a specific kind of governance process in the energy sector, attempting to contribute to a transformation process in the energy system from the bottom-up.

3 Existing research in the field

Existing research on energy cooperative and local ownership of renewable energy technologies has so far to a large extent examined cases in the area of wind farms. A detailed account of the success story of wind turbine development in Denmark has been provided by Jørgensen and Karnøe (1995) looking among other things at the grassroots entrepreneurs pioneering technology development in the second half of the 1970s and arguing for the necessity linking up technology development with supportive institutional frameworks. Kemp et al. (2001), drawing on this analysis, have compared the effects of wind power policy in California and Denmark in late 1970s and 1980s in the context of the general issue of developing transition paths in socio-technical regimes such as the energy system. They conclude that the approach taken in Denmark which supported bottom-up technology development emerging from self-build groups has proved considerably more successful than the investor-driven approach in California triggered by favourable economic incentives.

Several studies have investigated the institutional frameworks affecting wind power implementation in more detail since, in several cases also specifically focusing on the conditions for community wind power projects (Bolinger 2001; Miles & Odell 2004; Olesen et al. 2004; Bolinger 2005; Toke 2005; Breukers & Wolsink 2007; Toke et al. 2008; Agterbosch et al. 2009). These studies have mainly looked at situations in Denmark, the UK, the US, the Netherlands and, to a small extent, Sweden and Germany. They have drawn attention to issues such as systems of financial support, traditions of 'energy activism' (especially the anti-nuclear movement), planning systems, land use policies, feed-in laws, taxation schemes, legal forms available for cooperative-like enterprises and gradual institutional capacity building.

Walker (2008) has provided a general review of incentives and barriers to community-owned means of renewable energy production in the UK, addressing issues such as local income generation, increased local control, lower energy costs and environmental commitment but also highlight the problems of instable and fragmented funding programmes and a number of barriers to market entry. Furthermore Walker, Hunter et al. (2007) and Walker and Devine-Wright (2008) draw attention to divergent understandings of 'community energy' in the UK and critically assess the significance of recent embracements of the term in UK policy.

A small number of analyses have also looked at micro level processes of negotiation and network formation processes within community energy initiatives in the UK. These studies have looked at negotiation processes between external community development practitioners, the community itself and donor agencies (Hinshelwood 2001) as well as at the important role of interpersonal and social trust in the establishment of community based renewable energy projects (Walker et al. 2010).

Another issue that has attracted increasing attention recently is the potential of local ownership of renewable energy production facilities, as a means to create higher acceptance for their deployment. This instrumental view on local ownership has once again been emphasised especially in relation to wind power deployment, where local opposition has often been particularly harsh, due to concerns over landscape protection, noise and wildlife disturbance. Case studies that were conducted in various different countries, including Japan (Maruyama et al. 2007), New Zealand (Barry & Chapman 2009) and Scotland (Warren & McFadyen 2010) provide evidence that local ownership does indeed increase support for wind power deployment. Furthermore general attitudes towards community-owned renewable energy projects have been investigated for the UK (Devine-Wright 2005; Rogers et al. 2008)

4 Conceptual approaches for analysing energy cooperatives as social innovations

In order to analyse the establishment of energy cooperatives in the field of renewable energy technologies and the innovative practices emerging from them (see section 2), it is valuable to build on a general understanding of innovation processes and a conceptual frame for understanding transformation processes in the energy system.

Transformation processes in the energy system towards more sustainable forms of energy provision clearly involve fundamental changes in a large scale infrastructure system. A number of different technologies for energy generation and distribution are being experimented with and are in the process of complementing and, to some extent, replacing existing ones. However, the design of technologies and technical systems does not just follow an internal 'engineering logic', but is as much socially shaped and dependent on socio-cultural contexts. Introducing new technologies or new services in most cases also means transforming relevant institutions, expectations of users and other actors and social practices evolving around technologies. However, these social and institutional factors are not simply adjusted to new technologies as they are introduced to the market, but themselves also shape the course of technological development in a co-evolutionary process.

Especially in the case of energy systems, it is obvious that we can understand change processes only at the level of such socio-technical systems: Both the institutional framework

and the technological basis of energy systems are presently in a state of flux. Policies aiming at transformation processes in the energy sector are continuously adapted, new technologies are developed and mature further, supportive and oppositional groups form in relation to specific technologies and new forms of services emerge, such as energy consulting services or energy contracting. Energy cooperatives in themselves already involve changes in economic relations and social practices. However, they also have to deal with the technical and institutional environment evolving around them. They are thus operating in a field where they are dependent on available technologies and on institutional framework conditions, but at the same time also actively shaping these environments to some extent through their own activities.

In order to understand the role and position of energy cooperatives within these dynamic processes of system change, the literature on socio-technical transitions and technological innovation systems, can serve as a valuable starting point. One such approach is the multi-level model of technical change, as introduced by Rip and Kemp (1998), which appears to be especially helpful to integrate local activities and practices with broader social and economic structures and provides a framework for the dynamics of technological change from innovation to adoption. The multi-level model of innovation separates the 'breeding' of new technologies in confined technological niches from a meso-level of socio-technical regimes (e.g. the system of mobility, the energy system) and a broader context of the socio-technical landscape, which encompasses cultural norms, values or dominant economic or governance regimes (such as the present trend to liberalise former infrastructure monopolies). A 'technological regime' means a rule set or grammar that structures the socio-technical co-evolution process. The value of such a concept is to point to the multi-dimensionality of processes of socio-technical change, to the multiplicity of actors involved in the process and to the 'embeddedness' (Granovetter 1985) of local practices and niches in various contexts with their own specific history and dynamics.

Through this conceptual lens, both the analysis of niche dynamics such as learning processes, network formation or the formation of expectations (Geels & Raven 2006) and the analysis of established practices and institutions at the meso-level further our understanding of development processes in the system under study (e.g. the energy system). In particular, the interplay of the emergence of novelties at the niche level and stabilizing mechanisms at the regime level can be explored (Markard & Truffer 2006; Rohracher 2008). In addition to that, pressures from the landscape level (e.g. pressure towards environmental soundness or market liberalisation trends) need to be taken into account. This framework also supports the concept of 'strategic niche management' (Rip 1989; Kemp et al. 1998) which aims for careful policy support for emerging technologies by the creation and nurturing of protected spaces to facilitate ongoing interactive learning of the actors involved.

A different, though related strand of work centring on technological innovation systems attempts to understand the establishment and growth of socio-technical configurations around a given technology area by looking at specific actor constellations and the activities unfolding around them (Jacobsson & Johnson 2000). This innovation system analysis can be seen as an attempt to capture the interplay of technology development and the development of relevant framework conditions for a particular technology area, to describe its dynamics and to identify possible development pathways. One specific form of such an innovation system analysis consists of analysing the fulfilment of 'system functions' that are seen to contribute to the advancement of an innovation field. Such system functions are taken to include such aspects as the creation of new knowledge, entrepreneurial activity, the guidance of direction of search, the supply of resources, the development of markets, the creation of positive external economies and legitimation activities (Bergek et al. 2005; Hekkert et al. 2007). By examining the interplay of such system functions, driving forces as well as blocking mechanisms for the diffusion of the technology can be identified.

Focussing very much on technological innovations (in their social context), these frameworks will certainly have to be adapted for studying energy cooperatives and other forms of local ownership of renewable energy technologies. As noted before, energy cooperatives are not only a site for technological innovation activity but also constitute social innovations, establishing new forms of socio-economic organisation in the energy sector. Such adaptations may be informed by existing literature on social or non-technical innovations, conceptualising innovation not only as the introduction of new technologies but, more generally as new ways – both material and social – of satisfying societal needs and solving social problems (e.g. Zapf 1989; Gillwald 2000; Mulgan et al. 2007; Roth 2009). Indeed, Seyfang and Smith (2006) as well as Seyfang (2009) have already started to develop an analytical framework for analysing 'grassroots-' or 'community innovations', partly based on the multi level model of innovation referred to above. Furthermore Kemp et al. (2001) and Walker et al. (2006) have described policy responses to energy cooperatives and community energy initiatives in terms of the concept of 'strategic niche management'.

5 Outlook: Issues for further research

Following the view on energy cooperatives as innovation sites outlined in section 2, as well as the conceptual approaches outlined above, an attempt will be made in the project 'energy cooperatives as social innovation processes' to arrive at a dynamic perspective on development processes in the area of energy cooperatives and similar forms of local ownership of energy technologies.

Furthermore, while the emphasis in the literature on locally owned wind energy projects certainly mirrors the considerable amount of activities in this area, there appears to be a lack

of attention towards cooperatives and local ownership involving other renewable energy technologies. Also, considering the significant level of activities in recent years in Germany, there is an obvious deficit in documenting and analysing this case. Germany has seen an upsurge of activities in the area of energy cooperatives in recent years, mostly in the field of photovoltaics and wind power (Flieger & Klemisch 2008; Rutschmann 2009). Yet, in contrast to other countries with a considerable level of activities in this area, such as Denmark or, more recently and to a smaller extent, the UK, there is so far very little research documenting and analysing these activities. Austria, by contrast, has a long tradition of biomass district heating networks, frequently taking the form of farmers' cooperatives or communal projects (Rakos 1998; Madlener 2007). In recent years some activities have also arisen in the area of renewable electricity production from wind and photovoltaics. Though often not formally set up as cooperatives they also display several characteristics of such organisations. The project 'energy cooperatives as social innovation processes' will thus focus particularly on developments in Germany and Austria.

More specifically, against the background described in the previous sections, the following issues appear for be of interest for further exploration and shall be pursued further in the research project:

(1) Conceptualising developments around energy cooperatives as innovation processes

Energy cooperatives may be thought of as a social innovation in the sense of introducing a new form of socio-economic organisation for satisfying societal needs (in this case energy provision). However, they are also very clearly set up around a specific technological basis. The literature on socio-technical transitions and technological innovation systems provides a valuable resource for analysing the micro- and meso-level dynamics of such innovation processes. However, some adaptations will be necessary, which may be informed by the literature on social or non-technical innovations as well as the literature on grassroots activism.

How can the activities in the field of establishing energy cooperatives and local ownership of renewable energy technologies be brought into a conceptual framework that can further our understanding of micro- and meso/macro-level dynamics in the field?

(2) Different organisational variants and roles of energy cooperatives:

A significant number of organisational variations of local ownership of renewable energy technologies exist, partly due to varying legal systems and cooperative traditions in different countries. However, there also seems to be some evidence that next to strictly local projects at a small scale, larger organisations and more far-reaching cooperation networks are gradually gaining importance (e.g. larger cooperatives, emergence of umbrella / intermediary

organisations, cooperatives taking on the role of utility companies, cooperatives on the basis of communities of interest rather than community of locality, etc.).

What different types of community ownership of renewable energy technologies can be distinguished, not only on the basis of legal structures, but also on the basis of pursued strategies and roles taken on in systems of energy provision? Can changes in typical actor roles, resources and strategies be observed? What future developments (organisational forms, actor groups involved, range of diffusion, possible forms of policy support) are conceivable?

(3) Interplay of macro/meso-level framework conditions and micro-level actor networks:

Energy cooperatives and other forms of local ownership of renewable energy technologies are operating in a field where they are dependent both on available technologies and on institutional framework conditions. These environments are not stable but are shifting, e.g. as policies aiming at transformation processes in the energy sector are continuously adapted, technologies mature further or supportive and oppositional groups form in relation to specific technologies. These processes are partly shaped by the actors in the area of energy cooperatives themselves, e.g. by pioneering technology development and by lobbying for individual projects or favourable framework conditions.

In the process of establishing energy cooperatives or related initiatives, the actors involved need to take account both this institutional framework and the micro-level processes of network formation and the management of stakeholder relations. Previous research has already pointed to the involvement of residents able to bridge different networks and thus providing access to appropriate social capital as an important factor for community-based cooperatives (Lang & Roessl in press). The activities, strategies and resources of energy cooperatives are therefore best understood in a combination of micro and meso/macro level perspectives.

How do these processes of network formation and the management of stakeholder relations unfold within cooperatives or locally owned enterprises in the field of renewable energy technologies? How are strategies formed and resources (financial, social, technological) mobilised at this micro-level? Which institutional barriers and incentives promote or impede the development of energy cooperatives and local ownership in the area of renewable energy technologies? How have these institutional frames developed over the last years? Where and how has institutional support for energy cooperatives formed?

(4) Linkages with the mainstream regime of energy provision

The potential of energy cooperatives and local ownership of renewable energy technologies to contribute to a transformation process in the energy system will, among other things, depend on ways in which the grassroots-model relates to the mainstream regime of energy

provision and higher levels of governance. Feed-in regulations for independent producers of electricity, though not geared exclusively towards energy cooperatives, constitute one powerful coupling process to the mainstream energy regime. In addition to that, among policy-makers local ownership of renewable energy technologies appears to be increasingly viewed in instrumental terms (creating acceptance for renewable energy technologies) rather than in the normative terms of community empowerment and solidarity principles that have underpinned the founding of many such initiatives. While this points towards divergent interests and values, it also could mean that further room is emerging for linking bottom-up and top-down initiatives. Further possible linkage processes remain to be explored.

Acknowledgements:

This paper is based on the ongoing project 'Energy cooperatives and local ownership in the field of renewable energy technologies as social innovation processes in the energy system'. The project is funded by the anniversary fund of the Austrian National Bank (Jubiläumsfonds der Oesterreichischen Nationalbank). The project is coordinated by Prof. Dr. Dietmar Roessl, head of the Research Institute for Co-operation and Co-operatives (RiCC) at the Vienna University of Economics and Business.

I would like to thank Dietmar Roessl (RiCC) as well as Harald Rohracher (IFZ) for comments and suggestions on earlier versions of this manuscript.

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