Chapter 10
Social Acceptance of Bioenergy Use and the Success Factors of Communal Bioenergy Projects

André Wüste and Peter Schmuck

Abstract This chapter analyses the social acceptance for bioenergy resources and bioenergy utilisation based on the following three studies: (1) A quantitative study on 678 rural Germans and Austrians attitudes towards bioenergy, based on a standardised questionnaire; (2) a study in 13 villages, analysing data on 2,200 inhabitants readiness to support a bioenergy project; (3) a qualitative interview study analysing the success factors as well as impediments to establish decentralised, communal bioenergy projects. Interviews were conducted with the initiators or participants in 25 bioenergy villages in Germany. This chapter focuses on changes in the individual and social well-being during the planning of a bioenergy village. Through the three studies, we seek to gain insights into Germany's very dynamic development of bioenergy production facilities, not all of which meet sustainability criteria: A growing number of people in Germany's rural areas are directly or indirectly affected by the increasing development of bioenergy utilisation. In many cases, only the economic aspects of bioenergy plants are considered prior to their being built; local population and other stakeholders are not involved. Increasing fears, caused by the local population's lack of information, often lead to conflicts, resistance and declining acceptance of bioenergy projects. The studies in this chapter seek to open potential avenues in order to have local population's support for sustainable bioenergy projects.

Keywords Acceptance • Bioenergy village • Success factors

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H. Ruppert et al. (eds.), *Sustainable Bioenergy Production - An Integrated Approach*,
DOI 10.1007/978-94-007-6642-6_10,

10.1 Introduction

This chapter focuses on social scientific studies as an activity that helps solve problems during the transformation of our conventional energy system on the basis of renewable energy sources. Our study bases on the Göttingen approach of sustainability science (see Sect. 2.3). In the selected problem field of bioenergy use – one option in a future global renewable energy scenario – traditional research results should be used as a general basis for solving problems. However, few such results are available. The development of bioenergy production installations in Germany has been a swift and dynamic process. This has prevented researchers from using the usual sequence, in which, prototypically, several years of basic research result in a substantial knowledge pool that serves as the basis for practical applications. Given that sustainability science has to solve global problems under severe time pressure, swift changes have forced scientists to undertake research and apply the result in parallel.

The situation becomes more concrete if one knows that, 10 years ago, Germany had only a few biogas plants, but since the introduction of the 2000 Renewable Energy Sources Act, the number has increased by several hundred per year to more than 7,000 today. Therefore, public acceptance of these plants may change substantially from year to year: There are different advantages, but also negative side effects, such as maize monocultures, which may critically influence public opinion. If one intends to support sustainable bioenergy projects precise data are required on the public acceptance of different production and consumption alternatives. These data include qualitative information about the different argumentation pattern types (for and against) within Germany's rural population. Such scientific knowledge allows a researcher, when planning with practitioners, to anticipate and adequately respond to biased arguments against bioenergy projects or to incorrect information in the media.

Our studies also analyse the success factors of already completed sustainable bioenergy projects in Germany. Applying these success factors to on-going projects has proven a very powerful mechanism for transferring sustainable models to our projects and to the regional and national levels. In 2000, we analysed the social success factors of pioneering communal renewable energy projects and then successfully applied these principles (Eigner and Schmuck 2002), when establishing five bioenergy villages in the Göttingen district between 2002 and 2010. In 2008 we documented our experiences in Jühnde as well as those in various following projects. The resulting publication (Ruppert et al. 2008) was distributed nationwide and supported the developing of more than a hundred of other bioenergy villages in Germany.

In this on-going project, we follow the principles of our Göttingen approach of sustainability science at the regional level, widening our focus on solutions for sustainable renewable energy models from villages to rural districts, each of which include several communities and villages (see Chap. 11).

10.2 Acceptance of and Social Barriers to the Development of Bioenergy Usage

Since the first amendment to the Renewable Energy Sources Act, there has been a boom in biogas production in Germany. Today, there are more than 7,000 biogas plants in Germany (FNR 2012). However, this rapid growth has partly led to the rural population's declining acceptance of these plants and to dissent regarding their suitability in agriculture.

Thus, in addition to bioenergy plants' technical, financial, administrative, organisational and infrastructural challenges, the perceptions of and acceptance by the affected population represent a massive obstacle to their implementation (Roesch and Kaltschmitt 1999, p. 348) that needs to be overcome to facilitate the shift to renewable energies.

There are many definitions of acceptance. According to Endruweit and Trommsdorff (2002), acceptance is an attribute of an innovation's introduction in order to achieve positive responses from the concerned people. Dethloff (2004) considers acceptance the positive adoption of an idea, a status, a product or service, thus defining willingness. Acceptance is therefore not merely toleration and tolerance (attitude level), but also comprises readiness to act (behavioural level) as a criterion. The opposite of acceptance is rejection or non-acceptance, and if the rejection is linked to defensive actions, this leads to active resistance or reactions (Dethloff 2004, p. 18). At the very least, acceptance is a tolerant attitude or even a consensus-oriented process (Jenssen 2010, p. 197).

A nationwide survey by the German Forsa Institute ascertained that more than 95 % of Germans approve of the increased development of renewable energies (AEE 2011). On the other hand, hundreds of citizens' action groups have been formed against bioenergy projects in Germany. For example, the construction of a biogas plant in the northern Hessian village of Wommen was prevented by a citizens' action group. There are even citizens' action groups against bioenergy in our three selected districts. In the city of Burgdorf, in the Hannover region, a citizens' action group was formed to oppose a large biogas plant (1.5 MW) (see Chap. 11).

The causes of social protest against bioenergy projects are multifaceted. Fears that local residents' current quality of life – especially due to unwanted odours from the bioenergy plant – could be affected play a major role in this regard. Further concerns include rising costs, loss in value of immovables and of other tangibles (Mautz et al. 2008, p.107), traffic nuisance owing to biomass transport, monocultures' effect on the landscape and fear of accidents. These fears are potential causes for the well-known NIMBY (not in my back yard) conflicts. NIMBY has meant that while rural inhabitants considered bioenergy technology very important and useful in principle, they nonetheless often oppose bioenergy plants in their surroundings.

The increase in conflicts over renewable energy and especially bioenergy may partly be derived from the shift from small plants to large-scale industrial biogas production. Pooling individual bioenergy plants in bioenergy parks, which occurred in Penkun (north of Berlin), for example, requires extremely area-intensive and transport-intensive logistics. Increasing resistance may therefore be expected from the inhabitants of such

park's surroundings. In addition, mainly non-agricultural investors, such as power supply companies, implement such large-scale projects. Furthermore, as a rule, local citizens do not participate in industrial-scale biogas production. The profits from local raw materials use therefore do not remain in the region, but mainly benefit investors who are often not from the region (Mautz et al. 2008).

To prevent the NIMBY phenomenon, local residents need to be involved in decision-making and implementation processes (Aretz et al. 2009, p. 49). This allows them to openly discuss their fears, which could then perhaps be overcome. Zoellner et al. (2008) showed that there are significant correlations between the fairness perceived by the implementation processes and the acceptance. Furthermore, it is crucial for the implementation process to be transparent, since citizens tend to be oppose a bioenergy project if they are not involved in the planning and decision-making processes (see Zoellner et al. 2008, p. 4140).

To date, there are very few scientific results concerning bioenergy acceptance – only a few relating to wind energy. Egert and Jedicke (2001) investigated wind energy acceptance in relation to the landscape of a northern Hessian region. A team of environmental psychologists from the University of Magdeburg analysed renewable energy acceptance in four different regions, focussing on photovoltaic, wind and biomass energy (Zoellner et al. 2008). Griesen (2010) investigated biogas plant acceptance factors by surveying two German regions. He identified the following key acceptance factors: (1) the ethical appraisal, (2) the distance between the biogas plant and the local residents' homes and (3) the residents' perceptions of bioenergy.

In our research project, we undertook a bioenergy acceptance study in Germany's rural areas that will provide findings on the acceptance of current bioenergy production and consumption options and bioenergy usages perceived and expected opportunities and risks. However, our research project has already contributed findings about the social criteria for multicriteria decision analysis (MCDA) (see Chap. 12). We next outline a few of the first study results.

10.3 Bioenergy Acceptance in Germany: A Nationwide Acceptance Survey

This acceptance study, which took place between the summer of 2010 and February 2011, focuses on the different bioenergy production alternatives (e.g., small biogas plants, major industrial bioenergy plants and biofuel plants) as well as the different biomass resources (e.g., wood, straw, liquid manure and energy crops).

10.3.1 Methods

10.3.1.1 Description of the Sample and the Investigated Regions

Six respondent sub-samples from residents in rural areas of Germany were surveyed: The main sample (n = 377) comprised people living in villages without

bioenergy production. This sample gives an overview about general acceptance or concerns regarding bioenergy. Furthermore, several smaller samples were collected from residents in areas surrounding the following special pathways of bioenergy production and use:

- local communal biogas projects (n = 66)
- major industrial bioenergy plants fuelled with energy crops (n = 98)
- major industrial biofuel plants (n = 55)
- organic farming in combination with biogas production (n = 30)
- short-rotation plantations (n = 52).

10.3.1.2 Design of the Questionnaire

A partly standardised questionnaire was created for the survey, with ten groups of questions. Question complex one contains 15 items related to different biomass resources for producing energy (e.g., bio waste, straw, energy crops, tree-cut, liquid manure) with three response categories ("I am in favour because ...", "I am only in favour if ..." and "I reject this because ..."). Each respondent also had the opportunity to write a short statement. Question complex two contains nine items concerning different bioenergy consumption opportunities (e.g., communal biogas plants with or without a heating concept, large industrial biogas plants, biofuel plants, wood heating plants). The response categories in question complex two are the same as those in complex one. In question complex three, there are open-ended questions on the potential opportunities and risks of using bioenergy. Question complexes four and five contain closed questions relating to the expected consequences of a bioenergy plant's construction in the main sample and in the smaller samples to identify the perceived consequences in areas with specific bioenergy production lines. Five-point Likert scales were used evaluate statements regarding these questions. Question complexes six and seven are semi-open questions on experiences with bioenergy in the respondents' local surroundings and their attitudes towards a possible bioenergy plant in their villages. Question complex eight contains nine items concerning other energy generation opportunities, such as petroleum, coal, solar energy and wind energy; the response categories are the same as those in complexes one and two. Question complex nine relates to the respondents' actual and planned energy supply. In the question, we requested complex, demographic data.

10.3.2 First Results

The questionnaire analysis is still on-going; we therefore focus on descriptive results.

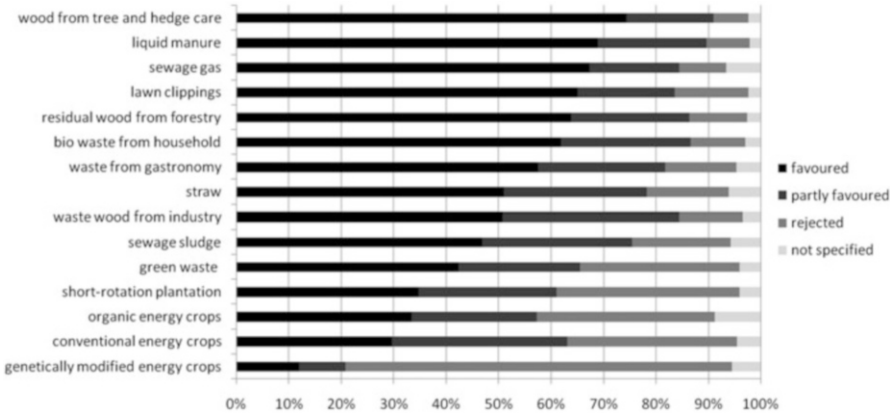

Fig. 10.1 Percentages of subjects' preference for potential bioenergy resources in the bioenergy acceptance survey

10.3.2.1 Acceptance of Different Biomass Resources

An impressive result is the participants' preference for biomass resources that consist of waste materials. Wood from trees and hedges to generate bioenergy is favoured by 75 % of the respondents , liquid manure by 69 %, sewage gas by 67 %, lawn clippings by 65 % and residual wood from forestry by 64 % (see Fig. 10.1). The respondents mention *waste materials' usefulness* and *waste reduction* as a main reason for this high endorsement of waste materials. Further positive outcomes associated with waste material use for bioenergy are its *environmental* and *financial benefits*.

The general endorsement and the rejection of the use of short-rotation plantations and organic energy crops are in balance. The respondents mention *competition between food production and energy crop production* as a main reason for their rejection of energy crops and short-rotation plantations. A further reason is the *risk of monocultures*. Positive arguments for energy crops use are that energy crops are *renewable sources* and that they can help *conserve fossil fuels*. The highest rejection figure (at 74 %) is for genetically modified energy crops, reflecting the Germany population's assessment of genetic engineering having too many unforeseeable risks.

10.3.2.2 Acceptance of Current Bioenergy Consumption Options

The respondents favour smaller, communal plants regarding their acceptance of current bioenergy consumption opportunities. Small biogas plants with a heating concept and heating plants with residual wood are greatly favoured at 72 and 69 % (see Fig. 10.2). The respondents explain that these are *useful* and *decentralised* bioenergy consumption opportunities with *benefits for the environment*.

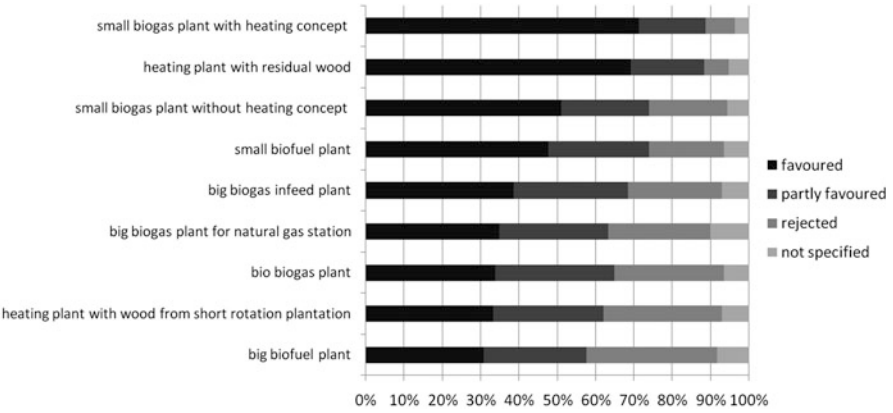

Fig. 10.2 Percentages of subjects' preference for potential bioenergy production lines in the bioenergy acceptance survey

A relatively small majority (50 %) supports small biogas plants without a heating concept, while almost 20 % do not, owing to the *lack of a heating component*. About 35 % approve large industrial bioenergy plants. The respondents refer to concerns relating to *competition between food production and energy crop production and impacts on quality of life* (e.g., traffic nuisance, impact on the landscape), but mention *independence from fossil fuels* and *environmental benefits* as positive aspects.

10.3.2.3 Acceptance of Other Energy Sources

The survey results show a general support for renewable energies. The highest approval is for solar heating (more than 80 % of respondents) and photovoltaic energy (approximately 74 %), followed by geothermal energy (more than 67 %) and hydropower (65 %). The respondents especially mention *benefits for the environment and the global climate* as the main reason for their positive appraisal of renewable energies. A relatively small majority of respondents (51 %) are supportive of wind power plants.

The fossil fuel and nuclear resources are less accepted. Especially nuclear energy receives a high rejection rate (63 %), while that of coal energy is almost 50 % (see Fig. 10.3). The main reasons for the high rejection of fossil and nuclear fuels are *negative environmental effects* and the *finite nature* of these resources. The *unclear situation concerning the disposal of nuclear waste* is another aspect that the respondents mention.

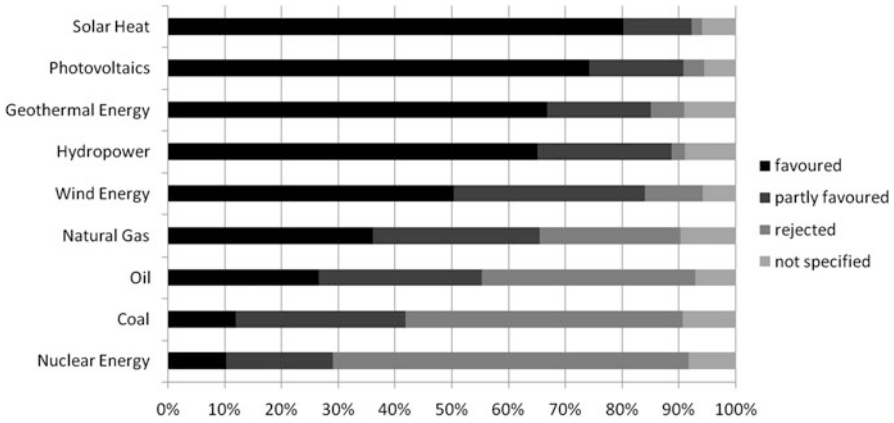

Fig. 10.3 Percentages of subjects' preference for fossil, nuclear and renewable energy resources in the bioenergy acceptance survey

10.4 Acceptance of Bioenergy Villages in Göttingen District

After the successful implementation of the bioenergy village Jühnde, the district of Göttingen initiated a follow-up project in 2006 to establish more bioenergy villages in the district. As part of a village selection process, 34 villages were interested in biomass-based power and heat supply. Representatives from the bioenergy village's project team and from the district administration organised meetings and information sessions in these villages. Through selection criteria such as "agricultural and forestry potential", "actors' high motivation" or a "compact village structure", 13 potentially suitable villages were selected: Barlissen, Ellershausen, Erbsen, Gelliehausen, Hemeln, Krebeck, Landolfshausen, Lödingsen, Reiffenhausen, Renshausen, Sattenhausen, Scheden and Wollbrandshausen. In these villages, further village meetings were organised and working groups, which the university team moderated, were initiated. The working groups comprised interested and active villagers, who analysed the local biomass potential and potential plant locations, informed and mobilised other villagers. A survey with the following research questions was conducted in the single households to get information about their readiness to participate on the bioenergy project:

- What opportunities, expectations, risks or fears regarding the implementation of a bioenergy village do the villagers express? Which main motives lead to the approval or rejection of the bioenergy village concept?
- How willing are the residents to participate in the planning phase?
- How do the residents assess the bioenergy village's feasibility as a shared task of the village community?

10.4.1 Methods

A two-page household survey was done in 2006 in 13 candidate bioenergy villages in Göttingen (n = 2,061). The survey consisted of quantitative and qualitative questions addressing:

- The villagers' willingness to connect their households to the planned local heat supply system
- The villagers' assessment of the notion of a bioenergy village (with explanatory statements)
- The villagers' willingness to participate in working groups
- The village community's assessment of the chances of implementing a bioenergy village project successfully.

This study focuses primarily on the open questions, which were analysed by means of a content analysis. This is one of the classical approaches to analyse text material (Flick 2004). The central element of a content analysis is creating a category system. The category system can be developed through (1) a deductive approach with the categories being developed before the analysis, or (2) an inductive approach with the categories generated on the basis of the text material without reference to pre-formulated theory concepts (Mayring 2008). A deductive theory-driven approach is combined with an inductive material-based approach to develop the category system. After defining the categories, the text material is compared with the category system by noting the occurrence of the categories in the text. Based on the text material, open-coding – which seeks to summarise data and phenomena by dividing them into units of meaning (Flick 2004, p. 259) – is chosen. Single statements are defined as the coding units. Quantitative working steps let us to arrange the categories according to the frequency of their occurrence in the material.

Two examples illustrate the category system's development: In keeping with the three-pillar model of sustainability, a theory-driven and deductive approach is used in respect of the question regarding the motives for agreeing to a bioenergy village concept. Hence, the categories *economic*, *ecological* and *social* motives are conceived, which prove useful to assign the data. The reasons for the rejection of the bioenergy village concept do not correspond with these categories; here, categories are developed inductively from the text material (e.g., *ethical doubts* or *limited quality of life*). After repeated reading, the categories are confirmed and arranged according to the frequency of their occurrence.

10.4.2 Results

10.4.2.1 Question 1: Willingness to Connect to the Local Heating Network

The survey reveals 52 % of the respondents' general readiness to connect to the communal heating system. The highest connection readiness was in village H (67 %), and the lowest in village J (only 31 %) (Fig. 10.4).

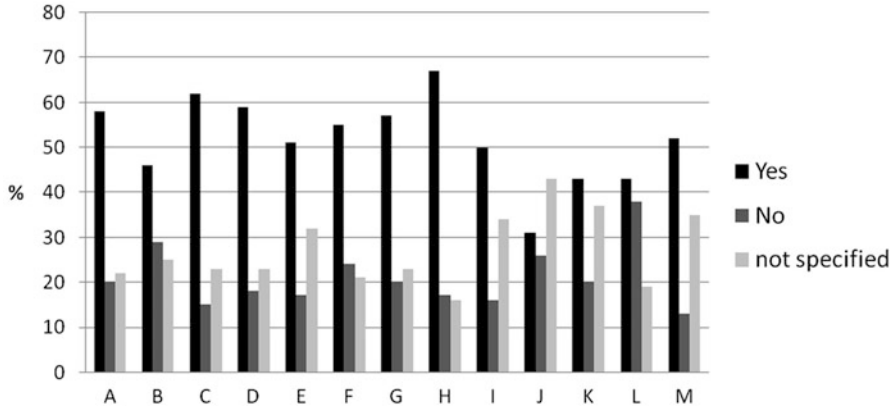

Fig. 10.4 Percentages of respondents intending and not intending to take part in the bioenergy village project in 13 villages (A–M) of the Goettingen district

In 9 of the 13 villages, more than 50 % of the villagers expressed a desire to join the project. In these villages, the process of social and technical support for the later steps, such as the feasibility study, continued (IZNE 2007).

10.4.2.2 Question 2: Assessment of the Notion of a Bioenergy Village with Explanatory Statements

74 % of the respondents in the 13 villages expressed a positive opinion of the bioenergy village concept, 11 % were undecided and only about 1 % (or 34 of the surveyed households) rejected the project (Fig. 10.5).

The reasons for a positive assessment of the bioenergy village concept, namely ecological motives, economic motives and social motives, are used as possible categories and are later confirmed through a data review. This division is inspired by the three-pillar model of sustainability (Ott 2009). Other categories are *increased comfort* and a residual category formulated during the content analysis process. The categories regarding a negative assessment of the bioenergy village concept are *economic motives*, *limitation of living standards*, *lack of experience*, *ethical concerns* and a residual category.

The quantitative analysis of the categories results in the following findings: Economic motives (e.g., *savings in heating costs* or *energy independence*) are the category mentioned most often (58 %) regarding a positive assessment of a combined power and heat supply. Ecological reasons (e.g., *reduction of greenhouse effect and climate change*) follow as they are mentioned by 31 % of the respondents. Social reasons (e.g., *stabilisation of the village community*) and increased comfort (*heating oil no longer needed*) are given less often.

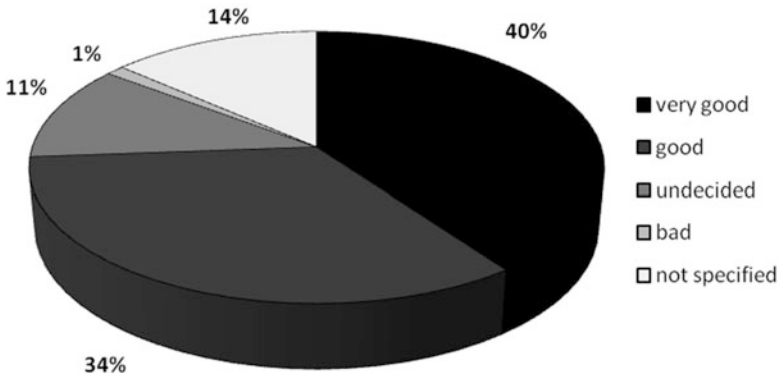

Fig. 10.5 Percentage of the respondents' opinion of the bioenergy village plan in 13 villages of the Goettingen district

Furthermore, the rejection of a bioenergy village is mainly justified for economic reasons (43 %). The perceived limitation of living standards (e.g. *odour from manure or traffic nuisance*) is mentioned by 23 % of the respondents. Ethical concerns (e.g. *the burning of food*) and a lack of experience (e.g. *the technology is not fully developed*) are not often mentioned. Other reasons include the *perceived dependency on farmers* (Fig. 10.6).

10.4.2.3 Question 3: Willingness to Participate in Working Groups

In total, 474 persons (25 %) agreed to participate in planning working groups – an average of 36 persons per village (variation: 16–55). The highest willingness to participate in planning was 44 % – in village K. The lowest interest in active participation was found in village L (17 %) (Fig. 10.7).

The reasons for a lack of willingness to participate in planning are assigned to the following categories: high age, health concerns, lack of time, information deficit, distance between home and work, and other reasons. The main reason for most villagers' lack of willingness to participate in the working groups is a lack of time, followed by high age. Medical concerns, lack of information and the distance between home and work are also mentioned (an equal share of 6 % each) (Fig. 10.8).

10.4.2.4 Question 4: Assessment of the Village Community

The question about the village community's ability to establish a bioenergy village as a shared project drew an affirmative response from most villagers (on average, 85 %) in the 13 villages. Even in village A, the least optimistic village in this regard,

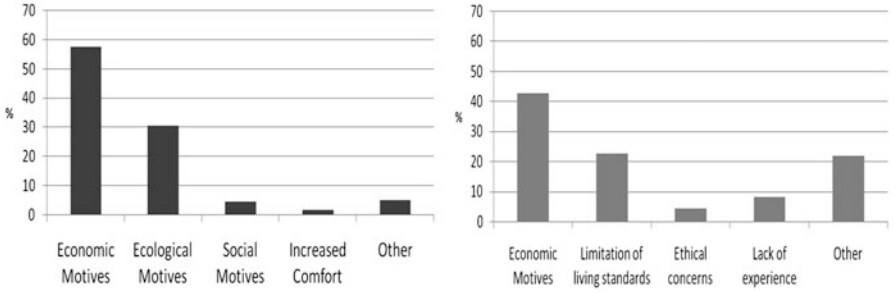

Fig. 10.6 Percentages of respondents' motives for supporting (on the *left*) and rejecting (on the *right*) the bioenergy village plan in 13 villages of the Goettingen district

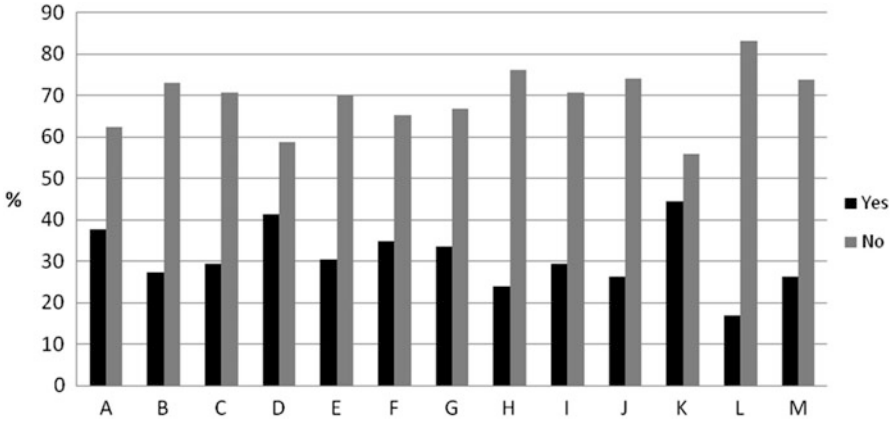

Fig. 10.7 Percentages of respondents intending and not intending to participate in working groups in the bioenergy village project in 13 villages (A–M) of the Goettingen district

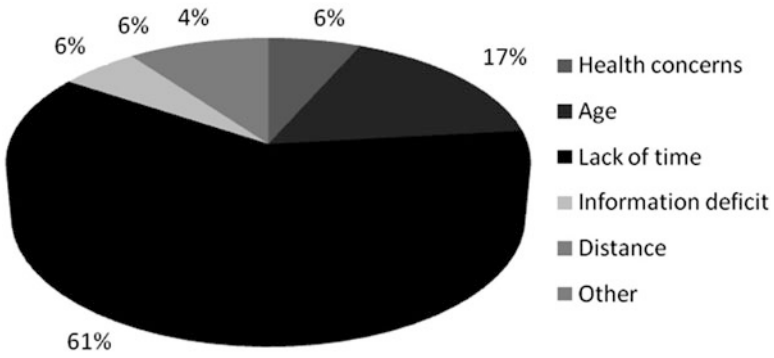

Fig. 10.8 Percentage of respondents' reasons for their lack of willingness to participate in the working groups in the bioenergy village project in 13 villages of the Göttingen district

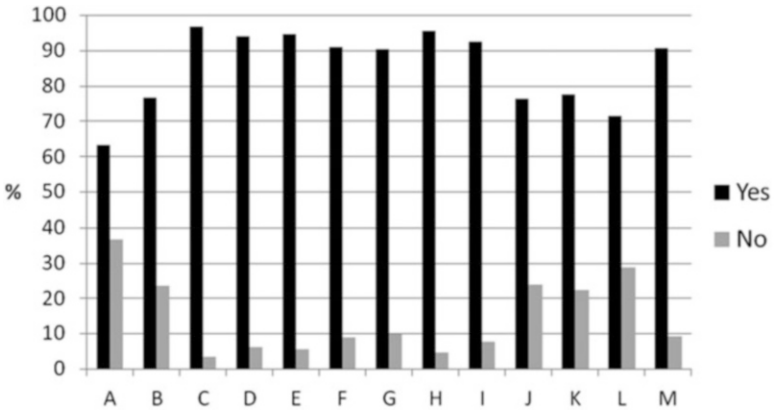

Fig. 10.9 Percentages of respondents in 13 villages (A–M) of the Goettingen district who are optimistic and not optimistic that their village will successfully complete the bioenergy village project

66 % of the analysed households were of the opinion that the village community could implement a bioenergy village project (Fig. 10.9).

The following are our theoretical considerations when categorising the respondents' reasons: The collective self-efficacy construct is a potential motive for faith in the shared project's success. According to Bandura's (1992, 1997) the social cognitive theory, cognitive processes, motivational processes, emotional processes, and behavioural processes are controlled by self-efficacy expectations. Self-efficacy is described as the extent of the subjective expectation of being able to perform a required behaviour to achieve a desired result. Individual expectations and collective expectations differ. High collective self-efficacy is based on the assumption that the group has trust in the team's capacities and on an optimistic perception of the accomplishment of future stress-producing events (Eigner-Thiel and Schmuck 2010). Schwarzer and Schmitz (1999) describe collective self-efficacy as the subjective certainty that new or difficult requirements can be managed by means of the group's shared competences. The appropriate category can be confirmed in the responses. During the analysis, the category *positive experiences* is formed and anchored in personal perceptions of previous community activities in the village.

The positive statements about the village community were primarily explained (46 %) by the perceived collective self-efficacy. Positive experiences with community projects were also mentioned, for instance, "building a community house", "renovating a swimming pool" as well as "village festivals" (Fig. 10.10).

The following categories were formulated for negative attitudes about the shared project's success: "disinterest" in a community development, the (negative) "personal experience" resulting in a lack of faith in the project, and a residual category. Remarkably, in the category "other" reasons (see Fig. 10.11), structural aspects of the village, such as the small "size of the village", the "too large buildings" and the "new buildings" were specifically mentioned. This suggests that some respondents

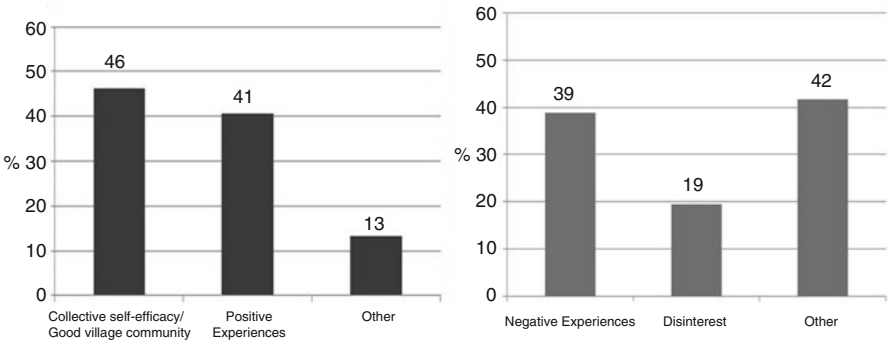

Fig. 10.10 Percentages of respondents' reasons in 13 villages of the Göttingen district for optimism (on the *left*) or lack of optimism (on the *right*) regarding a successful creation of a bioenergy village

did not understand the question, since the question sought to determine the village community's perception of the feasibility of a bioenergy village as a village community project.

10.4.3 Discussion

An average of 70 % of the villagers' answers point to strong interest in the bioenergy village concept. This high percentage may reflect the university members' successful public relations activities as well as the positive influence of the well-known bioenergy village Jühnde, which is very close to the other villages. Even the lowest rate of 51 % in village J was impressive.

10.4.3.1 Motives for the Assessment of the Bioenergy Village Concept

Economic and ecological reasons dominate regarding the positive statements about the bioenergy village concept, while social motives play a minor role. According to Stern et al. (1993), these motives can also be interpreted as egocentric (self-centred), biocentric (nature-related) or anthropocentric (related to the community of all humans). This means that the economic reasons mainly reflect egocentric motives, because heating cost savings are expected once the bioenergy village has been realised. The expected increase in comfort by having an own heating system and the lower maintenance costs may also be assigned to egocentric motives. Biocentric motives play an important role as they were approximately one-third of all the reasons mentioned. Anthropocentric motives have little significance. This could be explained as a ceiling effect: In these villages, a strong sense of community predated the start of the on-going project (see above). Another aspect that may

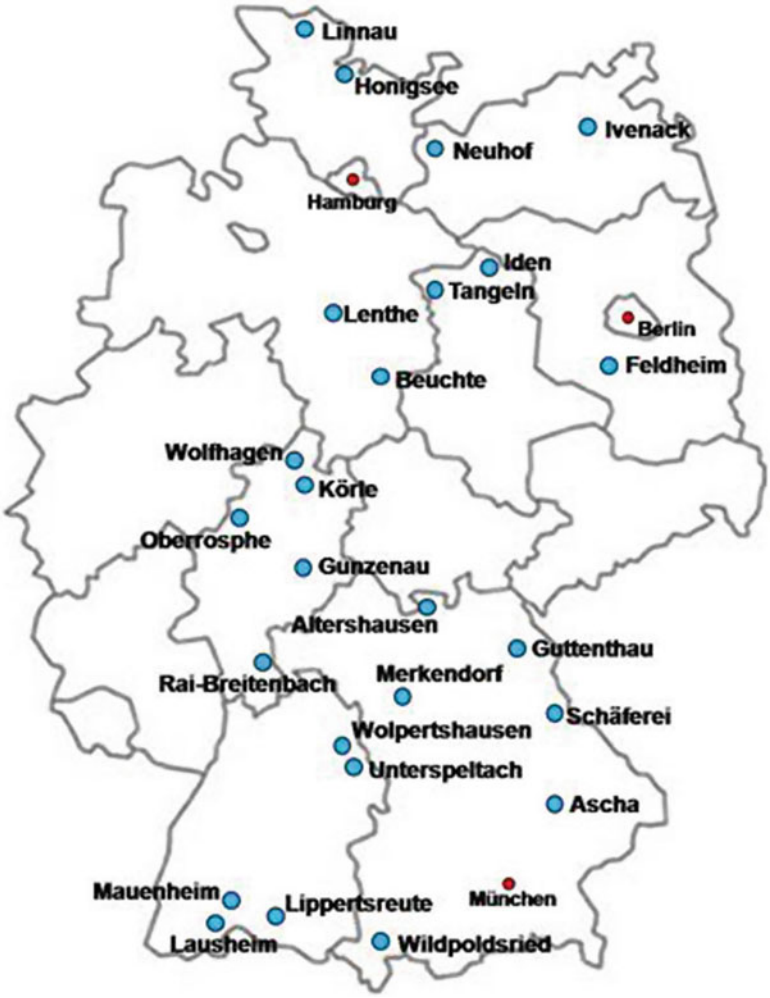

Fig. 10.11 Location of the 25 German communal renewable energy projects whose initiators were interviewed

exert a positive influence on the assessment of the bioenergy village concept is transfer effects and positive experiences with the bioenergy village Jühnde. However, these are rarely mentioned in the survey (under the category "other"). In the case of the negative statements, the economic reasons and the expected limiting of living standards can be assigned to egocentric motives. The "ethical concerns" that lead to the rejection of a bioenergy village can be interpreted as an anthropocentric motive, because "the burning of food" competes with the consumption of food and is thus detrimental to humanity. The category "lack of experience" reflects suspicion of the "new technology" and the associated fear of supply uncertainties.

However, such fears can be countered by targeted public relations activities, for example, by visiting best practice projects. In some cases, the new dependence on the farms providing the material led to the rejection of the bioenergy village concept.

The following recommendations can be derived from these findings for future projects: In the first information sessions with villagers, it seems to be important to stress the broad range of positive motivations for such projects. In addition to financial aspects, the benefits to the community and the ecological advantages should be addressed in detail to strengthen the biocentric and anthropocentric motives. A motivational mix rather than a single motivation seems to increase the likelihood. According to the findings, the rural population has different motivations for participation. On the other hand, critical arguments should be addressed early and systematically. If possible, such arguments should be refuted in public discussions or invalidated by visiting best practice models to show that certain concerns are unfounded.

10.4.3.2 Social Feasibility

In all the villages, the evaluation shows slight willingness of the inhabitants to join working groups to organise the conversion process. Since the required activities are mainly unsalaried, limited available time is a barrier conditioned by work and family responsibilities. Furthermore, the offered jobs are mostly outside the villages, so that many residents are dependent on a daily or even weekend commute between home and work. Our recommendation is that, with regard to project implementation, the main actors in the operating company should discuss the possibility of a shift from voluntary activities to financed activities. The statements concerning the positive assessment of the village community were equally due to collective self-efficacy and positively perceived experiences. For future projects, this means that the likelihood of establishing a bioenergy village should be based on a systematic survey of the village community's opinions. If there are positive experiences and attitudes, the likelihood of implementation are probably higher. However, this is a beneficial, but not sufficient, condition for the project's success; our study shows villages, in which optimism was present, but the project has not as yet been implemented.

In short, in these 13 villages, there was a very high social acceptance of the bioenergy village concept. Nevertheless, the low willingness to connect the own house with a heating network shows that there is a discrepancy between the general support and the de facto implementation of a bioenergy village. Despite the relatively equal initial conditions in the 13 villages, only four villages have to date successfully converted into a bioenergy village.

10.5 Success Factors for Communal Bioenergy Projects

Following the principle of a community-related energy supply, many villages and communities take control of their energy production. There are approximately 140 bioenergy villages in Germany, with many more in progress. For example, the state of Baden-Wurttemberg is funding the development of 100 bioenergy villages until 2020 and the state of Mecklenburg-Western Pomerania is planning 500 bioenergy villages until 2020. On the other hand, many project plans have not been realised. Therefore, analysing the conditions for success in such projects may be a valuable instrument to increase the likelihood of a systematic transfer of the idea of self-sustainable renewable energy communities.

The following section deals with the different paths to implement communal bioenergy projects and its success factors. These are based on a qualitative interview study. This study mainly sought to elaborate on motives for engagement, motivation, organisation and implementation strategies, the factors supporting and hindering a bioenergy project's implementation and the consequences of an established project. Therefore, interviews were held with initiators in 25 bioenergy villages or communal renewable energy projects (see Fig. 10.12)

10.5.1 Methods

Witzel's problem-centred interview method, an established qualitative method, was used to collect data. The interview allows the interviewee to speak as freely as possible, thus allowing an open discussion. However, it is centred on the interviewer introducing a specific problem. The interviewer prepares certain aspects of this

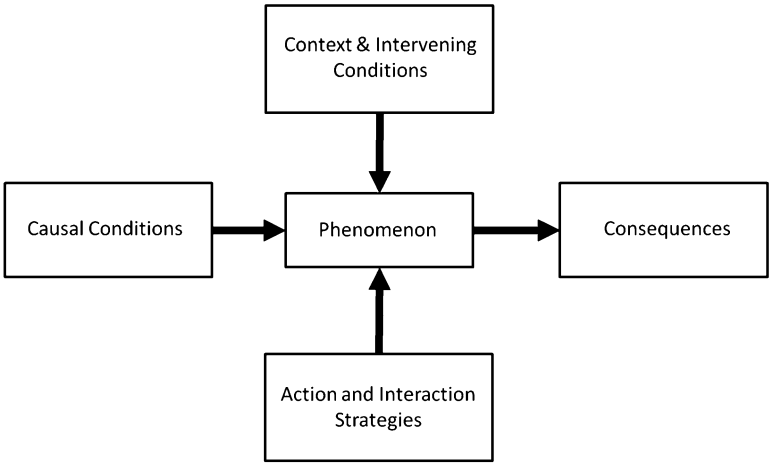

Fig. 10.12 Paradigm model (see Strauss and Corbin 1996)

problem beforehand, having compiled these as an interview guide. The principle of openness is important for the interview procedure. The interviewee can respond without predetermined response alternatives (Mayring 2002, p. 67).

In 20 bioenergy villages and five "integrative" bioenergy projects that combine bioenergy use with other renewable energies, we contacted interviewees who were substantially involved in projects' initiation, development and implementation. We then transcribed the recorded interviews.

10.5.1.1 Analysis of the Interviews

The interview transcripts were analysed using the grounded theory method (Strauss and Corbin 1996). Grounded theory is not a method, but a style of research and a strategy to discover a theory on the basis of empirical, mostly qualitative, data (Legewie 2005, p. 12). Its central element is the encoding process. Encoding means assigning one or multiple codes (keywords, items) to a text passage. During the analysis, the codes are not only derived from the data, but are also linked together and combined into superior categories (Legewie 2005, p. 16). It is useful to classify the categories in a coding scheme in order to determine their relationship. Strauss and Corbin (1996) proposed a particularly common coding paradigm. In addition, the analysis has a central phenomenon to which the other categories are related. The causal conditions are events that help develop the phenomenon. Furthermore, the phenomenon is embedded in a context with intervening conditions. Action and interaction strategies refer to the actions and reactions that occur as the result of the phenomenon and, finally, these actions and reactions' outcomes are the results (Strauss and Corbin 1996).

10.5.2 Results

The illustration of the results relates to Strauss and Corbin's (1996) paradigm model.

The following five main categories were formed as causal conditions: "local conditions", "impulses", "individual motives", "other participants' motives" and "tackling problems with dynamism". Verve concerning the context and intervening conditions, the main categories were "impeding factors", "internal barriers", "support factors", "cooperation" and "synergy effects". In the field of the action and interaction strategies, the following main categories were developed: "looking for information", "information strategies", "communication strategies", "project implementation strategies" and "organisation". The consequences were reflected in the subcategories "project effects", "personal effects" and "new perspectives and aims" (Fig. 10.13).

We next describe the different main categories on the basis of the proposed subcategories.

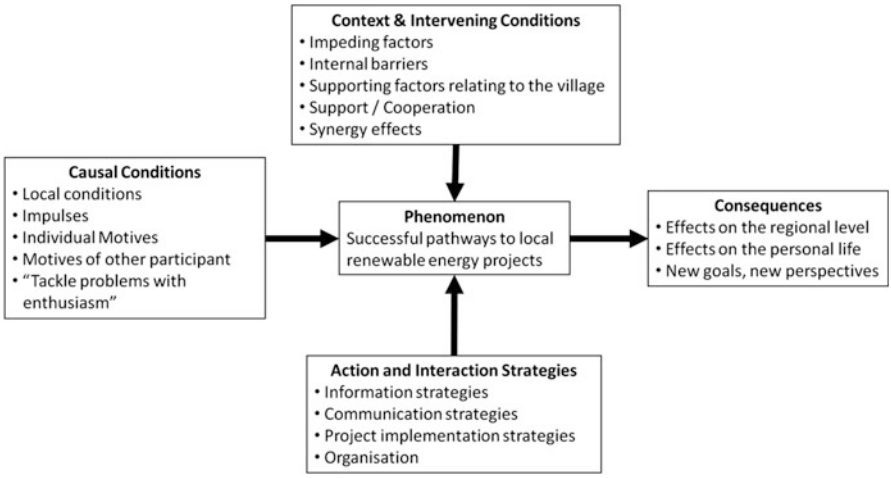

Fig. 10.13 Paradigm model of the results of the interviews with the initiators of renewable energy projects

10.5.2.1 Phenomenon

The phenomenon is referred to as *successful pathways to local renewable energy projects*, because the interview study focuses on determining the different success factors as well as transferring them to and applying them in our own projects (see Chap. 11). Some of the investigated villages combined bioenergy use with other renewable energies; the phenomenon therefore does not only focus on bioenergy projects.

10.5.2.2 Causal Conditions

We subsequently describe the conditions responsible for project initiation.

Local conditions: This main category describes important requirements that support the implementation of a bioenergy village project. The local inhabitants' peaceful coexistence is also a relevant condition to successfully establish the project. Many interviewees mentioned the availability of agricultural area and biomass for energy production as a fundamental requirement for the project. Another requirement is the interviewed initiator and other local persons acting as a driving force.

Impulses: This category describes the various initial sparks that lead to the project's initiation. Transfer effects from other, already established, bioenergy villages in Germany or Austria, such as the bioenergy village Jühnde and the energy self-sufficient district Guessing, were considered crucial. These projects' positive effects influenced the interviewee and other inhabitants, who conveyed these ideas to their own village. In some villages, the impetus to realise a bioenergy

village came from the villagers. In almost all 25, the interviewees mentioned the active search for alternatives to fossil or nuclear energy based fuels. It became clear that there were different initiator motives and participant motives.

Individual motives and other participants' motives: During the analysis of the interviews, a spectrum of different motives was identified. The main reasons for engagement in a bioenergy village project were ecological motives (e.g., carbon dioxide reduction), social motives (e.g., to strengthen community life), economic motives and self-sufficiency (e.g., agricultural added value).

Tackling problems with dynamism: This category describes the constant efforts and endurance required for a sustainable and local energy supply to improve living conditions in the village and eventually culminating in the transformation of society.

10.5.2.3 Context and Intervening Conditions

We next present the general conditions that influence the development of a bioenergy village project.

Impeding factors: This main category describes the influencing factors that negatively affect the project development process. On the one hand, there were price fluctuations in the global market (crop price increase or oil price decrease), which influenced the bioenergy village project negatively. Another negative factor was the uncertainty concerning the project financing, especially the acquisition of financial support. These aspects therefore have an impact on the project economy. Some interviewees mentioned their uncertainty concerning the economic viability of the project and contradictory economic interests as impeding influencing factors. The initiators also mentioned the lack of support by policymakers and administrative bodies as a negative influencing factor.

Internal barriers: This main category relates to impeding factors concerning the village and the local conditions generally. The inhabitants of all 25 villages had doubts about the project. The initiators in particular have to grapple with questions concerning costs and energy supply security. Certain villagers' envy of others was another problem. In some villages, doubt and envy led to negative propaganda about the bioenergy village project. Disinformation (rumours) was mentioned as an impeding factor.

Supporting factors relating to the village: In nearly all of the 25 villages, the initiators mentioned open-minded inhabitants as an essential supporting factor in the village. In some villages, discharge pipe or road construction works were planned, so that the installation of the local heating grid could be undertaken in combination with the roadworks. These synergy effects had a positive impact on the project acceptance and project economy.

Support/Cooperation: Constructive cooperation with supporters at different levels was a key factor. Especially support from the local council and the mayor was considered necessary for the successful implementation of a bioenergy village project. Assistance from outside the village was also important if, for instance, the district administration and the permit authorities supported the project. Some of

the interviewed initiators perceived different organisations' support as helpful (e.g., association of cooperatives, German Biogas Association (Fachverband Biogas)). Some interviewees appreciated constructive cooperation with planning offices and funding bodies.

10.5.2.4 Action and Interaction Strategies

We subsequently describe the envisaged strategies that contribute to project success.

Information strategies: In all the examined villages, the initiators planned information sessions and village meetings to inform the inhabitants about the project and mobilise them to participate in the planning process. Best practice visits were organised to already established, communal renewable energy projects. Face-to-face conversations were very important, especially to convince sceptics and opponents. In some villages, a significant contribution was conversations with inhabitants and word-of-mouth recommendations by them.

Communication strategies: This main category describes ways to discuss and communicate with the inhabitants about the bioenergy village project. Most of the 25 interviewed initiators emphasised the principle of transparency, especially relating to project finances and project economy. That means that all problems and points of criticism were discussed openly with the local inhabitants. In some villages, an independent moderator was included in the communication process.

Project implementation strategies: Most interviewees considered the involvement of the villagers in the planning and implementation process to be important. As a result, one or more working groups were established in the villages. The villagers' competencies were not only included in the planning process, but also in the construction work of the heat supply system. In a later phase, it was necessary to obtain professional support, such as planning offices, for a feasibility study. Some initiators recommended a cross-party approach. It is very important that the project is not exploited for the interest of only one sub-group of villagers.

Organisation: This main category contains important organisational steps relating to the bioenergy village project. This includes the choice of the type of company, the acquisition of subsidies, the organisation of biomass and cooperation with financial institutions.

10.5.2.5 Consequences

In the following we describe the individual-level consequences and effects.

Effects on the project: Nearly all the interviewed initiators reported positive ecological effects as a result of the project, especially carbon dioxide reduction. Furthermore, the projects added much value in the region, because energy expenditure remain in the region instead of it being paid to energy companies outside the region. Nearly all the interviewees noted an improved communal life, a feeling of

togetherness in the village and that new inhabitants had been integrated into their communal life. Only in two cases did the initiators not notice any effect on their communal life. Furthermore, in some villages, the inhabitants identified with the project and appreciated the work of the initiator and the main actors.

Another positive effect was more nationwide publicity. Many interviewees reported numerous visitors to the villages. In addition, many bioenergy village projects won awards, for instance, from environmental organisations or from federal state governments.

Personal effects: This category focuses on the personal effects that the interviewed initiators experienced during and after the implementation process. Many were proud of the achieved result and reported stronger feelings of well-being. Some interviewees noticed improvements in their social skills. Furthermore, the initiators gained professional knowledge in the field of renewable energies. Some of them are now highly sought as experts in the development of a communal renewable energy supply. The interviewees also reported a higher quality of life owing to the more secure local or regional energy supply.

New perspectives and goals: This category describes further developments in these 25 bioenergy villages. Newly established goals include the expansion of the local heating grid, the implementation of other renewable energies, developing the region into a renewable energy region and the construction of renewable energy charging stations for electric cars.

10.5.3 Discussion: Success Factors and Recommendations for Future Projects

Similar to the experiences of the bioenergy village Jühnde, this interview study confirmed the findings of Eigner-Thiel and Schmuck (Eigner and Schmuck 2002; Eigner-Thiel 2005; see Chap. 2). We subsequently focus on the relevant success factors derived from the interview study results.

10.5.3.1 Individual Motives

The motives for initiator engagement in the investigated villages are multifaceted. The interviewees primarily mentioned ecological aspects, mostly in combination with other motives, such as the regional added value, independence from fossil fuel resources, and intergenerational justice. The diversity of the personal motives for engaging in communal renewable bioenergy projects confirms Dörner's (1999) findings that ecological actions require a mix of motives. Self-centred motives, such as the desire for self-realisation, also play an important role.

10.5.3.2 Create Awareness

There are different reasons for individual inhabitants participating in a communal renewable energy project. A holistic message is therefore important to communicate that various objectives, for example, a balance between environmental protection and regional added value, can be achieved with these projects.

10.5.3.3 Financing Aspects

All the projects could only be implemented on the basis of the funding opportunities that the federal government's Renewable Energy Source Act offered. Further financial support from different funding programmes was also necessary for investment.

10.5.3.4 Support from Politicians and the Administration

Political support is a very important factor for the successful implementation of a communal renewable energy project. Support from the local council and the mayor is especially necessary. High-level political support (e.g., the administrative district, federal state government and federal government) assists with the implementation process. In some cases, the projects were considered lighthouse projects, which made it easier to obtain subsidies and permissions.

Given that initiators of and participants in such communal bioenergy projects work on an honorary basis, a stronger knowledge-based, logistic and financial support from competent authorities is helpful.

10.5.3.5 Democratic Structures

A democratic organisational structure, such as a registered cooperative society, is recommended for the operating company. Some bioenergy villages show that energy supply on the basis of renewable energies may help democratise society's energy supply.

10.5.3.6 Transparent Communication Policy

A major challenge for the initiators was finding appropriate information and communication strategies. Village meetings are suitable for conveying the initial information. New information and results arising from the process can also be made public in village meetings. One-on-one conversations are very helpful, especially when dealing with sceptics. Transparency should be applied during the information

and communication process. Furthermore, visiting model plants and already established communal renewable energy projects is a very successful way of obtaining information and convincing people to participate in a project.

10.5.3.7 Involvement of Inhabitants

The early involvement of inhabitants in the planning and organisation process increases the likelihood of success. Inhabitants can contribute their different competences and knowledge, and the work can be divided over many people. In some villages, working groups similar to the Jühnde model (see Chap. 2) were founded.

10.5.3.8 Personal Contribution

In most villages, the inhabitants' personal contribution to the project proved a success factor. Not only it is an opportunity to save costs (e.g., the excavation work), but it can also strengthen the village community.

10.6 General Discussion and Outlook

The Göttingen approach of sustainability science includes the close interconnection between social scientific research results and their applications in transdisciplinary projects. We could directly apply some of these study results in the planning workshops in our model regions of Wolfenbüttel, Goslar and the Hannover district (see Chap. 11). For example, the results (success factors) of the interview study in the 25 communal renewable energy projects were presented in a planning workshop in the district Wolfenbüttel. Based on these experiences and the experiences of the bioenergy villages of the Göttingen district, the workshop participants started an initiative to convince the district government of Wolfenbüttel to provide financial and political support for the development of bioenergy villages in their districts. Convinced of the impact that visiting model plants has, our team invited district politicians to a best practice tour of the bioenergy villages Barlissen, Krebeck and Wollbrandshausen in the Göttingen district. As a result, the initiative received funding to start a bioenergy village support process in the Wolfenbüttel district.

The nation-wide acceptance survey results are useful to predict the acceptance of different bioenergy consumption options. Consequently, they are useful when policymakers seeking to help develop bioenergy use in their region need to make strategic decisions. The broad concerns regarding energy plants or wood farms call for careful reflection of which bioenergy resources to prioritise, given that rural populations accept biowaste resources more easily. Further, the limited arable area available for both food and bioenergy production calls for a more complex consideration of the interplay between the different renewable energy production lines than

that on which our project has focused to date. The follow-up phase of the on-going project will therefore emphasise the combination of different renewable energy lines. For instance, in the Goslar district, the combination of wind and water power, bioenergy from degraded soils and the storing of wind electricity in underground pump power stations is thought to create a stable and locally-based energy supply, in order to successfully progress to a post-fossil and post-nuclear age.

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