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Community Renewable Energy Project Phases and Support Needs in the European Northern Periphery

- A Case Study Research from Finland compared to Scotland and Sweden

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Commissioned by the Smallest project

Abstract

The objective of the thesis was to research the renewable energy projects which the local communities have implemented in the northern periphery area in Europe. The project phases and support needs during them were researched using qualitative research methods.

The renewable energy project phases were recognised inside the communities but the amount and order they were realised was unique in each case. The support needs were similar in comparison countries, and they concentrated on advisory services, financing and technical matters. To find support was not easy for every community. An existing organisation structure can make the road smoother for a community. One key person answering to the core team's support needs can be the lifeline of the whole project. Communities should be encouraged to realise and make the most of their inner networks and know-how.

Developing a one-desk support service would even the variable abilities and conditions communities have and enable effective use of resources. A follow-up research of a few large-scale communities conducting a renewable energy project would enlighten how the process differences from small-scale projects.

Language	Pages	66
English	Appendices	2

Keywords
community, renewable energy, project phases, support need, northern periphery

CONTENT

APPENDICES

NOTATION

DE	Distributed Energy
DME	Dimethyl Ether
DTI	Department of Trade and Industry
EU	European Union
HPAC	Heating, plumbing and air-conditioning
NGO	Non-governmental organisation
NPA	Northern Periphery and Arctic Programme
NPP	Northern Periphery Programme
PV	Photovoltaics
RE	Renewable Energy
SMALLEST	Solutions for Micro generation to Allow Energy Saving Technology

1 Introduction

In this thesis I intend to shed some new light on the phases and support needs that communities go through when implementing a renewable energy project. I use qualitative research methods to explore the phases step by step and bring up the support needs communities have.

The research material consists of twelve case study interviews. They were collected for the SMALLEST project, which was the commissioner for the research material. The goal of the SMALLEST project was to help communities to maximise the economical, socio-political and environmental benefits the renewable energy sources provide. This was to achieve via education and advisory and political influencing. (Paakkonen, 2011.)

Since the subject interested me and was related to my studies, I decided to write my thesis about it. The researched interviews come from three different countries located in the northern periphery: Finland, Scotland and Sweden. After introducing the theoretical framework, I put the material into new compilations to find out the essential themes. By analysing each phase I will produce answers to the set research questions. After showing results, I shall discuss the results. This work required me the same as did the energy projects from the communities:

> Setting up a community project will involve the commitment and dedication of a number of people over a lengthy period of time (DTI 2000, 23).

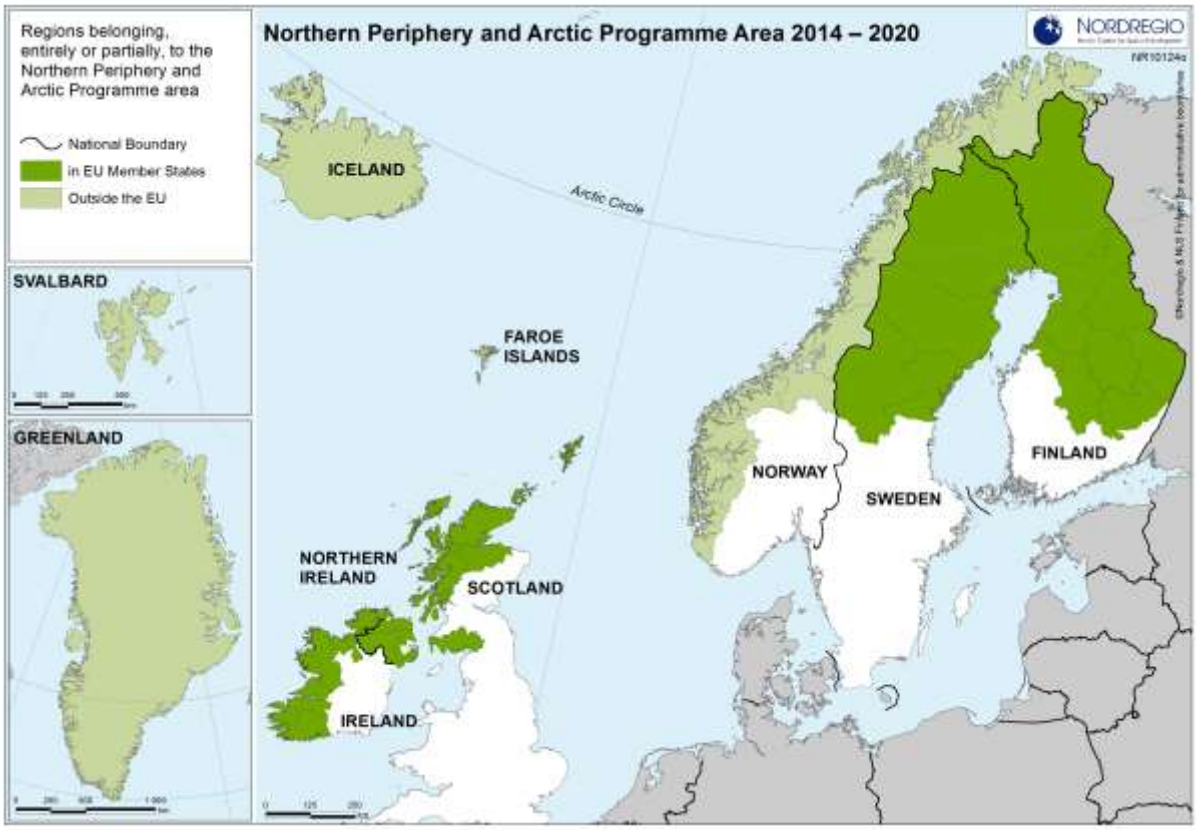
2 Theoretical framework

2.1 The key concepts

Renewable energy (RE) sources are solar, wind, hydro, wave, tidal, geothermal energy and sources of bioenergy. **Bioenergy** covers all the wood-based fuels, agricultural biomasses, biogas and the biodegradable part of recycled fuel.

Distributed energy (DE) is a system where energy production and consumption are in close proximity (according to Allan et al., 2015 as quoted in Ruggiero et al. 2015, 433). According to Gaia (2014 as quoted in Ruggiero et al. 2015, 433), distributed energy systems usually utilise renewable energy sources and rely on small-scale energy-generating technologies such as biofuel boilers, ground source heat pumps, photovoltaic systems or micro-wind turbines.

The Northern Periphery areas are the sparsely populated areas in Northern Europe (see Picture 1). Here, the case studies researched come from Finland, Scotland and Sweden. In more specific, the periphery areas in Finland are Central Finland, North Karelia, Kainuu region, Central and Northern Ostrobothnia and Lapland. Others are the Highlands and Islands of Scotland and the counties of Norrbotten and Västerbotten in Sweden.



Picture 1. The Northern Periphery and Arctic Area (Northern Periphery and Arctic Programme 2014–2020, 2016)

A community of locality is created when people are living in the same geographical area and have a personal interest in it (DTI 2000, 6). The community of locality often has concerns about adverse details during construction work and project operating, which can turn into opposition. For that reason, highlighting the long-term economic benefits of a RE project is essential. (DTI 2000, 11.)

A community of interest is global and current concept; it includes groups drawn together via Internet because of ideological reasons or geographical location (DTI 2000, 6). It may own access to professional-level support on technical or financial matters and have previous knowledge about legal or political constraints (DTI 2000, 10). The community of interest can also act as a project partner (Okkonen & Paakkonen 2012, 28). Most of the communities in this study are communities of localities and the distinction is not underlined. The term community is used to describing all the communities interviewed.

Community RE projects can be led, for instance, by local people, a charitable body or a cooperative. They may be implemented on public buildings the members are using. Usually they have no commercial interests. (Walker & Devine-Wright 2008, 497–498.)

Community involvement is the success factory of a community RE project. The involvement may come from community of locality or community of interest, and from individuals or groups. Involvement is important during every phase. (DTI 2000, 22.)

The support needs mean the help the local community is provided or lacking, when implementing a renewable energy project. The support may be e.g. financial or technical. (Okkonen & Paakkonen 2012, 25.)

Social acceptance has the aspects of socio-political, communal and marketing acceptance. The conventional technologies available are not challenged by most of the RE technologies, so accepting them is “a choice between short-term costs and long-term benefits” (Wüstenhagen et al. 2007, 2684).

A triple-helix constellation is a concept, where university, industry and government are collaborating to create innovations based on scientific information (Lahtonen & Tokila 2014, 51–52).

2.2. The community RE project phases

The main theory is the guide “Community involvement in renewable energy projects” published by Department of Trade and Industry (2000). It describes the phases the communities go through during a renewable energy project (see Picture 2). Four phases in the beginning are additional and occur particularly when a community is involved (DTI 2000, 7). However, the order of the project phases is not solid and not every community goes through every one of them (DTI 2000, 9). The community projects have different kind of structures and core teams not to mention the differing means to get grants and organise the investment (DTI 2000, 22). In this chapter, I introduce the project phases more specifically.

2.2.1 The early steps

Formation of core team A core team manages the process and represents the community (DTI 2000, 7) and, when needed, presents the benefits of the project to other community members (DTI 2000, 11). Core team is essential since it drives the process forward and runs up against barriers (DTI 2000, 21). Community projects can be led in different compilations. Small-group is a group of local people, e.g. landowners and farmers, who wish to generate and sell power commercially. Developer is a commercial actor, who makes the project generate and sell power and then, sells the project to a local group. New group consists of motivated locals forming a new group to implement and operate the project with agreed royalty. Existing group may take care of the project itself or, if involvement is not seen necessary or desirable, it can give it to a registered charity, like a development trust, to carry through. (DTI 2000, 21.) Here, none of the communities hired a developer and mostly existing groups decided to take care of their projects themselves. Only three new groups were put together.

Awareness raising When seeking community's approval and commitment towards the project, is an essential phase (Okkonen & Paakkonen 2012, 27). To disseminate information and consult with the community is as essential as it is to take professional advice on technical, financial and legal matters (DTI 2000, 23).

Securing commitment Firm leadership from the core team and full consultation with community are essential to guarantee interest and top commitment (DTI 2000, 9).

Legal structure The guide introduces six possible legal structures in the United Kingdom: 1) Company limited by shares, 2) Public company limited by shares, 3) Private companies limited by guarantee and having no share capital, 4) Private limited company, 5) Public limited company and 6) Company limited by guarantee. Charities can have one of three structures: a company limited by guarantee, a trust or an industrial and provident society. (DTI 2000, 17–19.) These may not be familiar in the two comparison countries. The legal structures are in focus in Chapters 5.4 and 6.4.

2.2.2 The main phases

Site search and Land Negotiation To gain public support, it is important to keep the site phase open. Prior consultation from planning authorities may even generate more site options (DTI 2000, 7).

Measurement and Testing These are indicator tools of project feasibility. Early consultation with community is important because the phase is, and should be, highly visible. It is rare communities of locality to provide the expertise and experience needed throughout the project (DTI 2000, 8, 10).

Feasibility, Detailed Assessment and Planning Application This phase includes community consultation and development of project details. It should be led by the core team without excess impact from external parties. Community

can draw a planning application after few certain steps. Their site must be suitable and viable for development and the local-level consultation must have given a final plan including all project aspects. Planning permission must be obtained before any site work can begin. (DTI 2000, 8.) The term planning application differs in comparison countries. In Scotland, the process is slightly heavier before the building permission than in Finland. The planning application includes the evaluation of the land use for the purpose in question. This happens on a local level. In Finland, the phase could relate to area planning. (Okkonen 2016.)

Electricity/Heat sales contract and Investment The contract about electricity or heat sales can be made before or after applying for a planning permission. Price of the produced energy must be at such a level that it makes the project profitable. Investment community can seek at any phase and the seeking work should actually start early, before this phase since it includes formalities. Usually the major investment is not certain before the project operation begins. (DTI 2000, 9.)

Construction The construction work can start if the following demands meet. First, every viewpoints of the project are specified, secondly, if finance of development and construction costs are in order, thirdly, if power purchase contract is guaranteed and signed and lastly, planning permission is effective. The community's participation must maintain during the whole construction phase, although some exceptions may occur. (DTI 2000, 9.)

Operation In this phase, the investment pays off providing savings and improved community cohesion. Operation includes project management and company administration. The core team can affect community members' interest and commitment during operation. (DTI 2000, 9.)

3 The aim and objectives

The aim of this research is to explore the community renewable energy projects in northern periphery area through two views. Firstly, the phases the local communities went through when implementing their renewable energy projects. Secondly, what kind of support needs the communities had over those phases. The hypothesis is that both the project phases and the forms of support needs are similar in the comparison countries.

The commissioner for the research material collection was the SMALLEST project I worked in 2011–2012. The abbreviation comes from the initials of the project title “Solutions for Micro generation to ALLow Energy Saving Technology”. The project duration was 2009–2012 (Northern Periphery Programme 2007–2013a). In general, the project was exploring how to empower European, small-scale communities located in the Northern Periphery Program area to start renewable energy projects. It was a part of the European Union’s Northern Periphery Programme (NPP) 2007–2013, which encompassed Finland, Ireland, Scotland, Sweden and Faeroe Islands, Greenland, Iceland and Norway (Northern Periphery Programme 2007–2013b). Nowadays, it is called the Northern Periphery and Arctic Programme (NPA) and the current season is between years 2014–2020. The partner countries and regions inside them have remained the same. (Northern Periphery and Arctic Programme 2014–2020.)

In Finland, the focus was on the outreach of municipal decision makers and the development of policy. The case study material I collected and processed was published, among other results, by the Finnish project partner. (Puhakka-Tarvainen & Renvall 2012, 3.) Afterwards, I decided to go further and write a thesis since the subject area interested and linked directly with my studies and I was already familiar with the interviews.

4 The research material and method

4.1 Research material

The research is based on a qualitative analysis of twelve case study interviews I collected between January and August 2011 for the SMALLEST project. Each of the twelve interviews is telling about a renewable energy project implemented by a local community. The interviews cover northern periphery areas in Finland, Scotland and Sweden.

Several definitions were done before I even started to collect the research material. Geographically, there were three northern periphery countries chosen. Because of the commissioner's goals, the matter was renewable energy technologies, and target group local communities. The mixture of questions was gathered to fit in, naturally, with the project goals. The timeline was eight months in 2011. These definitions came from the project partner I worked for, so the material is not specifically collected for my study but for the use of the commissioner and other project partners.

For the SMALLEST project, I sorted the material suitable for their requirements: barriers, support needs and good practices were separated according to the project phases introduced by DTI (2000, 7). I also marked whether the needed support was found or not, and used both word processor and spreadsheet program to present the sorted material. The use of the main theory when sorting the material gave a good basis to continue the research for this thesis. In my planning seminar, I suggested reducing the amount of the Finnish interviews to make the comparison more even. All Finnish case studies were recommended to keep in the research material, so the portion of Finnish cases stayed higher.

The research data consists of twelve semi-structured case study interviews. In the semi-structured interview, the questions are the same for every interviewee but there are no prepared alternatives for answering, i.e. the interviewee answers with his own words. (Eskola & Suoranta 1998, 87.) There were almost 60 questions in the interview form (see Attachment 1). I needed to use Finnish,

Swedish and English to accomplish the interviews, and audio-recorded and transcribed the interviews verbatim in English. I conducted eleven interviews and stayed as an observer in one of them, which was also left unrecorded. In most of the cases there was one interviewee but in one case there were three of them. To give participants anonymity, all quotations are attributed to interviews rather than individuals, and masculine personal pronouns are used throughout. The cases are numbered from 1 to 12 to identify the community and the chosen technology (see Table 1).

Table 1. The case studies from Finland, Scotland and Sweden

no.	Community group	Renewable energy technology
	Finland	
1	A Heat Cooperative	Ground heat pump embedded into water system
2	A Parish	District heat system Environmental diploma designed for parishes
3	An Educational Organisation	Biogas, wind and solar energy for study and research
4	A Farm	A farm scale biogas plant
5	A Municipality	A fixed bed boiler for wooden chips
6	A Nursing Home	Two pellet boilers for wooden pellets
7	A Federation of Parishes	Geothermal heat pump embedded into lake sediment
	Scotland	
8	A Leisure Centre	A stoker boiler for wooden chips
9	A Residents' Association	A ground heat pump with four pipes embedded into ground
10	A Community Trust	Distributes money for development opportunities in the environment
	Sweden	
11	A Regional Biofuel Project	Biofuels for transportation
12	A Municipality	A biogas plant using a decomposition reactor

Most communities that were interviewed were traditional communities. Geothermal technology was chosen by a cooperative (1), a federation of parishes (7) and a residents' association (9). A municipality (5), a nursing home (6) and a leisure centre (8) installed wood-fired heating systems. The increasing price of oil was a driver in each community. Three communities (3, 4, and 12) were building a biogas plant. The parish (2) had two projects: joining to district heating and applying for an environmental diploma. The diploma is meant for parishes, is voluntary, and helps to improve the level of managing environmental matters (Kirkkohallitus 2012, 11). A farm (4) was the smallest community with one member. In each country, there was a development project: a trust (10) in Scotland, a regional biofuel project (11) in Sweden and an educational organisation (3) in Finland.

4.2 Research method

The research method is qualitative research introduced, for instance, by Eskola & Suoranta (1998, 175–176) but also a case study research, where the overall understanding of results is more important than the generalisation (Laine, Bamberg & Jokinen 2007, 73). The twelve case study interviews cover three northern periphery areas giving the opportunity to observe and compare the experiences communities had had. The research material is said to consist of documented situations (Alasuutari 2001, 85), and notes are usually taken and interviews transcribed i.e. written up (Metsämuuronen 2008, 48). I did not take notes since the decision about using the material for a thesis was made afterwards but I did insist on recording the interviews. I asked the permission to record from each interviewee, and will delete the recordings after the thesis is being published. I also transcribed all twelve interviews. The level of accuracy in transcription varies (Hirsjärvi, Remes & Sajavaara 2009, 222). I transcribed all the answers given to the questions leaving out pauses and such expressions.

In qualitative research it is characteristic the collected material is multilevel, complex and rich in expression and enables several angles to observation. In other words, it is quite opposite of the material collected for quantitative re-

search. (Alasuutari 2001, 84.) Laine et al. (2007, 49–50) reflect the meaning of material: the objectives should steer the collection of material but, on the other hand, choosing and collecting the material are important tools when outlining the research. Eventually, the researcher must decide which material is significant from the goals' point of view. The material I have is versatile and large enough to provide possibilities even for further study. Metsämuuronen (2008, 48) describes that the qualitative material needs to be thrown in such a form which can be analysed. This happened when I reorganised the material according to the project phases (see Attachment 2), barriers, support needs, good practices and general findings. The themes shedding light into the research objectives are the most important ones and are usually found when observing material together with the theory (Eskola & Suoranta 1998, 175–176). This method was useful, when finding out the characteristic support needs in each case and exploring the variety communities run project phases.

The compacting of meanings happens, when the researcher puts the meanings, which the interviewee has brought up, into a shorter, verbal form (Hirsjärvi & Hurme 2014, 137). This is done in Chapter 5. The interpretation of the found and compacted meanings happens when the interviews are looked through objectives. As a result, the text does not shrink but widens. (Hirsjärvi & Hurme 2014, 137.) To make an epitome general concept of the research material happens, when conclusions drawn on the grounds of it are taken off from individual persons, events and statements. After this process, the conclusions can be transferred into general abstract and theoretical level. (Metsämuuronen 2008, 48.) This happens in Chapter 6 and 7. To identify each case study, I use consecutive numbering. In the text I use quotations to clarify the circumstances in different cases and phases. After all, there are twelve storylines to follow. The mark – – in a quotation means something has been left out (Karelia-ammattikorkeakoulu 2016, 27).

5 Results

5.1 Formation of core team

In Finland two communities had support needs. First, advice for how to start a cooperative among three partners was needed and found (1). Secondly, the core team formed of parish (2) employees, lacked knowledge of renewable energy project and therefore searched and found an outsider employee (2). According to Walker, the ownership in renewable energy projects varies. Projects can be community-owned, or developed by the private sector and owned by a community. If ownership is a cooperative, the community residents or people afield become members of the cooperative and "buy shares to finance the project" (Walker 2008, 4401.) This describes the situation in case 1, where the other residents became members of the cooperative after the core team had figured out it was a reasonable legal structure and founded it. Other Finnish cases (3–7) had no support needs when forming core teams. Their teams varied from a single farmer and a few key persons (4) to several projects (3). The municipality (5) could benefit its existing organisation structure: there were only municipality officers working in the project team (5). The leader of their core team had earlier been in a steering group of a bioenergy project called Tulipasilli working in the province. In case 3, there were several project partners: a regional Bioenergy Programme, two other schools and a municipality. The community was taking part from the beginning since the school personnel worked in the project organisation.

In Scotland two cases expressed support needs. The trust (10) needed eight directors to found the organisation. Support on this was found but directing education focusing on the procedure of running a company or a trust was not. In the leisure centre (8), there was a lack of planning knowledge inside the core team, which consisted of centre manager, designing company and an administrative body worker. Support was not found. In the residents' association (9), the core team was formed like this: two members along with local fundraiser, architect and two national advisory and funding body officers involved the management committee and reported the main group. The latter is a classic example of

community charity ownership Walker (2008, 4401) describes. It is an association with charitable status providing or running facilities, such as renewable energy power of heat for buildings, for the local community (Walker 2008, 4402).

In Sweden one process started as a free initiative, where “a bunch of people decided to do something together around the biofuel transport sector” (11). Nowadays, instead of a core team, there is a process group consisting of ten process leaders. However, back then, the core team made important decisions. Core team thought biofuels could be a good contribute for both sustainable development and regional growth, and it decided to function on a regional context. In the municipality (12) an early stage barrier was a lack of special organisation. At first, consultants and the most active municipal officers worked together. After receiving a declaration about organic waste management from the Swedish government, a meeting with municipal authorities was organised and future actions discussed. A special organisation was created, when the municipality decided to build a plant. The department manager and the complete technical department were part of the project organisation.

5.2 Awareness raising

According to Okkonen & Paakkonen (2012, 27), raising community’s awareness, acceptance about RE project and adding members’ commitment started during this phase. Other energy projects initiated and led by community members can offer first-hand experience and therefore make the residents more informed to decide about their involvement (Rogers et al. 2008, 4225). Not every resident becomes to like renewable energy projects, but the local involvement leads to supporting the positive value of renewable energy (Walker & Devine-Wright 2008, 499).

The Finnish cases 1–4 and 6 made it clear they would have needed some sort of advice in the beginning. All of them mentioned both excursion to similar systems functioning and a basic level renewable energy course. Cases 1– 2 did not find any solutions. It was said, for example:

> Although the environmental diploma was recommended for parishes, there was not enough education of it. – – It took a couple of years to explore what the environmental diploma for parish really means. (2)

> There are no advisory services in the area. (1)

In some cases (3–6) there were some kinds of solutions found for the support needs. When case 3 launched its project, no education or advisory services meant for biogas plant users was provided. Without having regional examples, similar plants were visited in Europe. On the other hand, being a pioneer on those latitudes attracted interest:

> There are many farmers that are planning a biogas plant of their own but who first want to see how this plant will work. (3)

Expert advice concerning environmental legislation and biogas production was sought but not found in case 4. There the plant designer was a key person who could provide not only designing but also support and information. Advice was also given by another farmer owning a biogas plant. Luckily, the regional biofuel project called Tulipasilli organised two excursions for biogas plants in Finland and in Germany and organized seminars concerning biogas. In case 5 there were no support needs but a certain kind of a pressure to take renewable energy in use occurred because the municipality had a connection with the above-mentioned Tulipasilli project. The core team leader supervised other team members, which were employees in the municipality. In case 6 different plants were checked to find a suitable model but no RE course was taken. Walker & Devine-Wright (2008, 499) present the more direct and substantial involvement there is from local people, the more RE project has acceptance and support in the area. One case (3) raised awareness in public through radio and newspapers, when another faced less encouraging local attitude (1). In the parish (2), the environmental program process and employee initiative started both projects. People showed interest, ignorance and objection towards the diploma project. In case 7 the project was not publicised to the actual parishioners, so there could not be any resistance. In addition, there were no support needs during the phase. Two interviewees (5–6) did not mention how they informed the community members.

In Scotland there was a similar need for a course of renewable energy sources as in Finland – and none of the cases was able to have one. A course was not the only thing case no. 9 lacked. There was ignorance about planned installation technology inside the core team and the need of information seemed occasionally almost desperate:

> Any course would have been beneficial in the beginning of the project. (9)

In addition, advice (9), knowledge (8) and information about the needs of the local people (10) were sought and found. The trust (10) executed a survey among the residents: people wanted e.g. better housing, renovation of the village hall and play area for children.

In Sweden the biofuel project's (11) biggest challenges were around knowledge. It was the core team who realised it would be more attractive and raise larger interest to work on a regional level. They met people representing the region and finally negotiated with representatives to join the project. The project was named in English to give local people the sense they were contributing to something larger than home region. In addition, partnership in European projects was seen likely to happen. The municipality (12) needed to spread correct information. Support was found by investing on a very extensive informing campaign about citizens' waste sorting. That was needed because the biogas technique had been criticised heavily from different directions. Citizens also feared that the plant would smell and lure vermin. The community realised the relevance of honesty, accuracy and openness:

> It's important to work and be open with the public so that everyone knows what is being done. (12)

The project was launched after the Swedish government indicated organic waste should be treated e.g. through decomposition or by producing gas, heat, energy or even vehicle fuel. The municipality's (12) information campaign concerning biogas plant and waste sorting was put very well into action, and 66% of municipal's legal representatives supported the project although it took a long time and there were elections during the way.

5.3 Securing commitment

Not all the communities mentioned support needs during this phase. In Finland there was “a huge lack of information” (1) and therefore, the cooperative partners had to encourage one another that the idea was good. Despite of the varying attitude, the parish (2) decided to apply for the environmental diploma. There, a lack of knowledge inside team leading was seen as a blockage, especially because the time was limited. In case 3 the regional bioenergy program obligated the school to complete energy facilities and begin educational execution before the end of this regional program. Both teachers and students were going to work in the project, and two other schools would process the scientific research results. The Finnish communities had clear and motivating reasons to start a RE project, such as reliable heating system (2, 7), saving money by replacing oil (4, 7), energy self-sufficiency (4), importance of environmental issues (2, 7) or using locally produced biofuel (5).

In Scotland no support needs or barriers were mentioned. The reasons to implement RE project were energy costs (8), unsafe and inefficient heating system (9) and ethical values (8). In case 9 the previous heating system had lowered the usage of the community centre building and that encouraged the community to install a new system. To become a trust (10) director, one needed to be a resident at least for eight years and know the families and different persons in the area.

In Sweden the municipality (12) did not have any support needs but was put to “think in new ways” by legislation, which directed Swedish municipalities towards recycling, producer's liability and new ways of managing waste. The core team of the biofuel project (11) started involving as many volunteered people as possible for different working groups. They consisted of researchers, average people and some municipality officials.

> The strategy has always been to try to engage, motivate and activate as many as possible to make the change to happen. (11)

With the help of a working group leader and a supporting body, working group members set an agenda. The network of the regional biofuel project was formed

at this phase. First, lot of time was spent engaging and motivating people. According to Walker et al. (2010, 2662):

> – – community cohesion and trust between local people and lead groups is not universally ensured just because a project is given a community label – and that cohesion and trust can – – become severely eroded and problematic.

Previous came up, when joining the network and a non-profit organisation was felt diffuse and vague (11). After four years, it was realised different members had different expectations when joining the network. By the core team, a declaration of commitment was taken in use to clarify the expectations and contributions of the members. When interviewed, the most important thing was to active the right people and resources.

5.4 Legal structure

Renewable energy project can be owned various ways. They can be community-owned or developed by the private sector and owned by the community. The community-owned and community-financed energy may be produced to the grid or benefited both locally and nationwide. The ownership can be a cooperative, community charity, development trust or local community organisation having shares. (Walker 2008, 4401–4402.) None of the communities explored here used a commercial project developer.

In Finland most cases (2–7) already had an organisation and therefore faced no problems (3–7) with the legal structure. The founding partners in case 1 would have needed, but did not found, correct information suitable for their situation from the municipality. Instead, they got essential help from a key person and a regional project called Northernmost Lapland Leader. Partners discovered that as a cooperative, it would be easier to administer the project and apply grants. There, community ownership was ensured as Walker (2008, 4401) describes it: people in the local community became cooperative members and bought shares to finance the project. There were three religious communities (2 and 6–7), which all gained from internal knowledge. In case 2 both the governing body and master builder could help with the district heating project, and environmen-

tal working group prepared environmental program for the parish. Still, it was difficult to find an external employee to work with the diploma project but eventually the employee was found. In case 7 the existing Real Estate Committee took care of the project. The community in case 6 was not only religious but also an enterprise-based nursing institution. In case 5 the structure of the municipality provided everything needed. The community in case 3 was a certain profit center unit of the educational organisation and it was taking part in the regional bioenergy program and RE projects.

In Scotland the community in case 8 was a leisure centre providing sport services to the villagers. Case 9 was a resident's association taking care of a community center, which was a place for local people to meet for different functions, like clubs and groups. All eleven committee members were part of the management committee. Case 9 was an example of a community charity Walker (2008, 4401) describes. It is usually an association with charitable status providing or running facilities for the local community; for instance, a village hall association using renewable energy to power or heat their buildings (Walker 2008, 4401–4402). The community trust (10) was a non-charitable company with limited liability. It was set up by the community council, and membership was shared between community council members (1/3) and members appointed by election (2/3). Trust was distributing money from development opportunities in the environment, e.g. hydroelectric schemes and wind farms. This confirms, what Walker (2008, 4402) presents: development trust is especially familiar in Scotland, where it is used when representing "communities' interests in revenue-generation enterprises". In addition, Bomberg & McEwen (2010, 442) describe the community energy projects in Scotland most often are trusts with priority of income generation and sustainability. The leisure centre (8) and the resident's association (9) could use the existing organisation structure to carry out the project, and neither had support needs during the phase. The trust (10) would have needed education concerning both the organisation structure and charitable status coming from the regional administrative body but support was not found. Interviewee mentioned that although the trust is informal, the director must be able to carry out formal meetings.

The municipality (12) in Sweden had, of course, an existing organisation. To be precise, the structure was a unification of neighbor municipalities in Northern Sweden. Case 11 was a regional project, which had a triple-helix constellation (see Chapter 2.1) with the public and private sector and universities working together. The organisation was independent and total free without governmental or authoritative ownership. In the background, there was a non-governmental organisation (NGO) run by 30 members. The NGO owned a limited company, where all the activities were conducted. The limited company was an ideological and non-profit corporation. No support needs raised up during this phase.

5.5 Site search and Land negotiation

The amount of siting decisions is higher in RE plants since they characteristically are smaller than conventional power plants. Most of the technologies are not challenging existing technologies, so accepting them is “a choice between short-term costs and long-term benefits”. From the community acceptance’s point of view, the specific acceptance of siting decisions is a describing indicator. In RE projects the community acceptance should come from local stakeholders, especially residents and local authorities. (Wüstenhagen et al. 2007, 2684–2685.)

In Finland five cases brought up a support needs. Support was found on confirming the location (1, 4), equipment (1) and permission (7). Communities found both consultation help taking the idea into practice (5) and key persons, such as a HPAC engineer (1) and a municipal environment secretary (4) to give answers to some specific questions. Then, support was not found when searching for regional or local advisory service (4), a course, which would go together with the environmental diploma guide (2) or someone to answer the practical questions regarding the biogas plant (3). The question whether the chosen technique would function on the northern region was left to be discovered.

There were no huge obstacles in site search and land negotiation in Finland. Case 1 found a regional example of a functioning ground heat system. In case

2 the district heating project was developing three main buildings. The farmer (4) had the site already and did not need to negotiate. Since the municipality (5) owned the school buildings, it was easy to get approval for the idea. To find the place to embed the geothermal pipes in case 7 was also easy – community even had three site options available: embedding to the lake, embedding to the ground or drilling wells. In case 3 the possible forthcoming good was emphasised. The research would especially concentrate on how the plant would function under the local weather conditions. The research results would benefit the whole region of Finnish Lapland. Interviewee also stated a functioning biogas plant would have heavy, not just energy-focused but economical effect on a regional level. Even the siting of micro-scale generation (according to Sauter & Watson 2007 as quoted in Wüstenhagen et al. 2007, 2686), where an individual makes the investment, project faces the three forms of acceptance, which are community, market and socio-political acceptance (see Wüstenhagen et al. 2007, 2684). In case 1 the interviewee did mention that locally the area would need someone to encourage people to carry out similar projects. In case 4, the municipal showed its acceptance, although it did not provide advisory service. One can see the social acceptance was either high (4) or low (1).

In Scotland the leisure centre (8) would have needed visiting in 2–3 well-established sites. That did not actualise. The interviewee highlighted the designing phase was not analysed strictly enough by the community. In case 9 there was a need for a new heating system and a RE heating system was suggested for them. Interviewee described how the leaders of the community would have needed support with the matter:

> I think we were also green in the beginning: it was almost like a blind leading a blind as far as our committee was concerned. (9)

In the latter two cases (8–9) no objection was mentioned. In fact, in case 9 the whole village was looking for renewable solutions at the time. The third Scottish case (10) did not express any support needs here. Based on the survey results, the trust drew up an ambitious, 20-item list of priorities and aims. Thinking unconventionally and keeping track of what other communities were doing was important. Two examples were given concerning site search. First, the negotiation skills of a trust director helped to split hydro schemes' sites with a neighbor

community council. Secondly, when developing wind farm projects, the negative influences of the wind farm location might reach the next-door community council. Wüstenhagen et al. (2007, 2684) links the latter with social acceptance: wind turbines are a visible technology often more near to residents than conventional energy plants, so the environmental impact comes near as well and residents start processing their acceptance.

In Sweden the municipality (12) did not mention any support needs. The goal of the second governmental proposition, reduction of the amount of waste in landfill sites, guided the community to a conclusion they could have an own organic waste sorting system. The site of case 11 was the whole region the project covered including inhabitants, companies and municipalities. They were tried to engage into transition from fossil to renewable fuels and towards sustainability. There were regional barriers such as negative mindset and long distances when transporting available resources. Knowledge, infrastructure, skills in handling natural resources and growth-potential were seen as drivers. Sweden has favored green electricity quota system and simultaneously their taxation on fossil fuels is heaviest in Europe. The institutional reluctance for direct energy policy interventions separates Finland from Sweden and other European countries. (According to Nordic Council of Ministers 2014 and Svebio 2016 as quoted in Ruggiero et al. 2015, 441.) Although the Finnish state is important role, knowledge institutes, prosumers and industries are important actors as well (Ruggiero et al. 2015, 441).

5.6 Measurement and Testing

In Finland support needs fulfilled were advisory services (2, 3), technical support (3–4 and 7), excursions (4, 6), similar case studies (1, 7) and consultation for project preparation (5). Support needs left unfulfilled were professor level expertise during the early steps (3), RE awareness course (6–7), governmental or local advisory services (4), information about national support mechanisms (6), very detailed advice concerning technique (3–4), consulting from heating

technology firms (5) and advice about geothermal from the local HPAC offices (7).

Communities gathered useful information and found solutions best for their situation. For instance, the municipality (5) chose woodchips over wooden pellets on grounds of the size of the needed heating system, while the nursing home (6) chose pellets because they were easier to adjust to smaller capacity during summer. Case 7 did profound work and was able to eliminate such unsuitable RE sources as pellets, solar and wind but felt challenged to plan the installation without any examples or expertise of large-scale geothermal in parishes, or in Finnish weather conditions. In the parish (2) the environmental diploma was more like an ideological project, for which they searched advice from administrative bodies and other similar communities, while the district heating project demanded more financial effort. Case 1 had no troubles during the phase: ground heat was seen as the most effective energy source and the help from one key person from the administrative body was important. The regional biofuel project organised two excursions including several biogas plants in Finland and Germany (4) and provided cheap consultation help for the project preparation (5). The municipality (5) had experience on district heating with biofuel and could take advantage of its employees' knowledge. The personnel of the nursing home (6) had knowledge of their own as well.

The support needs were similar in cases 3 and 4, although the scales were different. Both had excursions in Finland and abroad. At the time, it was difficult to get information or support because there were no advisory services about biogas (4), biogas-lobbying group was difficult to reach to get information (4) and there was no-one to answer to the practical questions (3). Case 3 spent many years gathering information about biogas, wind and solar power and contacting all advisory services, university, research centers and plants abroad, available. The lack of expertise help was also experienced as a progressive problem:

> The more you get information, the more painful it gets because you start thinking: How are we going to cope with the choices we have made? (3)

Both also had specific technical questions, such as the use of digestants and concentrates inside the reactor (4) and the maintenance of thermophilic process

during the winter frosts (3). If the mesophilic process functions, it will neutralise weed seeds and that would be a huge benefit for the school's organic farming. Another important discovery was that during the biogas process, cow manure converts into reject water, which could be exploited as fertilizer on the field. Landscaping work was another application. This is very useful since it decreases the use of artificial fertilizers. For both cases, finding the designer was a big step forward.

In Scotland not all support needs found an answer. Advice (9) and education (10) about technology solutions were both needed and found but education (9), visits to similar cases (8) and quality designing (8) were not. In case 8 the designing phase was analysed not strictly enough by the leisure centre. In case 9 information was gathered as much as possible although it was difficult:

> There were no courses about renewable energy heating systems available. (9)

Still, sources of advice were found and RE installations were considered for a number of other public buildings in the region. The trust (10) sent people to take an energy efficiency course to find out the advantages there had been made in the technology. The fast developing of technologies were named as a barrier for them. The trust could use the help of a local college and the survey results, which they collected in the beginning.

In Sweden, only a few support needs were brought up. The biggest challenges in case 11 had been, and still were, around competence. First, the focus was mostly on bioethanol and Fischer-Tropsch diesel but later the focus spread over DME, biogas, electricity and pine diesel. The project saw necessary to widen the definition of biofuels; for instance, electricity was seen as biofuel, when based upon biomass. The project had also reached the conclusion people need to depend on many biofuels and types of bioenergy in the future. Smaller-scale projects closely matching the existing load can defer expensive upgrades and extensions of the network. At the same time, they create islands of security during grid outages. (According to Hain et al. 2005 and Strbac et al. 2006 as quoted in Walker 2008, 4402.) This is how communities can become more self-efficient in energy production. It has been stated (Giddings & Underwood 2007

and Kellett 2007 as quoted in Rogers et al. 2008, 4217) the public participation in local energy planning should be on a higher level through decentralised, community-based renewable energy schemes, especially in rural areas. There, local communities can become “consumers with generation capacities” i.e. prosumers if they start producing heat or electricity for the community and sell the surplus generation into the district heating network or electric grid (Ruggiero et al. 2015, 433).

The municipality (12) would have needed a course about biogas technique; there was a lack of knowledge concerning the technology and the matter in general. If there were a course now, it should contain examples of how plants have been built and problems solved, not just in Sweden but elsewhere in Europe too. Composting possibilities and landfills as gas sources were explored and excursion made. The biogas plant was chosen to build because it had the best profitability and end product quality. The core team wanted to learn from others’ mistakes such as often complained smell and biogas from composting being less productive when refined into vehicle fuel. The power plant municipal owned offered possibilities to take advantage of the existing competence. The technical competence needed was found from the different consults.

5.7 Feasibility, Detailed assessment and Planning application

5.7.1 Feasibility

The ways to find out the feasibility of the RE project varied in Finland. Calculations about the energy production and cost-effectiveness were done for example with the help of a regional project (1, 4) and a real estate manager (7). Mentioned goals were not only savings in the energy costs but also independency from oil (1, 7) and friendliness towards the local environment (7). The techniques were under comparison and balancing. Drilled well or pipes in the river (1), a pellet boiler or geothermal heat (7), solar electricity with or without solar heat generation (3) and how to implement this big a heating system (5), communities were asking themselves.

The need of advisory service was emphasised and support was found from different sources. Advice was provided by a project (1), employees of the community (2), an employee hired for the project (2) and a designer (4). In case 3 several excursions were made to Finnish, Austrian, German, Danish and Swedish cases, and the core team of case 7 gathered crucial information by visiting many case studies in Finland and in Sweden. In case 5 a biofuel project, which the core team already had connections with, could provide advisory service on a local level:

> The regional project called Tulipasilli was ought to find "targets" like the municipality, which was changing the boiler from oil to renewable fuel. (5)

A local HPAC company familiar from a previous collaboration consulted the core team in case 7. By its recommendation the community hired a planning office in southernmost Finland to plan the geothermal heating system. It was the only existing major operator in Finland and was also advising the community, so there was no need for direct contacts towards advisory bodies.

For the two biogas plants (3–4) designers were hired but in the smaller case (4) the basic idea of the way the plant functioned came from the community member himself. Both mentioned the local authorities being very supportive although there were no advisory service on biogas at the time. The experiences of other Finnish biogas producers were opposite; they were either not happy to share their knowledge without putting a price on it (4) or a small group of people, almost like a family, working on the same field and no-one trying to hide any information (3).

In Scotland one community (9) was looking for firms to do the feasibility study but since the contacted firms in Scotland and England never replied, they had to proceed without it. From the trust's (10) point of view, the level of local advisory service was low, probably because the trust was a new activity and managing and creating benefited money.

In Sweden the municipality (12) had a consulting firm which draw up the preliminary report and helped with technical issues. They also got a jurist who helped with some questions. The regional fuel project had to make its own way:

> It was a little bit of process itself to find out things during the way. (11)

5.7.2 Detailed assessment

Initiation is particularly difficult phase since money can be difficult to find although it would be essential for the project to proceed (DTI 2000, 22). This came true mostly in some of the Finnish cases. In Finland different kinds of documents were drawn, e.g. a limited business plan along the grant application (1), an economical plan with a consult-drawn estimation (2: district heating), an estimation of costs (6) and data of the school unit's energy consumption (3). In case 5 it was known beforehand the use of the school center would be reduced and it was taken into account in the calculations. In four communities the nature of the community (3–4) or project (2: diploma, 7) released them from preparing a business plan. In case 6 the payback time of the project turned out to be so short that the investment was worth of doing on a fast schedule without being subsidised:

> If the administrative funding had been applied, the benefits of the gained support would have been lost while waiting the decision. (6)

The procedures inside the communities were different. To use an HPAC consult and contact municipal construction supervision and administrative advisory service was a basic procedure (2). The school unit (3) was already employing people with construction, electricity and planning skills, which ensured that the knowhow was staying inside the community. The municipality (7) found out the project requirements and resources needed. Offers for equipment (1) were asked and heating project was put out to tender (7). Despite the try, the tender gave no results. Two communities learned there was no large-scale expertise in the region:

> If you are able to pay, you can find expertise on geothermal, put not locally in Eastern Finland. (7)

> In the level of regional council of Lapland no advisory service has the experience of biogas. (3)

In case 1 the regional project was providing the project funding. Before the funding decision was received only a planning phase was allowed to be done. The community in case 3 would have needed commercial education including marginal profit calculations for a northern operator. Finding out the profitability was seen essential:

> It has to be cleared up whether the business is profitable or not – of course on the assumption this technique functions on this area. You don't want to build an expensive plant, which' only benefit is a green card but wears your other potentials out. (3)

In Scotland the core team in case 9 got an advice to make direct questions about the tenders and their prices. They received two tender offers, from which one included everything within the price and gave a trustworthy impression. The key support need was the advisory service:

> One of the main barriers was the lack of knowledge inside the residence of association. (9)

In one case adequate support on funding was found (8) but in another one to arrange project funding took a long time and several meetings (9). The trust (10) would have needed support from other organisations in land revenue for charitable purposes. In addition, the directors needed knowledge about accountancy, law and engineering and education about the procedures there are run when working in a trust. For example, they needed to know the level of compensation developers were offering. The ability to negotiate was an important feature for a director:

> If you don't have negotiation skills, the developer or their agents can easily put you down. (10)

In Sweden the biofuel project (11) interviewee told economic and work-related resources and advice concerning biofuels were both needed and found. It was brought up that despite Sweden was providing good opportunities for biofuel development, there was still a lack of competence both on national and regional levels. The municipality (12) needed expert help with technical issues and excursions to functioning biogas plants.

5.7.3 Planning application

When generating and selling distributed electricity in Finland, taxation and the variability and complexity of building permit procedures have been seen as administrative barriers. Municipalities operate with wide autonomy in permit regulations. It has led into the situation of each municipality applying its own set of rules for building permits – despite the size of the RE installation. The construction permit fees vary as well. (Ruggiero et al. 2015, 440.) Most of the Finnish communities needed only a planning permission (2–4 and 6) and other, substitutive document was an economic plan including a profitability estimation (5). In both geothermal cases permission from the water partners had to be applied because it fastened the processing in the administrative body (1) and was the only permission needed (7). In addition, statements from the municipal's environment and security departments (4), the requirements of the ATEX directive (3) and rescue authority's help with the safety questions (4) were required. Information about the needed permissions was found, for instance, inside the community (6), from the Finnish environmental administrative body (7), a regional project (1) and an educational biogas guide published in the Savonia University of Applied Sciences (4).

Case 5 had an interesting process here. The building permission was applied from the municipality itself, and its employees' had skills on economics and building. The municipality set competition bidding but there was only one tender. The interviewee pointed out the current global economic situation made it difficult to get tenders at all. For the same reason, a supplier appeared challenging to find. It also took more time than scheduled to find a constructor.

In Scotland decent support on permissions (8) and the main contractor for the village hall renovation (9) were found but there were delays concerning the planning permission from the local authorities' direction (8). For a director (10) the knowledge of one's own community was the most important education available. Secondly, the interviewee recognised a lack of education for social skills:

> There is a need for better communication with other communities doing the same thing. (10)

In case 8 the main barriers during the project were faced in designing and planning. Some advisory help with technique was received but the interaction with local authorities was difficult and slow. The interviewee was also critical towards compensation and companies selling renewable energy heating systems and said that in their kind of cases:

> – – honest and objective advisory services from a national body would be useful. (8)

In Sweden the municipality (12) struggled and needed juridical help. There were two processes to pass: 1) the biogas plant and 2) the juridical process for the environmental study. The core team believed, and was told, the existing town plan would allow building a biogas plant. The environmental permission was applied but the environmental legislation included an appeal procedure towards the permission:

> We had to go through all three administrative courts before we got the environmental permission. (12)

After that a building permission was in order. The local board of construction granted them a building permission but someone appealed about it to the County Administrative Court. The building permission was granted again but the decision was appealed for the second time. The Administrative Court of Appeal denied the permission. Then, the municipality decided to appeal about the decision to the Supreme Administrative Court but did not get a positive decision because the permission should have been discretionary. The municipality had to start preparing a new town plan, and it was also appealed through the whole process. Eventually the town plan was approved in the Supreme Administrative Court and building the biogas plant was allowed. After the town plan was in order, the building permission was applied again – and appealed through the whole process before being granted. In short, the environmental study, town plan and building permission were all being appealed, and it took about four years to get all the permissions needed. In all phases help was found.

5.8 Electricity/heat sales contract and Investment

The investment the community RE project requires careful consideration. Each community will set up the project by unique circumstances. (DTI 2000, 11.) In Finland the communities searched mainly for economic support. They found it in the form of a grant for equipment and installation (1), public and regional funding (3), subsidises for the project (5) and an unexpected 20 % governmental fund (7). On the contrary, local level advice and encouragement concerning grants for energy efficiency actions (1), information about the national support mechanisms (6), education about energy efficiency (6) or education including financial information (6) were not found. Like an advice, it was said:

> If someone has a project same size as this, consultation from projects for the economic calculations will be useful. – – with the calculations, it is easier to justify the need of the investment to the trustees and decision-makers. (5)

During the phase, the expertise inside the communities rose clearly up. There were work efforts given by the personnel (2–4), students (3) and volunteers (6): the latter lowered the investment costs. According to DTI (2000, 22), a portion of development costs can be eluded if the local firms or interested individuals give their technical and professional skills in use. That is exactly what one interviewee put in words:

> I also see as an investment the work effort that the personnel and the students are giving although it's not exactly a financial contribution. (3)

Cases 2–3 had most barriers. Community in case 2 funded the project itself since it was not possible for a parish to apply any grant, and no advisory service contacted them concerning the district heating. In case 3 the core team knew there were private plants founded on a reasonable cost but for a public organisation the building process was different, for example the security systems were more accurate. Regionally, it was difficult to get financial support for a RE project producing information for research, development and innovation. The subsidising for biogas coming from administrative body was too small (30 %). Finally, the project got notable amount of public funding (60–65 %) from two different European Union foundations.. The rest of the funding came from the educational federation of municipalities and the community itself.

According to DTI (2000, 13), it is rare for a single community member to make a significant investment on this kind of project. There were two Finnish cases, which funded the project themselves. In case 4 the funding from the administrative body included conditions, which would have raised the costs higher, so it was also cheaper to use the community's assets. Ruggiero et al. (2015, 442) suggest that, in addition to investments grants, householders should be offered an investment support package. Package could include e.g. state guaranteed and private issued soft loans, tax rebate of bought generation machinery and incentive for production tax in a set rate per unit of produced renewable energy. This kind of investment support would have suited especially for case 4. If the nursing home (6) had waited for the funding decision, the digging and installation work would have delayed a lot because of the change of seasons. The decision would also have been unprofitable:

> Because oil price was increasing, the payback time turned out to be short – that is why it was profitable to make the investment right away without any administrative funding. (6)

An administrative body not only appropriated subsidises but also helped the core team (6) to draw a proper for application for them. The community could fund the project and earmarked the necessary money in the municipal budget. The nursing home brought up several support needs involved with national subsidisation. The lack of guidance and advisory services were felt as explicit barriers as well as the long and bureaucratic process of applying for funding.

> It required self-help to find all the information needed. – – The information and answers needed are out there if you just see the trouble of digging them out. (6)

Other than financial issues were mentioned as well. To find a supplier company, case 5 arranged a competition bidding and there was, again, only one tender. Finally, a previous renewable energy project helped to find the supplier company. In case 1 making the heat sales contract was easy because the core team presented all three end user group and the HPAC engineer helped to evaluate the offers. In case 2 a consult concerning stream extent in district heating system was needed and found. In case 7 there were difficulties in calculating the payback time. The geothermal heating system was chosen because it had a relatively short payback time and low energy price after that. The community itself secured the funding.

In Scotland the local fundraiser (8) was described “highly effective” since the funding came from three different sources and was slightly over the installation costs. In case 9 funding for both renovation and renewable energy project was needed because a change in a rent leash made the community responsible for taking care of the building. The local development coordinator found the money for both with the help of the national advice and funding body, which had been advising the community. The grant came from two sources and covered all the costs the heating system caused.

> It was comparatively easy to find the money for the heating project, partly because of the big renovation. (9)

In Scotland state support is a core resource and generously available. It is crucial to have access to it but the group’s ability to take advantage of it is crucial as well. (Bomberg & McEwen 2010, 440.) This seems to have come true in above-mentioned cases. Secondly, as interviewee (8) stressed, the grants addressed to renewable energy systems create a possibility for device and installer companies to abuse the system. In case 10 the costs of setting and registering the company cost no more than 100 £. The trust had some capital money hold on short term and long-term accounts. In Scotland the charities raise money having gifts or contractually from the public. The directors in charitable organisation are obligated to go along the objective, have restricted investment powers and do not get paid. (DTI 2000, 19.) Here, only the secretary and the accountant were paid for expenses. There were three new developments, so the annual income was, possibly, ought to increase. The interviewee brought up the trust was not able to work on things the local authority should do because of the conditions attached to the money it received, and they need to know the level of compensation the developers are offering.

In Sweden the municipality (12) needed economical support from the state and got it. The financing was easy to find because the municipality was the main funder and there was a political majority in favor of the biogas plant. Normally, the municipality does not loan for its investments, and it did not happen this time either. The same was seen in the Finland, where municipality (5) did investments concerning its property and money for the RE project was earmarked in

the budget. The Swedish municipality (12) had also invested a lot in air cleaning, e.g. different kind of filters used in the plant, probably because of the occurred critic (see Chapters 5.2 and 6.5). Although the investment of the biogas plant was the most expensive alternative, its calculated payback time was only 10 years. In case 11 the project was trying to upgrade the member fees with project funding. The member fee was different depending on whether the member was a public or a private organisation and based upon the number of inhabitants: a small municipality is contributing much less than a large municipality. Some contributions were also coming from local authorities such as counties. Interviewee stated:

> For European people, money is a very good way to show how effective and attractive your network is. – – In Sweden, the lack of resources for important investments is a barrier. (11)

5.9 Construction

In Finland the installer was easy to find in cases 1 and 4 but difficult in case 2. Those three communities had several needs of support, which were fulfilled only partially. The cooperative (1) would have needed information about the installers available and the commissioning process. One key person, an engineer, helped them with technical questions. Because of a mistake during the installation, the cooperative could not use the system properly right from the beginning and suffered from cool inside temperatures. Afterwards they figured that money could have been saved by ordering the pump and liquids from abroad and let a local company install them. In case 2 no barriers occurred when installing the district heating system. The parish could benefit from the skills of its own employees during the construction work. In case 4 the installation took a long time and hiring labor force and equipment was expensive. In addition, ordering parts like burner and gas blower abroad caused delays. The farmer could do a lot of the building work himself and relatives helped with the construction work. During the phase, very detailed advice from the site manager, the presence of the building inspector, and proper instructions in concentrates feeding were needed but not found. The construction director and building inspector were not available enough. This comment summed up everything:

> There wasn't detailed advice provided during the construction phase. (4)

In cases 3 and 5–7 the construction phase succeeded but, naturally, each community had their unique circumstances. For example, the construction site of the biogas plant (3) faced the harsh northern weather conditions, a frost period of 114 days with top -35 Celsius degrees, during the casting. The amount of tenders from device suppliers and installers varied. At worst, either there was no national web system for tendering process (7) or there was lack of tenders in the municipality's competition bidding (5). At its best, the installer was easy to find because there were suitable installers in the community's acquaintanceship (6). The communities could take advantage of the skills of their members, like employees (3 and 5), students (3) and volunteers (6), which could slower the phase (3) or cause savings (3 and 5–6). In one case (7), the current business field situation affected heavily the project management since only one large-scale geothermal installing company was operating in the country. A turnkey contract was made to cover the whole project from planning to installation. The interviewee related they would have needed knowledge of the installation in practice:

> The handling of the project would have been easier if the planning and installation work could have been in separate contracts. (7)

In Scotland two cases brought up support needs. In short, proper installation work (8) and better information flow between the two companies working in the same building (9) were the issues. Both communities faced obstacles caused by the designers and construction companies. In case 8 the start of the installation work delayed because it took 3–4 months instead of six weeks to get the planning permission. The two local companies installing the heating system did several mistakes in their work. The storage space for fuel turned out to be limited because the delivery pipe was installed in a horizontal position instead of being sloping. Too small a boiler was causing extra costs annually because oil was needed as well. In the beginning, the wooden chips were delivered in fertilizer boxes and there was no bridge for the storage room, so renting the equipment caused extra costs until the bridge was built. In addition, there was first no system for ashes. As the interviewee (8) described, to make the heating system fully functional, the community would have needed basic level advising on heating systems and proper planning.

In case 9 two projects were carried out simultaneously. The company, which installed the heating system, was doing a good job. During the RE project, the whole building was under construction work. The renovation work should have taken five but was being finished in 17 months. The main contractor of the renovation work caused the delay. The heat pump system was completed before the renovation work was finished. When the constructor laid a wooden floor inside the village hall, screws were put through the pipes, which were installed under the floor for the new heating system. As a result, water came through the floorboards in one spot. The constructor failed in fixing its own mistake; only most of the holes in the under floor pipes were found. Fortunately, the constructor company's insurance covered the costs. The community's financial burden for both projects was only nominal:

> It cost 180 £ to get the electricity company to put the electricity back on. (9)

Case 10 had no barriers during this phase. The operation of the trust had created jobs indirectly, e.g. in building, construction and installation work. The energy efficiency program included insulation of the housing stock and support for the replacing the white goods. The energy efficiency program was going to continue supporting people to put up PV-panels, heat pumps etc.

In Sweden three kinds of support needs were mentioned: economic and work related resources (11), advice concerning biofuels (11) and technical help during the construction time (12). Both communities received help for these matters. In case 11 there were networks depending on the type of partners, such as members, network coordinators and projects, topics or area. It was important that the network had resources and someone coordinating and pushing it forward – and keeping eyes and mind open for different views. The declaration of commitment gave useful information about the expectations and contributions of the members. Transparency was important and competition was tried to get rid of as much as possible. In case 12 the consulting firm helped the community through the construction time and there were no big barriers. The municipality would recommend others to build after the same concept as they did.

5.10 Operation

Community involvement is needed variously in all project phases (DTI 2000, 22). There are assumptions concerning the residents' behavior in the community. According to Walker & Cass (2007) as quoted in Rogers et al. (2008, 4218), individuals are assumed to participate likely than protest community projects. When taking part, the understanding of sustainable energy issues might supposedly increase and consequently increase acceptance. Also, time dimension is a specific feature. The typical pattern of local acceptance follows a U-curve: first, a drop from high to low acceptance during the siting phase and then back high once the project is finished and running. (Wûstenhagen et al. 2007, 2685.) The installations had various effects on communities. For example, the attitude had changed more to an ecological direction (2, 4, 12), and the installation had saved money (1–2, 4–8), decreased CO^2-emissions (1, 7) and enable energy efficiency (6, 12). Also, the project had helped the school unit (3) to improve its, normally separated, network inside the educational federation, and improved the social solidarity of the trust (10).

In Finland communities were lacking more support than receiving it. Guidance for implementation (1), instructions on one's native tongue (1), education for attitudes (2), a maintenance course (6), education for practical work (8) and advising from the HPAC offices (7) were left unfound. One interviewee (3) could not name the need of support yet. Then, support was found in the form of a consult on district heating (2), workable material cycling system in town (2), education and training for the maintenance and use of geothermal installation (7) and adjustment advice (7). After all, the Finnish communities were quite satisfied with the installations. In case 3 the RE implementations, the biogas plant, wind and solar energy systems and a biogas fuel filling station, were still waiting to become concrete.

The three religious communities 2 and 6–7 were very pleased with the experiences of operating the installations in practice. The lessening of maintenance was a mutual experience, even a pleasant surprise:

> It takes only 10 minutes per day to check the facility and once a month there is a chimney sweeping that takes half a day. (6)

Other positive surprises were how easy and quickly the whole project went through (6), a halved payback time (7) and the project improving the community's imago (7). Thanks to the received environmental diploma, certain employees were in charge of environmental issues in the parish (2). The parish was happy with the results, although some doubted the project still, and the diploma process was about to continue towards a next four-year-period. The federation of parishes (7) had also applied, and received, the exact same environmental diploma. Technical issues had occurred with pellet quality (6) and silo design (6) and when the changing seasons required adjustment to the equipment (7). Because there was only one organisation able to educate maintainers in Finland, the interviewee had a proposal:

> The HPAC offices should be able to advise the customers willing to invest in geothermal. (7)

The savings the installations created had allowed the nursing home (6) to invest for extra labour force for the nursing facilities. The example had encouraged more than one house owner investing on a pellet boiler (6), the neighboring parish to start planning a geothermal system (7) and the community itself (7) to install more similar heating systems. The successful project had encouraged to apply subsidises from a governmental body to implement a district heating project (5). After being finished, the biogas plant (4) had raised interest and drawn visitors. In addition, the improved content of slurry needed no longer aerating before spreading and the need of artificial fertilizers had decreased (4).

In Scotland the cases 8–9 went through some colorful happenings before settling. In case 8 some crucial problems were left unsolved: an oblique input device, which caused blockages in the oven every now and then, the cleaning maintenance routine with a designing fault and too small a boiler. There, a surprising connection occurred: after the wood chip boiler was installed, the regional officer of the national advisory and funding body visited Finland and came back with answers to the mistakes there had been made. It was discovered the original design included a delivery pipe sloped correctly but the plate and platform were delivered in a wrong position by mistake. The installing com-

panies did not fix this obvious mistake but it would have been difficult to go to court about the matter. The problems with fuel delivery and ash were solved in time. One of the installing companies was first maintaining the system but after the ashing had caused problems during a holiday season and the centre was left without maintenance, repair or heating in three weeks, another one was sought. Despite the obstacles, the leisure centre was happy with the installation and had received positive feedback from the customers. Now, the companies maintaining the system and delivering the wooden chips were decent, the heating costs had decreased 50 % and the amount of working hours in the leisure centre, local sawmill and delivery service had increased. The ash was used to deicing the car park during the winter. Because of the efficient funding raiser, other people had been starting to install renewable energy systems too.

In case 9 the opening time of the community center had widened significantly, more rooms were in use and the quality of the heating was better than before the installation. In addition, lots of people had come to see the functioning of the geothermal heat pump. As a barrier, people had a low interest in maintenance; when interviewed, only one management committee member knew how to maintenance the heating system. In addition, the users of the community center were not taking into account other users when setting the temperature. The community needed consultation, technical help and new compressors during this phase. It took a while after the village hall had been signed off, when the community members found out two smaller rooms had water under the floorboards. It was not sure whose fault it was but construction work was no longer under guarantee. It would have been very expensive and difficult to prove it was the constructor's fault. The cheapest way to deal with the problem was to cut the heating off in those two rooms and keep their doors open constantly. The advice came from the national advising and financing body. Then, a broken heat pump compressor stopped the heating. The company, which had installed the heating system, advised to contact a certain local engineer interested in heat pumps. He managed to solve the problem and after seven months and two compressors transported the heating returned. After all the phases and struggles, the interviewee commented:

> If all the information that there has been found out had come in one punch, it would have been too much to digest for the key persons handling the project. (9)

Voluntary directors maintained the trust (10). The annual income depended on the developments; wind farms and hydro schemes were examples of such funding sources. According to the interviewee, the timing for this kind of project and function was good. The applicants and people wanting to use money within the area contacted the trust actively:

> The more informed people there are in the community, the better it is for the trust to come to award grants for projects. (10)

The finance had some restrictions. To confirm a planning concert, the developer had to direct the development project money (£/MW) to the trust. Part of the money had to be channeled through a national, charitable body, which was limiting the use of it. The conditions of the received money also prevented the trust spending it on things the local authorities were responsible of. It was pointed out the trust was bringing forward development that was a low-level priority to local authorities. Still, the service the trust provided was noted:

> It seems that the local authorities are very happy that another organisation is taking some of the financial burden from their shoulders. (10)

The effects of the project were various. For instance, the energy efficiency had been improved after insulating houses and purchasing new white goods, and activities to children and elderly people were provided. Nevertheless, when the effects of a project reached the area of another community council, a conciliatory answer to question who is the beneficiary of the money was to be found.

In Sweden in case 11 the process leaders, 10–12 persons, were working directly under the umbrella of the regional project with the help of the members, companies and industrial clusters concentrating on bio-refinery development. The networks were maintained by regular meetings. The lack of competence in the government and national authorities and set of different biofuels competing against each other's were barriers. The general opinion had also been positive towards the project. The interviewee described it was encouraging to be able to see some of the applications, which are spoken to be the future solutions, in practice.

The municipality (12) was very happy with the installation and the chosen technology; the heat production was efficient and heat was recycled inside the plant. To prevent the complaining about smell, the plant was designed so that trucks can drive inside the building before unloading organic waste cargo. The most difficult thing had been guiding the citizens to sort their waste. The municipality invested on a very extensive informing campaign to spread the knowledge, one neighborhood at a time, about biogas plant and carefully chosen waste sorting alternatives. At the time of the interview, about 98 % of the citizens sorted their organic waste. If the project were started again, the municipality would build the plant in the same way except some details. A load of people had visited the plant to ask advice for waste sorting.

6 Discussion

6.1 Formating a core team

Walker and Devine-Wright have examined community renewable practices and policy in the UK. They present an ideal community project would be “entirely driven and carried through by a group of local people” and bring ”collective benefits to the local community” (Walker & Devine-Wright 2008, 498). According to DTI, the core team manages the RE project process (2000, 7) and is essential driving it forward despite barriers (2000, 21). The latter was found in the material and I conclude a strong core team can work as a buffer against barriers.

Interviewees from all countries were looking for people: adviser, trust directors, employee; someone, who could tell how to get together in the beginning of the project. The structure of core teams varied from one person to key persons of several projects. People involved were interested in the matter. Their knowledge, previous experience and existing structures show here as advantages. Okkonen & Paakkonen (2012, 27) name it differently saying it was a good practice to ensure the access to the external advice. A regional biofuel project, Tulipasilli, run by local advisory service, was mentioned in two Finnish

cases. Tulipasilli provided help with the preliminary report (4) and in case 5 there was an employee, who had worked in Tulipasilli before.

In Finland communities could benefit a lot from the existing organisation structure when forming the core team. There were few support needs. Core team compilation varied a lot. The cooperative (1) core team felt it was good to have three of them because they could share the burden and responsibility. In case 3, being part of a wide group of projects made it simpler to format versatile a core team. Case 7 might have had the ideal core team with five members: real estate manager, financial director, specialist on construction and two parish council members. The team was ideal because different aspects and expertise were drawn together in the early phases. One community proceeded without a core team at all:

> There was no need for a specific planning group because the nursing home had knowledge inside the community (6).

In Scotland two core teams (8 and 10) did not found all the support they needed; planning knowledge and education of running a company or trust would have been essential support for them. In cases 9 and 10 the structure of the core teams seemed versatile and functioning.

In Sweden active people were launching the projects and there were no great barriers in this phase. The municipality (12) could take advantage of its existing organisation structure and personnel but the waiting they faced through the process begun right from the first phase.

6.2 Awareness raising

According to DTI (2000, 23), to disseminate information and consult with the community is as essential as to take professional advice on technical, financial and legal matters. Here, advisory services were really needed. Nine communities out of twelve mentioned this phase. In Finland the core teams in cases 3, 4 and 12 did a lot of independent research and sought knowhow through excursions in European biogas plants. Two of them (3– 4) almost discussed with

each other both realising there were no examples or advisory services nearby, one need to travel abroad to see functioning plants and both will become someone else's case study in the future. The scales of those cases were controversial, which shows how alone a single-member community (4) can be compared to organisation with existing connections (5). These two communities benefited from the same regional project (see Chapter 6.1). When advisory service did not exist that project took temporarily its place. For the farmer regional project was an essential source of help but for the municipality it was more like an outside driver. Not every community made the project public. The federation of parishes (7) did not try to hide it but it was a normal procedure to carry out such a project within a certain working group. The other parish (2) behaved similarly with the district heating project.

In all Scottish cases core teams lacked knowledge about the chosen technology. Although there was not enough information, the attitude towards the project was enthusiastic (9). In case 10 awareness raising work was done towards residents in the beginning. In all three case studies there must have been internal drives which ensured the project progress. Later, the technical ignorance (8, 9) led to problems. Similar case studies available could have lightened the burden because community can learn from other, successful community projects (Rogers et al. 2008, 4225).

High, general popularity of a new energy technology not necessarily means there is preliminary acceptance towards such a project in the community (Wûstenhagen 2007, 2686). In Sweden both communities made sure information about their actions was spread. In case 11 this was probably possible because the core team consisted of skilled people and the working methods and organisation structure were well-thought. The municipality (12) did invest time and money informing residents and answering questions and prejudices. The long period of time did not prevent the municipality from gaining support from municipal administration.

It is shown (according to Walker et al., 2007, as quoted in Walker 2008, 4403) that although some community organisations enthusiastically welcome new ide-

as and initiatives, others may be “reluctant to become involved”. Latter can be seen in case 2, where an employee was raising parish’s environmental awareness by making an initiative but not everyone in the organisation welcomed the idea or believed its usefulness. In case 12, there was repeated objection towards the project as described in Chapter 5.7.3.

The Finnish and Scottish communities mentioned different kinds of information gaps: especially the need of advisory and educational services rose up. There was also same kind of technical ignorance (8–9 and 2) found, and communities in both countries wished for a course about renewable energy sources. Like Rogers et al. (2008, 4225) describe, more institutional support from e.g. local authorities will be needed to ease energy projects and participation. Instead of local authorities, some cases (4–5 and 1) were give essential help from a regional project. Also the core team of the municipality (5) had existing knowledge of wood energy usage. Most cases’ reaches were local. In Sweden the core team chose not to act locally but regionally (11), which happened also in Finland (3) and Scotland (10). They were also bold enough to think big and envisage the future. Some also knew they were pioneers and going to be examples to others. When interviewed, the heating system of case 9 was a successful example with lot of visitors. Similarly, the core team members in case 3 were being invited into different working groups as biogas experts. Education available not yet but in the future was seen to ease and quicken the process of the incoming projects by other communities.

6.3 Securing commitment

Here, the commitment was either not a problem at all, somehow self-evident or a problem. For instance, some interviewees (3–6) stated there were no barriers in securing the commitment and some (5, 8, and 10) did not mention it at all. Full consultation with the community did not happen in every case, especially in Finland. The farm (4) had the smallest community possible and it made, along the parishes (2, 7), nursing home (6) and municipality (5), an independent choice. On the other hand, the parishes and municipalities have a responsibility

to take care of the environment located on their region, so their actions are not totally independent. Inside the school unit (3), there probably was no-one, who would not have been aware of the project and it was thought beforehand how all the knowhow would stay inside the community. In Scotland (8–9) the residents were informed directly and regional residents through a survey (10). There were no real barriers in Scotland during this phase. It means, the core teams have been committed and managed to inform the necessary amount of residents. In Sweden the communities had communication with residents as well: regional project (11) by informing and searching for people and municipality (12) through an information campaign and later the massive appealing process (see Chapter 5.7.3).

The reasons for projects were tangible. Personal interest (1, 4, and 9) and economic reasons (1, 4, 6 and 8) were mentioned, for instance. The RE project could also be a part of an environmental program (2, 3, and 12), which, in a way, created an umbrella organisation. The reasons why communities started projects motivated and secured their commitment. For instance, in case 7 the idea was born inside the community, which already had experience on carrying out such large projects. This kind of structural advantage was seen also in cases 2–3, 5– 6 and 12. Then, there was a need for biogas research in the Finnish Lapland region. According to the interviewee (3), the project helped to join different operators around biogas field.

In Finland the concept of community is probably less familiar than in Scotland or in Sweden. Cooperatives and village communities are familiar here and taking part often means residents give comments, suggestions, objections or appeals about the scheme in question. For example, a wind energy project developed by an outside actor activated the locals to raise critical questions about wind farms' noise level (Karjalainen 2016a) in my home village. On the other hand, the first wind power project installed by a North Karelian village community was informed in a positive way in a regional newspaper. (Karjalainen 2016b.) In Scotland the trust (10) interviewee pointed out here that determination was the most important quality one can have. The Swedish case 11 varied from others: the declaration of commitment was like a contract in a form of a formal and un-

dersigned letter. This practice could be worth of implementing in other large communities too, since it would both clarify expectations and inform core team their members' capabilities. The interviewee commented, if the whole process started all over again, the use of declaration of commitment would be taken in use much earlier.

6.4 Legal structure

According to DTI (2000, 17) the legal structure should be taken into consideration early but, on the other hand, the community should take legal advice before setting anything up. It was found here and earlier by Okkonen & Paakkonen (2012, 28) that most cases (2–9 and 12) already had a legal structure providing a good basis for the RE project. Therefore, those communities had potential to ease this phase. Firstly, there was no need to put time or trouble in creating the legal structure. Secondly, the community employees, members or volunteers were likely to have earlier experience and connections. This came up especially in Finland. Tacit knowledge about local conditions (Wüstenhagen et al. 2007, 2686) is also worth of mentioning here. As it shows in Chapter 5.9, two Scottish cases had existing organisation with people highly motivated but the communities were lacking technical skills. Also, the Swedish municipality (12) had to go through a long road because the permit processes were appealable. I conclude the existing legal structure gives great opportunities to implement the community renewable energy project but not necessarily guarantees the project will proceed smoothly.

In each country, there was a case (1 and 10–11), which needed to create a legal structure for the RE project. The trust (10) wanted to create a charitable organisation, and the biofuel project's (11) core team a very wide and open structure. I believe, the Finnish cooperative partners (1) said aloud the most important questions those three core teams had in mind: which kind of legal structure can help us generate RE activity and enable applying grants? The circumstances and practices around subsidies and grants are different in each country, so it would be impractical to assume the legal structures were consistent in

the comparison countries. One obvious similarity was between the municipalities in Finland and Sweden. Also, in each country there was a large-scale project (3 and 10–11). According to Rogers et al. (2008, 4225), a standardised process or clearer frameworks are likely to be needed so ensure a larger scale of communities undertake the energy projects. In case 3, existing structures of all parties allowed the project to proceed quite painlessly. In case 10, a framework for getting competent directors for the development trust was created. In case 11, the organisation structure was something totally new, non-governmental and consisting different kind of people sharing enthusiasm towards project. As described in Chapter 5.3, this community needed to create a tool called declaration of commitment for joining members.

Charitable communities divided comparison countries: Scotland had two, Sweden one and Finland none charity-structured cases. It was like Walker (2008, 4402) presents: charity is a common way of community acting in Scotland. Despite the high case amount, Finland had no charities. That does not mean the case studies would not provide benefits for the local people. In Finnish cases too, people, such as parishioners, school personnel, regional researchers and communities looking for a case study, could benefit from the project results for free. The open, free and non-profit legal structure in Sweden was notably different from others. The interviewee called it rather a process than a project since there was no certain start or end, only process continuing.

6.5 Site search and Land negotiation

In Finland communities recognised endogenously the site had a potential energy source (Okkonen & Paakkonen 2012, 28). For instance, the founding partners (1) knew the nearby river contained energy, the farmer (4) figured out himself steaming cow leftover-food would contain exploitable energy and the municipality (5) wanted to introduce particularly locally produced biofuel to heat one of its schools. No objection occurred. The municipality (5) and parish (2) could benefit the resources there were inside the community. There were also support needs, in which some communities (2–4) did not find answers. That

slowed the continuance of those projects because the communities were left alone with their questions. In case 3 the basic assumption concerning the prospective solar power project was that solar heat collection would be more profitable than solar electricity production. It seems there was a local bias towards solar electricity production. In Finland the markets for small-scale RE electricity are not functional enough since the price the prosumers get for the electricity sold to the grid can be one third of the normal retail price (Ruggiero et al. 2015, 441). On a sparsely populated area, the electricity transmission is usually more expensive compared to cities. On those areas, the Finnish electric power companies may raise their transfer fees but in return they need to improve the security of energy supply against storms (Vironen, 2015). Therefore, the advantages of solar electricity production for the community are the saved transmission fee and taxes. If the community has a constant need for heat during the summer season, the solar heat production is more profitable.

In Scotland the interviewees in cases 8 and 9 did not mention land negotiation at all. The communities did not have people prepared to ask the right questions during designing, which I connect to the site search phase. Both would have benefited the kind of coordinative help Letcher et al. (2007, as quoted in Rogers et al. 2008, 4225) presents: communities without skills, time, confidence or experience would benefit from support coordinating and directing a project. In the United Kingdom there is no single service desk combining finance, independent advice, support and training for communities, which have a RE project in mind (Rogers et al. 2008, 4225).

According to DTI (2000, 8), when making rent and other agreements core team needs to cherish the balance between confidentiality towards landowners and openness inside community. This was found in Sweden in case 12 where the biogas technique was criticised and doubts about the effects on the neighborhood expressed. Making implementation decisions raises questions in residents living near the implementation location: how it would affect on living, how it would look like, does it change the landscape? Depending on the situation, living near the location can be seen as a privilege or a compulsion. (According to Sauter & Watson 2007 as quoted in Wüstenhagen et al. 2007, 2686.) This kind

of responses from the community was found in part of the cases. Some got acceptance right away since the atmosphere towards renewable energy was positive (9) or the acceptance was shown although the asked support could not be provided (4). Some met negative or suspicious reactions (2, 12). The large-scale projects in each country (3, 10 and 11) were trying to reach wide acceptance in both residents and administrative bodies. In rest of the cases, it was not found how residents reacted.

6.6 Measurement and Testing

The support needs in communities became much more versatile from this phase on. In Finland the decisions about the technologies seem to have been practical and each community managed to choose the kind of technology that could generate energy in their circumstances. The possibilities to ask advice inside the community varied. For example, the parish (2) could ask experiences from other parishes, which had taken the diploma in use, and in cases 5–6 there were employees with knowledge about the chosen technology. The case 7, also a religious community, was an exception: it did not found case studies in other parishes but plenty of similar installations in Finland and in Sweden. Excursions were important to many other communities too and some had to spend a considerable amount of time and imagination when searching for information. In case 3 the project team visited 20–30 different biogas plants in Finland, Sweden, Austria, Germany and Denmark, and learned in Denmark about wind power production as well. In case 4 there was a true lack of advisory service but the farmer managed to piece the puzzle together.

In Scotland a lack of information was faced. Because of zero excursion and poor designing, the leisure centre (8) got too small a boiler for their heating system. There was a need for a technology-orientated person inside the organisation. In case 9 there was a similar kind of situation: because there was less information available at the time, the core team needed to trust on other people's knowledge. The communities did not give up on the project, although they had limited access to information. The general attitude towards renewable energy

systems in case 9 prevailed positive, which must have helped the community sticking in its RE scheme.

In Sweden both communities searched for information and tried to apply it in their situation. In the meanwhile, the biofuel project (11) did important work because it was finding ways to energy-independence. In case 12 a set of environmental and economic aspects and criticism from different directions were reasons to build the biogas plant with top quality technique. This was supposed to avoid transportation costs, environmental impacts and possible complaints from the residents. The municipality could benefit knowledge existing in the community and an excursion helped to choose the best technology.

Walking a pioneer's path appeared to slow the process significantly and make the whole project look like a huge measurement and testing phase like in cases 3, 7, 9 and 12. When founding a community energy project, it is essential to have expert advice and support and learn from previous experience (according to Adams 2008 and Walker et al. 2007 as quoted in Walker 2008, 4402). The interviewees confirmed this. Especially technical competence and education about renewable energy would have been needed. One must remember the interviewees were asked (see Appendix xx) would they have benefited from a renewable energy awareness course, so I cannot assume all the mentions of it are self-thought. Still, it is clear there was a genuine need for basic information, at least about the chosen technology if not all the renewable energy sources. Technical support was another distinct need that appeared. It only varied from which direction the technical support was expected: local HPAC office, consultant, expert or advisory body. Many cases (1, 3–4, 6 and 12) also found case studies, which helped them establish their project but some (2, 7– 9 and 11) had no similar installations as examples. Since this was not the first time education and lacked of information were mentioned, I draw the conclusion a course placed in the beginning of the community RE process would be most beneficial in addition to excursions. Occasionally, community may need to find a consultant or a commercial developer to bring project into practice. Special skills can be found inside the community members as well. (DTI 2000, 21.) None of the cases used a commercial developer but one took turn-key contract (7). Most

communities could take advantage of their members' skills. Others (1and 8–9) proceeded with strong motivation but drifted to find right kind of help. This phenomenon can be seen in several project phases, not just in measurement and testing. Therefore, it seems the inner skills are precious to communities.

6.7 Feasibility, Detailed assessment and Planning application

This is the phase communities expressed support needs the most, not just numerically but also with a notable variety. In Finland support was commonly expected to be given by the municipality. Regional projects (Tulipasilli and Northernmost Lapland Leader) gave important support (1 and 4–5), information (1 and 4–5) and even funding (1). The role of the regional project was essential in case 1 since there was no internal expertise. The core team in case 5 got enough advice – only education for emission reduction calculations was missed out. From an empirical point of view, the interviewee, leader of the core team, recommended taking advantage of consultation from different projects. When asked, he stated a renewable energy course would have saved time. Case 2 had a useful organisation model and they could benefit from the expertise the employees had. It was easy to join the district heating network, probably because it is a common technique in Finland.

Case 3 had a pioneer role, which caused uncertainty. Still, despite the long process and difficulties in finding funding, the attitude had stayed positive. Cases 3 and 4 had the exactly opposite experience of getting professional information about biogas in Finland. The interviewee in case 3 mentions that they contacted all the possible advisory services, which included the university of Lapland, other research centers and plants abroad. One reason to that might have been the very different legal structures. Is it easier for a large educational community to gather information than a small-group or an individual? The wider the community is the wider are the connections. Perhaps the importance of the actor is valued by the size.

Case 6 seems to have had a lack of advisory services about the subsidise system in Finland. The financial support system was also wished to be higher and quicker, which tells information was, somehow, found without outside help. Here, money was the main reason in decision making. This community was the only one with support needs concentrated on just one area. Others had support needs on 2–4 different areas. Case 4 faced the lack of information and advice several times. This was probably because everything was new to the community member. What was the driver? If the community member would not have had internal expertise about technical matters, the biogas plant might still be only a great idea. It is then a driver that you have some experiment beforehand. Both cases 4 and 6 were submitted to proceed without governmental grants because it was economically more reasonable a solution. Both communities wanted to save money by investing in renewable energy technology. They also had knowledge inside the community in the form of technicians.

In Scotland communities 8–9 were both very keen on having a new, renewable heating system. They had a similar situation by lacking knowledge inside the community. Therefore, the people forwarding the project became heavily dependent on an outsider with knowledge. Both had severe difficulties with the system during the installing and afterwards. It is notable that they, without knowledge of renewable energy systems, succeeded in finding the key persons to help them. In case 10 the experience on negotiation and knowledge of the community were crucial skills for the trust directors.

In Sweden both communities had a different way when going through the phase. The biofuel project (11) had to create its way and the lack of competence around biofuels in Sweden was brought up. When comparing the neighbor countries, it came up that in Finland no small-scale RE heat markets are available because there are no business models for them. In Sweden, on the contrary, the district heating network has been opened local residents to sell surplus heat. In Finland there is potential for small-scale RE production but small producers face complicated permit processes, excluding support system and ignorance concerning the economic, employment and environmental benefits. Financial support is limited to large-scale electricity production. (SITRA

2012.) In case 12 excursions were important along with technical and economic advice. The process of permissions was huge and took as long as it could take. Legal help was needed. The community was determined since it did not give up. The lack of social acceptance Wûstenhagen et. al (2007, 2685) describes was seen there. If a local government is to site energy production near housing areas, people start asking questions that affect their acceptance: how it would affect on living, how it would look like, does it change the landscape? Living near the location can be seen, depending on case, as a privilege or a compulsion (according to Sauter & Watson 2007 as quoted in Wüstenhagen et al. 2007, 2686.) Obviously, some of the residents experienced the latter.

The three communities, which already had an existing structure for administrative and financial matters (2 and 11–12), mentioned less support needs compared to others. Those communities needed advice concerning an excursion (12), permissions (2), and the chosen technique and financial matters (11). Now those communities have knowledge they could easily spread just by letting another community to know what they would do differently, if they were to start over. It seems that a solid organisation structure supports the community during the phase by making the road smoother. An interviewee managed to compact it:

> The parish gained from its own employees' knowledge. (2)

Here, other communities found the support where others did not. The support needs during this phase varied a lot. Those community groups “proceeding alone”, faced here the question called how to go forward without knowing? The need of impartial information about the renewable energy technologies, their costs and financial support mechanisms came up in every country. The material shows that even the help of one person might be enough to walk through a project phase if the person can give the kind of support the community benefits from. To find that person, gives the core team more confidence on their project and confirms that the community is on the right track. It seems that if the community has a huge lack of information, even one person interested in giving them advice is enough. This one person can be the lifeline of the whole project.

6.8 Electricity/heat sales and Investment

Not every community had support needs here but each recognised the phase. In Finland the possibilities for investment support and attain the informative support varied a lot. One community (6) made wise decisions concerning the investment without having any advisory service. Time seemed to be in an essential role. It was important the grant was given in time (1) or time was wasted finding a suitable employee outside the community (2). Waiting gave devices time to develop (6) but would later have worn the benefit of the gained support (6). The feeding tariff was going to develop in time (3). One community was ahead of time was:

> It was known beforehand that the use of the school centre will be reduced and that needed to be taken into account in calculations. (5)

In case 3 there was a strong confidence on the positive effects the successful project would bring: encouragement towards the RE technologies, boosting local economy, waste maintenance and reduction of energy costs and CO^2 emissions.

According to DTI (2000, 11), communities rarely have experience of substantial projects or RE technologies. This theory did not apply to all cases. In Finland part of the cases (2–3, 5 and 7) had already some kind of experience of carrying through a technical project. When it came to searching for support, there was a contrast: communities either found advice and funding easily or did not. Two cases funded their project independently because the terms (4) and waiting period (6) of the grant would have neutralised the gained benefit. The other community (6) had members, who knew how to calculate the payback time after the search for grants had ended. The decisions to use own assets turned out to be economically wise. After a struggle, the educational energy project (3) got remarkable financial support. The technologies were not going to be a significant energy sources but important sources of information.

In Scotland financing went smoothly. Case 10 could start easily without economic issues. The projects in cases 8 and 9 needed and collected money the most. Both got essential help locally from one person, who found the support

source for the community. A national body was helping too (9). This sounds just like Bomberg & McEwen (2010, 439) according to whom, financial resources in Scotland are offered to communities mostly via “administrative and technical support provided by agencies and local authorities.”

The Swedish and Finnish municipalities (5 and 12) had a similar pattern here: they put in resources such as financial resources and dedicated employees. Also a couple of the largest communities (3 and 12) faced the biggest uncertainties but one can presume the savings, benefits and regional effects created during the life cycles of the technologies will be enormous. Community RE projects, especially biomass-related, can create new vacancies. In addition, they can help community towards more sustainable a life. (DTI 2000, 14.) For example, cases 2 and 10–11 could provide both a temporary or permanent jobs and the municipality (5) wanted to make a positive effect on the local economics by choosing a local fuel producer. During the construction and operation phases the communities will employ people as well. Ethical and environmental drives are important for public and private sector bodies, which have environmental and social responsibility policies (Walker 2008, 4402). This shows especially in cases 5 and 11–12 but most of the other cases mentioned sustainable life as well, for instance this way:

> Although the money was the main driver, it was positive to have an environmentally friendly heating system. (6)

The need of impartial information about the renewable energy technologies, their costs and financial support mechanisms came up in every country. I conclude there was a “single desk” service needed in comparison countries. This was seen especially in Finland. Singe key persons found during the process were essential and could provide support needed.

6.9 Construction

In Finland the existing technical competence connected most cases. The communities 2–6 recognised they had connections and community members with skills, which proved to be valuable during the phase. Communities 1 and 7

lacked that advantage and both realised afterwards, it might have been cheaper to divide the installation between ordering equipment and paying for the installation. DTI (2000, 22) mentions that professional competence, timing and accountability must be taken care of during the construction phase. For that, case 4 is mentionable: it had major barriers during the construction because there was not enough experience in the region. The same situation was in Scotland. I conclude communities should be encouraged to make the most of their inner networks and know-how, and additional support should be offered all in need. When a community recognises its strengths, it can also find the support needs it needs help outside the community. As mentioned before, case studies are important for communities planning a RE project. Case 3 was aware their project was going to be a case study for rural and tourism entrepreneurs sharing experiences of the biogas plant process. Some other cases mentioned it in the operation phase (see Chapter 6.10). Those interviewees were clearly personally motivated and believed in technical development.

According to DTI (2000, 14), many communities know already they do not have the needed expertise to manage a large-scale project. This was the situation in Scotland and it only got problematic because the companies giving offers were not capable enough. The installing companies made several mistakes in both cases showing they did not have solid experience of the work. In case 8 not finding the competent people for planning combined with having only a few, not exactly suitable examples of heating systems, created a dysfunctional heating system. It needed thinking outside the box to find solutions but the community still suffered from the poor installation. In case 9 the community faced consequences, when the two companies working at the same site did not share information. The year's delay in renovation work prevented also the use of the village hall. The trust (10) coordinators were in a significant position and the declaration of commitment showed its value. Since no buildings were built for the trust, no barriers, naturally, occurred during the phase.

In Sweden the attitudes (11) were seen as a barrier. The interviewee stated that although Sweden was investing a lot in renewables, it was still investing a lot on fossil fuels, too, and:

There is a lot of criticism towards biofuels. (11)

In addition to being a process, the project itself was a large network with more specific networks. The basis of the network was ought to be sharing instead of competing. Both Swedish cases shared the trust in development.

Notable was the amount of optimism communities had – it showed in whether there were barriers or not. Some communities had a load of troubles and some none during the phase. The lack of offers seems to have been the common factor: companies were not “woken up” for this kind of business in the comparison countries. In Finland the national energy industry network resists heavily the change into distributed energy - even though it also looks for new business opportunities on the field. In addition, municipal companies see expanded DE as a threat to the grid stability and grid fixing costs because they often are network operators in Finland. (Ruggiero et al. 2015, 441.) Hopefully, the situation has changed since the projects in this study were implemented.

6.10 Operation

According to DTI (2000, 14), RE projects can give an experience of accomplishment done together as a community. (DTI 2000, 14.) Although this was an interview question, the answer can be seen in the interviews. For instance, the Finnish municipality (5) was happy with the installation, the use of renewable energy and the activity it had brought. In many cases (4–9, 12) the installation worked as a case study and an inspirer for other communities. None of the interviewees mentioned regretting they had accomplished a community RE project.

In Finland there were project-friendly community structures including skilful workers. The environmental work inside the parish (2) was going be constant because the new application for a diploma needs to be submitted in every four years. The other parish (7) had the diploma in use as well. The environmental diploma for parishes may be a Finnish specialty worth of implicating abroad. Case 4 shows, there is a potential for even small-scale farms to become more

energy self-sufficient. The lessening of artificial fertilizers is important, as well as the flexibility farmer got to his working time. The biogas plant had become an interesting example. In case 3 it was not possible to say yet, whether the installation or technology was satisfying or not. The community seemed very well prepared for the coming installations and had great plans. The network working around the project had become more coherent.

In Scotland the installing companies in cases 8–9 lacked competence and the legal procedure of complaining was known to be expensive. In case of troubles, both communities had to wait service for a considerably long time without heating. It seems, a Scottish community might need to be careful which company to choose for installing, maintenance and fuel delivery. I believe there are more choices and expertise available nowadays. In both cases, and once again, there was a key person able to share knowledge. Those persons should be acknowledged for their important work. In case 9 help was found to various kinds of problems, which seems almost like a game of chance. There, the installation had made a big difference to the local people because they were now having a warm and safe building. Still, there was regrettably little interest on maintaining the system. Walker (2008, 4403) mentions the liabilities in maintaining the system and operating it efficiently may become an issue in the community, especially if “knowledge and skills dissipate after the initial period of installation”. Here, the maintenance was on one person’s shoulders. The trust (10) was investing in the area, for the community and the time was right for this type of organisation in Scotland. It was is easy to see now, why the directors were required to be residents for eight years and know people: to find the things community members needed.

It was delightful and encouraging hearing the core teams of the communities had found possibilities to widen the use of RE sources. For example, some communities in Finland were planning to increase the energy efficiency of buildings (2), replace dysfunctional heating systems with renewable ones (7), generate the waste heat for electricity production (4) or invest on a mechanical ashing and chimney weeping systems (6). Founding an energy cooperative among neighbor houses was recommended (1). In case 3 there were several plans,

e.g. providing education, a bigger biogas reactor and expanding the range of raw materials in the biogas process. As the interviewee related:

> It In the future, the carbon footprint gets smaller, if people living near the mountains can take an advantage of waste as an energy source. (3)

The Scottish communities were thinking to purchase a bigger and reliable boiler (8), learn more about heat controlling (9), arrange a course about the heating system's maintenance for current management committee members (9), pay more people to take an energy efficiency course (10) and start a wind or solar power project (9). Also, the trust (10) had suggested the regional administrative body to set up a local conference between four community councils for changing ideas and good practices. There was also an advice given:

> If you want to start a similar trust, do not work as a volunteer company because it limits your actions. (10)

Setting up a community project means lengthy and wide commitment and dedication from people (DTI 2000, 23). This was seen especially in cases 4, 9 and 12. They had pioneer problems and the processes took several years. The municipality (12) had so many members that it was difficult to steer them to act differently. In my experience, we have the same problem in Finland. Surprisingly, the worst barrier was said to be the citizens unwilling to recycle – not the numerous appeals during the processes. The community considered the possible complaints when designing the building "smell-free". The biogas plant must have improved the situation for the community. According to the biofuel project (11) interviewee, we need to make mistakes in the stage we are right now, so we can learn from them. This is a similar kind of thought as the interviewees presented in cases 12 and 4. The connection between Scotland, Finland and woodchip-boilers was interesting. Would there be possibilities for more cooperation between Scotland and Finland? An excursion to Finland might have helped the core team (8) to perceive the technical aspects. Do the Finnish device companies have capability to sell abroad or provide knowledge services? Finland and Sweden share the similar forest assets, so know-how could be delivered from Sweden too.

Did it pay off? A community-based energy production can generate local income: returns on investment, sale profits of generated energy or new jobs

(Walker 2008, 4402). The same goes for RE projects using biomass technologies (according to Madlener 2007 as quoted in Walker 2008, 4402). The communities 5–6, 8 and 10 could employ more people permanently in their businesses or in maintenance. Other cases could hire people temporary for the construction work. The savings were used growing the business and provide more services, which affect positively the local economics. Being a functioning example others to visit was another important result in many cases. I believe one important but uncountable income in each community was the experience of defeating all the obstacles and creating renewable energy locally.

7 Conclusions

This was my first research. I chose the research language to be English because I wanted the results to be found beyond the Finnish border. I believe the decision was right – not to mention what it did to my skills in English. The qualitative research done here is reliable and the research methods transparent. Eleven interviews were recorded by my own initiative. Recording not only gave me more time to interact with the interviewees but also ensured I got the statements correct. I handled the material consistently and the consecutive numbering of the communities is visible in quotes. Therefore, if I am asked particular questions about any of the cases, I will be able to trace the answers from the documents I created during analysis. Conducting more interviews from Sweden and Scotland would be useful since there were as much as seven from Finland. It would probably be possible to find case studies approximately from the same period. It would be interesting to implement a follow-up research about a RE project in a large-scale community starting the research process from up-front expectations and to operation and retrospect. Questionnaires before and after would be used and semi-structured interviews with carefully chosen questions. In addition, there is a possibility to change the angle and continue with the material I used here.

Below I am going to sum up the research results. They turned out to be clearer than I expected. The results will give practical help to current and future com-

munities implementing renewable energy technologies. The communities may also use the report as a guide through the minefield of mistakes and success. The project phases the main theory introduced were recognised but, as showed in this study, each community walked its individual path through them. The order of the phases was not solid. Most difficulties were faced during site search, investment and construction. I argue that recognizing the different phases and their meanings can help the forthcoming communities to evade some of the barriers and delays described.

There was a connection between the core team and the legal structure of the community. According to Rogers et al. (2008, 4223), it is confirmed the success of community project relates to the strength of the existing community framework. The results supported this. The existing legal structure can benefit the community during one or more project phase but having to choose the structure specifically for the energy project have its advantages as well. The communities with a strong core team, an existing legal structure, connections and technical skills had usually, but not necessarily, easier steps. I propose communities should become aware of their networks and know-how already in the beginning. Understanding which skills or knowledge the community is lacking enables to search that support outside the community in time. But as Walker (Walker et al. 2007 as quoted in 2008, 4403) suggests, committed key persons and support coming from the local institutions can be essential to make the project successful. Most cases needed support outside the community. Communities, which had more troubles than others, had at least one person, i.e. key person, helping them. This person could even be the lifeline of the whole project.

The support needs were similar in each country. The communities were searching support services for advice, finance and technical matters throughout the project phases. In addition, each comparison country had its weakness; incompetent construction companies in Scotland, exhaustive objection in Sweden and the lack of regional support bodies in Finland. According to DTI (2000, 11), help is mostly needed in site search, environmental effects, operational management and finance. This, except the environmental effects, was confirmed in the material. Communities needed mostly guidance towards the best RE technology in

their circumstances, financial support and tools to control the design and construction phases. The needed information was usually gathered from different sources and through excursions. According to these results, it would be beneficial, and advisable, to arrange a support service, national or NPA-wide, providing or leading to support during each phase of a community RE project. The database the commissioner project compiled of the regional advisory services and funding available for rural communities across the partner countries (SmallEst 2016), would have been highly beneficial for the communities in this research.

With or without success, the communities become important examples by showing which technologies were functional and sharing their experiences. Other communities will visit them, be astonished and ask how they did it. Those, who struggled, will answer, “We did not give up” and those with less obstacles will describe the beneficial skills and information sources they had. It is amazing, how these people kept on going against the odds. Setting up a community project means lengthy and wide commitment and dedication from people (2000, 23). This was truly confirmed.

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The questionary for case study interviewees

Background information

1. Name of community group

2. How many members are in the community group?

3. How long has the community group existed?

4. What type of community group is it; rural/urban/religious/sport/etc.?

5. Was a specific organization created for the project?

6. Why did the community group decide to implement a renewable energy project?

7. What are the local fuel supply options?

8. What is the main purpose of the community building?

9. What was the structure of the project team? How was the process managed when establishing?

Development of the project idea

10. What steps did you take to develop your project?

11. Did you contact any advisory services in your region?

12. Did you find them easy to find/contact?

13. What support did they offer? Did they advise on suitable technologies /costs /available funding?

14. Did any advisory services contact you unprompted?

15. Did you consult other communities for advice on best practice?

16. Based on this project, how high you think is the level of advisory services in your region?

17. Was a business plan prepared for the project? If so, how was it prepared it and who prepared it?

18. Did you need to get planning permission or other government/local authority permission to undertake your project?

19. Who did you approach to get find out information on this?

20. How would you describe your interaction with government/local authorities? Did they support the project?

21. Do you feel you faced any particular barriers /challenges in trying to develop your project?

22. If you were undertaking the project again, what additional support would you find helpful from an advisory service?

23. Was there any help you needed (particularly in relation to education and training) but could not get? Who do you think would be best to deliver these services in your region?

24. Which kind of education /training would be the most beneficial?

Implementation of the project

25. Which technology did you decide to choose?

26. What size did you choose (kW)?

27. How did you decide to choose this technology? (Did you receive advice from an advisory service /installer/etc.?)

28. Do you feel you could have benefited from a simple renewable energy awareness raising course before undertaking your project?

29. How much did the installation cost?

30. How did you fund the installation (loan /grant /privately financed)?

31. Did you find it easy to find funding?

32. Who installed your renewable energy system?

33. Did you find it difficult to find an installer in your region?

34. If you installed a biomass system, did you find it easy to find source fuel?

35. Was your renewable energy system installed in a new building or an existing building?

36. If you installed the technology in an existing building, did you have to improve the energy efficiency of the building beforehand (add extra insulation /double glaze /etc.)?

37. Was the building rented or owned?

The conclusions

38. Are you happy with your installation?

39. Have you had any problems with your installation?

40. Do you feel that you have installed the most appropriate technology and solution for your needs?

41. Who maintains your system?

42. Has the installation helped you reduce the energy costs? / Do you know how much money the installation helps you save on energy bills each year?

43. Do you know how much CO_2 you save each year because of the installation?

44. Are you aware of other positive or negative environmental impacts of the project?

45. How long did it take to complete the project from concept to installation?

46. What was the original schedule and how much it delayed?

47. Has the installation helped improve the situation for your community group?

48. Overall, did the installation project help improve social cohesion in your community?

49. What is the general opinion towards your project and why?

50. Have any other people in your region installed a renewable energy system as a result of seeing your successful community installation?

51. Do you have any advice you could offer a community group undertaking a similar project in your region?

52. What do you feel were the main barriers you faced in installing a renewable energy system in your region?

53. Do you feel you needed more support to help you with your project, if so, where should it have come from? (Government /local authority /advisory service?)

54. Which kind of education /training would be most beneficial in the future, from the point of view of your project /company (2-3- years time scale)?

55. If you were undertaking the project again, would you do anything differently?

56. Has the installation helped create any new jobs in your region?

57. Any other thoughts or comments regarding your community's renewable energy implementation?

The interviewer answers: 5 most important conclusions of the interview?

Figure 1. The community renewable energy project phases (Okkonen 2013)