

Available online at www.sciencedirect.com**SciVerse ScienceDirect**

Procedia Environmental Sciences 17 (2013) 719 – 728

Procedia

Environmental Sciences

The 3rd International Conference on Sustainable Future for Human Security
SUSTAIN 2012

Transitioning to community-owned renewable energy: Lessons from Germany

Li Wen Li^{a,b*}, Janine Birmele^a, Harald Schaich^a, Werner Konold^a

^a*Institute for Landscape Management, University of Freiburg, Tennenbacher Str. 4 D-79106, Freiburg, Germany*

^b*Graduate Institute of Environmental Engineering, National Taiwan University, No. 1 Sec. 4 Roosevelt Road, 106 Taipei, Taiwan*

Abstract

Providing mature technologies and in-servicing markets are not enough to foster the public use of renewable energy technologies for green transformation. A promising approach is to help policy makers construct a model for identifying and developing factors that will support community-owned technology initiatives. The literature on incentives for multi-actors to get involved in community-owned renewable energy project reveals that major success factors are of socio-economic character. The theory-collective action approach consists of five integrated dimensions of actors that enable an understanding of the role of, and linkages between, the stakeholders in a community. In this study we examine success factors in the implementation of community-owned renewable energy projects and look for theoretical explanations as to why they are important. We used the case study of Freiamt (a rural community in the Black Forest, Germany), which has already achieved 100% power production from renewable sources, to analyze stakeholders and their motivations for becoming active and investing in renewable energy. The case study shows that participative and bottom-up planning processes are very important for the implementation of the project and that economic and regional motives amongst the relevant stakeholders were dominant.

© 2013 The Authors. Published by Elsevier B.V. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/3.0/).

Selection and peer-review under responsibility of SUSTAIN conference's committee and supported by Kyoto University; (OPIR), (GCOE-ES), (GCOE-HSE), (CSEAS), (RISH), (GCOE-ARS) and (GSS) as co-hosts.

Keywords: Collective action; Public-private partnership; energy economics

* Corresponding author. Tel.: +886961052003; fax: +88633704084

E-mail address: liwenli.tw@gmail.com

1. Introduction

In light of the threat of climate change, goals to reduce CO₂ emissions via the use of renewable energies have been agreed upon. By 2020, the European Union aims to achieve a proportion of 20% renewable energy in overall energy consumption, the Federal Republic of Germany 18 % and the state of Baden-Württemberg 13%. Small-scale energy projects e.g. in communities or regions, can contribute to achieving these goals. One of the many lessons learned from the past decade in German communities is that the integration of financial tools, such as Feed-in Tariffs (FIT), in policies is a major contributing factor in successful development of green energy. Such tools provide investors and users a guaranteed price for power generated from a renewable energy source. They can also reduce public opposition against environmental impacts [1] and, moreover, can even promote public acceptance of, and participation in, projects [2]. This occurs if a planning process is openly discussed and involves the community and multiple actors [3]. There are many ways to mobilize local people and governments towards sustainable energy communities, but there are also many barriers and obstacles that hamper progress in this direction. Local governments also play a critical role in community decision-making in the movement towards sustainability [4]. Four theoretic models have been discussed in the social science field to explain environmental governance: pluralism, elitism, corporatism and neo-pluralism. Unlike the first three models, neo-pluralism is concerned mostly with complex action in policy systems, including agenda building, the logic of collective action, special-interest sub-governments, social movements, and advocacy associations [5]. In this context, cooperation forms between actors with shared values and common interests, and regulation takes place through forms of governance rather than government [6].

In Germany, the Federal Republic of Germany's Renewable Energy Act provides the basis for community-scale development of renewable energies. Agencies, involved banking institutions, and state and local governments play a smaller role than the residents who initiate the development. However, without any of the above players, the 100% renewable energy target could not be achieved. The fundamental idea for building sustainable communities is to create a partnership network for collective action among the different stakeholders. This is not an easy task. Lack of trust, local identity, and a general sense of the need to protect common interests must be overcome to trigger community social capital formation [7]. Each of these issues are related to the topic of local environmental, economic and energy governance. Financial potential as an extrinsic and key motivation for investing in renewable energy has been identified in recent studies as a decisive factor. Residents expect to save money through a cheaper and reliable provision of energy, as compared to fossil fuels [8-9]. They might also improve their income with the proceeds of the investment and the sale of energy produced. The decision to invest in renewable energy production, therefore, takes increasing costs into account. It is better to provide transparent information about the financial plan sooner rather than later because this justifies the higher allocation of benefits and risk [10].

The purpose of this paper is to investigate whether the involvement of residents and multiple actors in the planning process will contribute to greater acceptance of, and support for, community-owned renewable energy projects. The main research question in our case study approach was: What factors contribute to the feasibility of community-owned renewable energy projects in Germany? Lessons learnt from this case study research could be transferred to similar planning exercises in rural areas elsewhere where communities expect a more balanced consideration of environmental, social, and economic values. We use the case study community Freiamt located in southwestern Germany to analyze the impact of rural development in achieving the 100% renewable energy regions target.

2. Methods and material

The concept of collective action is adopted from our previous research. We have demonstrated that facilitating mixed sector participation in community collective action as a means of community empowerment can provide a number of key benefits. Collaboration, coordination and partnership are closely related activities that are undertaken within the context of a network that is strongly linked by financial, knowledge and governance frameworks via horizontal and vertical linkages. As illustrated in Figure 1 [11], a network of four categories of facilitators established through partnership building is responsible for empowering the inner cycle – community-owned renewable energy.

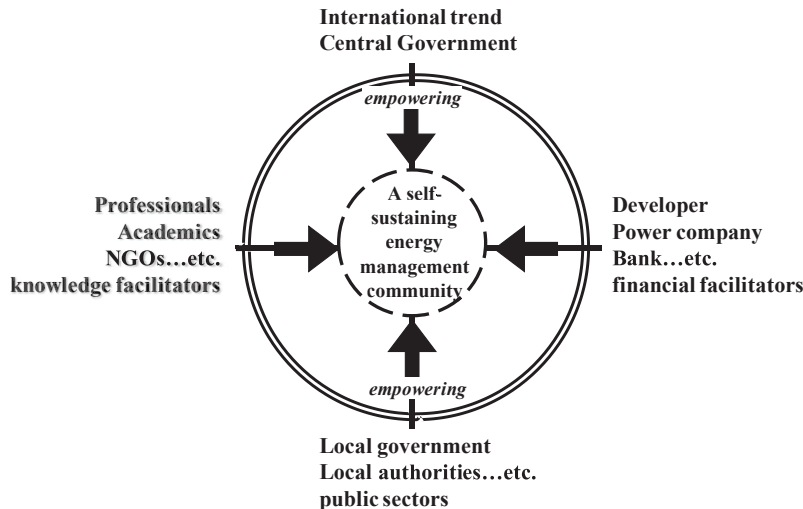


Fig. 1. A collective action model of public-private partnerships for empowering a self-sustaining energy community

2.1. Stakeholder identity and analysis

The most suitable technique for identifying the interests and strategies of actors regarding renewable energy community projects is stakeholder analysis. Research from a bottom-up perspective applied stakeholder analysis to identify those actors who are likely to be affected by renewable energy deployment and to describe their interrelationships and interactions as in Figure 1. Integrating a multiple-actor partnership in a community governance network can empower local people to achieve a self-sustaining energy management system [7]. A multiple-actor partnership involves different stakeholder categories such as governors, politicians, project developers, technology market actors, professionals and citizens. The vertical linkage between the public sectors assume the policy-making, promoting and budgeting responsibilities that are central to a sustained green niche of carbon reduction competitiveness and the promotion of collective action in communities worldwide. The horizontal linkages allow the private sector to exchange knowledge, information and technical, financial and business services. First, NGOs, academic institutions and professionals play the role of facilitators and coordinating actors. By coordinating information and activities with different sectors, both the vertical and horizontal linkages facilitate decision making through a systematic process that results in optimal actions.

2.2. Case Study

Using the example of Freiamt, a rural community in the Black Forest (see Fig. 2), which is often claimed to be a model in achieving power production derived from 100% renewable sources, this study is based on an article review and interviews with involved persons to identify the project stakeholders and their motivations. First, articles from regional newspapers and local community bulletins were analyzed to identify key stakeholders. Second, key stakeholders were interviewed to find out more about their attitudes and motivations for pushing forward the use of renewable energies in Freiamt. Afterwards, the findings were discussed using relevant literature. Freiamt's residents, the local government, the agencies fesa GmbH and Okostromgruppe Freiburg GmbH, involved banking institutions, the federal state of Baden-Württemberg, and the Federal Republic of Germany were identified as stakeholders.

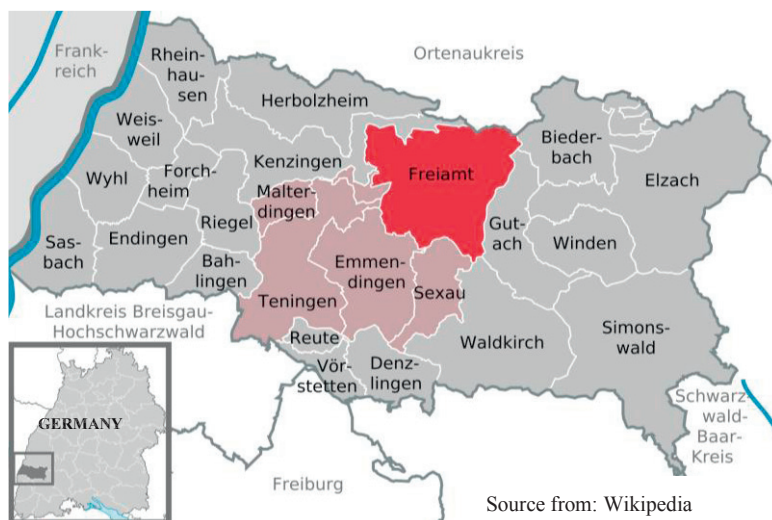


Fig. 2. The location of Freiamt's administrative district in the federal state of Baden-Württemberg (southwestern Germany)

In 2010, Freiamt had 4,219 residents and a population density of 80 residents per square kilometer. The renewable energy community projects raised the debt per capita in 2009 to 802 € (the state average per-capita debt is 400 €), and increased local job opportunities to 435 positions. There are also about 1,300 out-commuters. Although achieving a 100% renewable energy production was not the original goal, Freiamt was one of the first communities to reach a level of renewable energy power production that exceeds the community's own demand. The Association to support Wind Energy in Freiamt (Verein zur Förderung der Windenergie in Freiamt) was established by communal councilor Ernst Leimer and six other residents. Nowadays the association consists of 54 members from school students to retirees and has the task of informing people about the wind power plants and encouraging them to invest. The current annual power production from renewable sources accounts for 14 million kWh, which is over 2 million kWh more than is needed for the community of Freiamt and which can therefore be fed into the national grid (see Tab. 1). The wind power plants are of utmost importance for the power production. In 2011, the community of Freiamt yearly data report showed that the annual reduction of CO₂ emissions amounts to 9,800 t. However, beyond the use of renewable energy, the implementation of further measures – such as energy saving by modernizing insulation of buildings – by those residents in favor of reducing CO₂ emissions have not yet been successful.

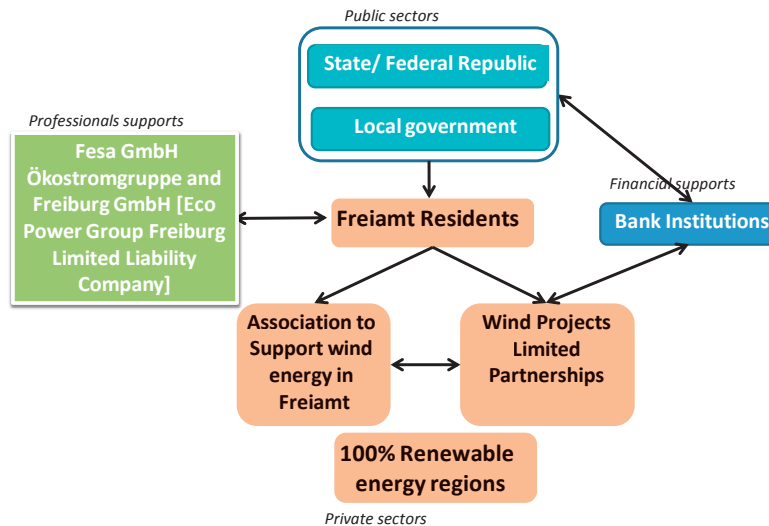
Table 1 Summary 2008 Freiamt power production

Renewable energy technologies	Capacity
4 wind power plants	7.4 MW
Ca. 160 PV plants	1695 kwp
2 biogas plants	420 kW
3 small hydro power plants	44 kW
Gross power production 2008	14.7 Mio. kWh
Gross power demand 2008	12.4 Mio. kWh
profits	+2.3 Mio. kWh

3. Results of Freiamt stakeholder analysis

The stakeholders involved in the community renewable energy project in Freiamt include local residents, local government, the agencies fesa GmbH and Ökostromgruppe Freiburg GmbH, banking institutions that provide loans, as well as the state of Baden-Württemberg and the Federal Republic of Germany who form the legal framework and provide support through programs (see Fig. 3).

Fig. 3. The stakeholders and their relationship in achieving 100% renewable energy for Freiamt



3.1 Local financial organization and residents' motivation

In October 2000, Freiamt Windmills GmbH & Co. participation KG (Freiamt Windmühlen GmbH & Co. Beteiligungs-KG) was established to finance the first two wind power plants. The GmbH & Co. participation KG is a limited partnership with a limited liability as a general partner, which means that all people investing money in the project are equal; the personal guaranteeing general partner is not a natural person, but a limited partnership. The organization's goal is to minimize the risks of liability for the natural persons standing behind this partnership. Owing to the fact that the farmers were the initial drivers of Freiamt's renewable energy development and that they obtained the best basic conditions – possessing the land to grow energy crops for biogas plants, mostly owning several hectares of forest for wood chips

or pellet production and having the ability to install bigger solar plants than on common roofs – they are of special importance.

Farming in the Black Forest has always been difficult due to its hilly topography and resulting small fields that prevent large-scale agricultural production. In recent decades, declining prices for agricultural products have had a great impact on the farmers' livelihoods. In particular, the Bovine spongiform encephalopathy crisis in 1999 and the constant low price for milk have led to much discussion in recent years which has also influenced the farmers' motivations in Freiamt [12]. As such, it was necessary to identify strategies for improving the income situation of the farmers, ideally without requiring additional work. This finding was affirmed by one of the dairy farmers who stated that renewable energy is an additional source of income for him and his family. This was his main motivation to switch from conventional energy sources to renewable energy. Meanwhile, the income from renewable energy accounts for 30 to 40% of the farmer's total income. Another important point to mention is that tourism can prosper through renewable energy development because it attracts eco tourists and potential investors in green energy provision from all over the world. Accommodation is mainly provided by farmers, but also the gastronomes of the community benefit from that positive touristic development. Fortunately, representative surveys have shown that wind power plants did not negatively impact tourist opinions towards landscape aesthetics and attractiveness [13-14].

Furthermore, building biogas plants, solar plants and wood chip heating systems supplement the income by saving money. For example, a resident who owns one of the biogas plants, has an agreement with EnBW, a regional energy company, with a contract period of twenty years, from which they receive 10.1 cent per kilowatt hour. The unused heat is sold to the distribution heating grid and provides heating to five neighboring buildings, based on the price of domestic fuel oil. Additionally, the owners of the land where the wind power plants are built are assured a safe tenancy for the coming twenty years. The new income streams have even led to a change in farm structures with farmers developing towards "energy farmers" [15]. One farmer of the community, for example, has given up cattle breeding and now uses grain and grass harvest for the biomass plant.

In sum, the Federal Republic of Germany's Renewable Energy Act provides the legal and financial basis for small-scale development of renewable energies. Agencies, involved banking institutions and the federal state of Baden-Württemberg, on the other hand, play a smaller but important role in financing projects. The residents who initiated the development and the local government were identified as key stakeholders. Their motivations were mostly financial considerations and environmental awareness. With increasing emotional distance from the project, the motivations of stakeholders seem to become more abstract. The residents and the local government are more concerned about their own benefit from the project and the influences on their local surroundings. On a more distant level, climate change and environmental issues are considered more important, since agencies and higher administrative levels take a broader view of the issue.

3.2 Local government

The local government (Gemeinderat) of Freiamt played a minor role in the planning of the wind power projects. They introduced the building application to the local council and gave their consent. The government had an advisory function [16], bringing residents into contact with manufacturers and banks. The local government cannot provide any grant for renewable energy implementation because of the community's debt [17]. The local government benefits from, and therefore appreciates, initiatives prompted by the ambition of Freiamt's citizens to achieve 100% renewable energy power production.

Generally, the development of renewable energy production benefits the regional value added chain in the community. Regional value means that capital is reinvested in the community and does not leave it

[17]. It combines private with communal benefit by the community cashing in taxes of those residents operating renewable energy production plants. Freiamt benefits in particular from business taxes: The limited partners who own the wind power plants are paid for feeding power into the grid. If this income exceeds 24,500 €, they have to pay a business tax [17]. Given that it receives relatively little revenue from business taxes in general, those from the wind projects' limited partnerships are essential for the local government. Moreover, the mayor mentions as a further advantage that the improved income situation of the farmers helps to prevent the abandonment of agricultural lands around Freiamt. This means that traditional cultural landscapes in the community have been preserved, which is important from a touristic and nature conservation point of view.

The wind power projects have contributed to Freiamt's image and have made the community a national and also international show case as well as a tourist attraction. Touristic day trips in particular are currently booming with approximately seven to eight groups, often from abroad, visiting Freiamt each week. According to the community of Freiamt 2011 report, the local government provides sight-seeing tours at a cost of 50 € per hour and takes visitor groups for a renewable energy tour. The renewable energy topic will also be integrated in several other events, such as in hiking tours and culinary offerings.

3.3 Eco Power Group Freiburg Limited Liability Company

The fesa GmbH Ökostromgruppe and Freiburg GmbH [Eco Power Group Freiburg Limited Liability Company] were recruited to support Freiamt's wind projects. While fesa GmbH was responsible for the marketing aspects including informing interested parties and for managing the trust account for the limited partnership, the Ökostromgruppe Freiburg GmbH did the complete project planning. Both companies were paid by the Freiamt project. Being professional agencies, their motivation was neutral. The fesa GmbH identifies the development of renewable energy and reduction of energy consumption in the region as their goals and aims to operate according to the slogan "think globally, act locally". The director of Freiburg GmbH states that the key motivation for pursuing the goal of obtaining local energy supply is that communities become more independent. Moreover, the development increases the regional added value since the capital remains within the community and helps to conserve the environment for future generations.

The Ökostromgruppe Freiburg GmbH states in their company guidelines the goal of increasing the percentage of renewable energy in overall energy consumption in the region. The director of fesa GmbH expresses a similar motivation for supporting this development as that stated by the director of Freiburg GmbH, i.e. that the capital remains within the community. Due to this, local power supply strengthens regional economic power and provides the basis for a sustainable environmental policy. Environmental and climate change related issues are stated as further motivations. The director of fesa GmbH notes furthermore, that investments in renewable energy should have economic benefits for all participants, but states that this is not a top priority for him.

3.4 Banking institutions

The banking institutions which provide the capital for renewable energy implementation – both wind and solar projects and for individual implementation – have no personal motivation in relation to the project. They are only interested in receiving repayment for their loans. Although a bank could potentially use their involvement in renewable activities to improve their image, this cannot be proved in this case.

3.5 Federal state of Baden-Württemberg and Federal Republic of Germany

The development of renewable energy projects on a small-scale relies on support. Therefore in the Federal Republic of Germany, the federal states and communities assist such projects by means of over 900 programs. Another project relevant to this research is 100% Erneuerbare Energie Regionen [100% Renewable Energy Regions] which is carried out by the Kompetenznetzwerk Dezentrale Energietechnologien [Competence Network Local Energy Technology] and supported and advised by the Federal Ministry for the Environment, Nature Protection and Nuclear Safety and the Federal Environment Agency. The project aims to support and especially to crosslink communities and regions which want to become energy self-sufficient, based on renewable energy. This support is not of a financial character since the regions benefit from consultancy services in relation to different problems such as the acquisition of subsidies, implementation of measures and involvement of actors. The driving force behind the project is a political resolution to transition towards energy supplies from renewable sources.

The state of Baden-Württemberg and the federal republic appreciate small-scale energy development because this can contribute to their overall energy goals. However, the crucial role of the Renewable Energy Act should be stressed. It provides the financial basis for the small-scale development of renewable energy.

4. Discussion

4.1 *Comparison of stakeholders' motivations*

The motivations of the different stakeholders show several similarities: the residents and local government were mainly motivated by financial considerations, a sense of place and associated local identity. The residents expected an improvement in income and a positive effect on regional development of the hometown surroundings. The local government expects a financial benefit from taxes and a positive effect on the community's image. Climate change and environmental protection topics seem to be of rather marginal importance. The residents' motivations in particular make the Freiamt case study noteworthy. The residents were the initial drivers of the renewable energy development of their community and fewer incentives from outside were needed for Freiamt to become one of the first communities to achieve a power production from 100% renewable sources. In contrast, the fesa GmbH and Okostromgruppe Freiburg GmbH are professional acting agencies, which are paid to support communities. They were therefore more distant and not directly or emotionally influenced by Freiamt's renewable energy project. As such, their motivations to support such developments were more abstract. Both agencies' directors noted the strengthening of the community's regional value added chain as a key motivation, which the director of fesa GmbH referred to as more of a financial aspect.

Okostromgruppe Freiburg GmbH, a form of public-private partnership between banking institutions and state and Federal administrations – is also noteworthy due to its motivations. As these institutions are very distant from the project, the term “motivation” is not appropriate. They appreciate the development of communities like Freiamt because this contributes to their stated climate protection goals or their company mission, but they are not directly affected by Freiamt itself. In summary, with increasing distance from the project, the more abstract the motivations of stakeholders seem to become. While directly influenced stakeholders, i.e. the residents and local government, are more concerned about themselves – their benefit from the project and the influences on their local surroundings – on more distant level, climate change and environmental issues are considered to be more important, since agencies and higher administrative levels have a broader view of the topic and are not personally affected by the project.

4.2 *Experiences with community-owned renewable energy on a regional level*

The model of “community-interest” [2] can be used to explain action based on considerations of local socioeconomic and financial benefit. According to this model, people generally act as individuals driven by economic incentives to maximize their own benefit [18]. In other studies, the creation of new employment linked to the implementation of renewable energy is mentioned as another important motivation related to financial issues [9-10]. No evidence could be found about new jobs in Freiamt, but at least the implementation of renewable energy and the related income improvement helped to save jobs, especially in agriculture. For local governments, the business taxes are essential [10], as also stated by Ernst Leimer and the Freiamt government. These taxes as well as the money savings and creation of employment support the regional added value. Furthermore, communities consider that renewable energy development is beneficial for their image, which in turn attracts people to the region – for example tourists and companies who bring capital to the community [10]. Tourism in particular plays a crucial role in Freiamt; while any negative impact caused by renewable energy plants would be a disaster for the community, the research in Freiamt has shown no sign of this.

5. Conclusion

To initiate small-scale energy projects such as those in communities, the commitment of residents is essential. This research therefore concentrated on the participating stakeholders and their motivations for becoming active in and investing in renewable energy. The study used the example of Freiamt, a rural area in Black Forest, Baden-Württemberg, which has already achieved 100% power production from renewable sources. Freiamt’s residents demonstrate a bottom-up movement, taking matters into their own hands. They display character traits typical for Black Forest people: a strong will for freedom, a “liability to insubordination”, rootedness in their hometown and proud character [15]. In Freiamt’s case, the residents are particularly proud of themselves for taking action and not only talking about doing something. The residents’ motivations for undertaking the project were strongly connected to community-interest as opposed to awareness of climate change which is generally far more distantly connected with their daily life. The residents and local government were more concerned about their own benefit from the project and its influences on their local surroundings. Residents expect a financial benefit from community energy projects; a self-ownership of renewable energy plants increases motivation and local acceptance and should therefore be supported by the state and Federal Republic, for example in the form of subsidized interest bank loans if the budget does not allow direct financial support.

However, there are differences between rural and urban communities with regards to basic conditions and social framework. To further develop renewable energy on a small-scale level, we suggest that baseline studies must be made for different kinds of German communities or regions. Such studies should concentrate more on the overall potential and suitable strategies for regional differences in terms of natural capital, socioeconomics and governance. Bottom up processes seem to be more sustainable in the long run and should be supported adequately. However, in other regions and communities with different circumstances and actors, a top-down approach might be more appropriate.

In conclusion, community energy projects contribute to climate protection by reducing the community’s CO₂ emissions. They create new income streams, have positive effects on the community’s image and are a way to strengthen rural areas by establishing a regional value added chain as the research on Freiamt has shown. Especially for rural areas, energy projects are a chance to foster regional development, to secure agricultural holdings and to conserve cultural landscapes that have been shaped by agriculture over centuries. This case study has shown that there are people willing to act and that it is possible to achieve a 100% power supply from renewable sources. With more support and less influence from commercial utilities at higher administrative levels, a significant increase of such community projects would be feasible.

References

- [1] Soini K, Pouta E, Salmiovirta M, Uusitalo M, Kivinen T. Local residents' perceptions of energy landscape: the case of transmission lines. *Land Use Policy*. 2011;28(1):294-305.
- [2] Li LW, Yu YH. From Self-interest to Community-interest: Low Carbon Community-based Process and Practice. *International Journal of Green Energy*. 2012;In Press.
- [3] Yu YH, Li LW, Kuo NW. The Pinglin low carbon community planning and design project. In: Government NTC, editor. Taipei2010.
- [4] Mark R. Sustainable community development: integrating environmental, economic, and social objectives. *Progress in Planning*. 2000;54(2):73-132.
- [5] McFarland AS. Neopluralism. *Annual Review of Political Science*. 2007;10(1):45-66.
- [6] Pichierri A. Concertation and local development. *International Journal of Urban and Regional Research*. 2002;26(4):689-706.
- [7] Li LW, Yu YH. Planning low carbon communities: why is a self-sustaining energy management system indispensable? *Energy Sources, Part B: Economics, Planning, and Policy*. 2011;In Press.
- [8] Rogers JC, Simmons EA, Convery I, Weatherall A. Public perceptions of opportunities for community-based renewable energy projects. *Energy Policy*. 2008;36(11):4217-26.
- [9] Walker G. What are the barriers and incentives for community-owned means of energy production and use? *Energy Policy*. 2008;36(12):4401-5.
- [10] Burch S. In pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities. *Energy Policy*. 2010;38(12):7575-85.
- [11] Li LW, Yu YH. Principles of Participatory Planning for Empowering Self-sustaining Low Carbon Communities. *Energy Policy* 2011;under review JEPO-D-11-01239R1(2011. 09.05).
- [12] Reinbold-Mench H. Erfahrungsbericht und Erfolgsgeschichte aus einer strukturschwachen Kommune im Südschwarzwald In: Schirmherrn BSG editor. Conference Erfahrungsbericht und Erfolgsgeschichte aus einer strukturschwachen Kommune im Südschwarzwald, Kongress Palais Kassel. Umsetzungsstrategien für Kommunen und Landkreise.
- [13] Calero R, Carta JA. Action plan for wind energy development in the Canary Islands. *Energy Policy*. 2004;32(10):1185-97.
- [14] Musall FD, Kuik O. Local acceptance of renewable energy--A case study from southeast Germany. *Energy Policy*. 2011;39(6):3252-60.
- [15] Scheuermann M. Ökopioniere - Die Strombauern aus dem Schwarzwald. Gemeinde Freiamt2007.
- [16] Grosse B. Des könne mir doch selber mache" – Wie die kleine Kommune Freiamt im südlichen Schwarzwald auf Wind, Sonne, Holz und Wasser setzt. Freiamt: KRONACH; 2007.
- [17] Busch H. Local success stories - An analysis of the motivations of municipalities in Germany to support renewable energies. Lund, Sweden: Lund University 2010.
- [18] Schweizer-Ries P. Energy sustainable communities: Environmental psychological investigations. *Energy Policy*. 2008;36(11):4126-35.