



# EMERGING ENLIGHTENED SELECTIVE SELF-INTEREST TRENDS IN SOCIETY

A STUDY APPOINTED BY:



**Tekniska  
verken**



Environmental Technology  
and Management



Tema  
Technology and Social Change

REPORT  
LIU-IEI-RR--14/00204-SE

This report was appointed by Tekniska Verken AB, and written jointly by the divisions of Environmental Technology and Management , and Technology and Social Change (Tema T).  
Linköping University  
2014

**Report number:** LIU-IEI-RR--14/00204—SE

**Cover design:** Marcela Pizano-Castillo

Emerging selective enlightened self-interest trends in society:  
Consequences for demand and supply of renewable energy

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# 1 Acknowledgements

This research is performed in cooperation between Environmental Technology and Management and Department of Thematic Studies: Technology and social change at Linköping University with funding from Tekniska Verken Linköping.

We would like to thank all respondents in the energy communities of Samsø, Thisted, Saerbeck, Wildpoldsried and Lyndhusrt for participating in the interviews and also to the residents of eco-villages for responding the questionnaire. Special thanks to key-persons in each eco-village for their help with sending out the questionnaire to the residents.

We also want to thank Jenny Palm from the Department of Thematic Studies: Technology and Social Change at Linköping University for her support during this project.

## Abstract

Energy supply has for a long time primarily been a question of central management with little communication between producer and consumer. Heating, electricity and other services have been produced by public corporations with little room for alternative solutions. However, this has started to change, through grassroots movements aimed at greater degrees of self-sufficiency in energy production. The trend is clear in both Sweden and internationally.

This study focuses on grassroots movements, to understand the determinants for up-scaling towards greater self-sufficiency. We are interested in understanding the driving forces behind different types of communities with high ambitions on sustainability and self-sufficiency. The study was conducted in two phases. In phase one, we have studied a total of five communities in Denmark, Germany and the UK that have taken extensive measures to increase energy self-sufficiency, in order to understand how and why they were created and how they work today. In phase two, we have conducted a web-based questionnaire to residents in the Swedish eco-villages, to understand the reasons for moving there and the experience of living in the villages. The overall aim of the study is to understand citizens' involvement in sustainable communities and analyse what this could mean regarding current supply and demand for sustainable energy.

The results from phase one, where interviews were conducted with key stakeholders in renewable communities, shows that these communities took their steps towards more sustainability due to either momentous events, such as the oil crises of the 1970s, or through national "energy competitions"; they started because of particular events. Of paramount importance for successful projects was a close cooperation between municipalities and citizens, particularly through civic ownership. It created interest, transparency and security in the projects. The development also created new jobs, attracting new jobs to the communities because of the expertise that were there. Although there are great advantages of the high degree civil activity it has been proved to be more time consuming. In all cases they have managed to become essentially self-sufficient in renewable energy, in one case, they produce up to 500 percent of their electricity needs, but a further challenge has been to adapt the independent systems to existing centralized systems, adapted to different conditions.

The questionnaire in phase two was sent out to 17 ecovillages. We received a response rate of approximately 30 percent and the questions concerned for example motives moving to the eco-village, environmental interest and perceived satisfaction with the accommodation. The results showed that residents are well educated with a great interest in the environment and that, although in many cases it expressed that sacrifices must be made on the basis of the accommodation, it is worth it. The replies expressed few social conflicts but that the technical systems resulted in work and discussions. In some cases it seems as the technical systems were off-gauge from the start and something that had to be handled a long time to come. The technical system performance is something that is very important for whether residents feel comfortable in village or not. The villages started as movements willing to do something different.

The results from the two studies show, among other things, the importance of communication and inclusion of residents. People are also willing to adapt to new situations as long as it does not affect the comfort too much or if it is for a good cause. However, there is considerable knowledge among all these communities that should be utilised in other contexts.

## 2 Sammanfattning

Energiförsörjning har under lång tid främst varit en fråga om central styrning med lite kommunikation mellan producent och konsument. Värme, el och andra tjänster har producerats av offentligt ägda bolag med litet utrymme för alternativa lösningar. Detta har dock börjat förändras, genom allt mer gräsrotsrörelser som siktar på större grader av självförsörjning av energiproduktion. Trenden är tydlig i både Sverige och internationellt.

Denna studie fokuserar därför på denna typ av rörelser, för att förstå avgörande faktorer för en uppskalning av högre grad av självförsörjning. Vi är intresserade att förstå drivkrafter bakom olika typer av gemenskaper med höga ambitioner gällande hållbarhet och självförsörjning. Studien genomfördes i två faser. I fas ett har vi studerat sammanlagt fem samhällen i Danmark, Tyskland och Storbritannien som vidtagit omfattande åtgärder för ökad självförsörjning av energi för att förstå hur de skapades, varför och hur de fungerar idag. I fas två har vi genomfört en web-baserad enkätundersökning till boende i svenska ekobyar, för att förstå motiven för att flytta dit och erfarenheter av boendet. Det övergripande syftet med studien är att förstå medborgares engagemang i gemenskaper för hållbarhet och analysera vad detta kan betyda gällande tillgång och efterfrågan på hållbar energi.

Resultatet från fas ett, där intervjuer genomfördes med nyckelaktörer i förnybara samhällen, visar att dessa samhällen tog sina steg mot ytterligare hållbarhet på grund av antingen omvälvande händelser, såsom oljekriserna på 1970-talet, eller genom nationella ”energitävlingar”; de startade på grund av särskilda händelser. Av största vikt för lyckade projekt var ett tätt samarbete mellan kommuner och medborgare, särskilt genom medborgarägande. Det skapade intresse, insyn och säkerhet i projekten. Utvecklingen skapade även nya arbeten och attraherade nya arbetstillfällen till orterna på grund av den kompetens som fanns där. Även om det är stora fördelar med stort medborgarinflytande har det visat sig vara mer tidskrävande. I alla fallen har de lyckats bli i princip självförsörjande på förnybar energi, i ett fall producerar de t.o.m. 500 procent av deras elbehov, men en ytterligare utmaning har varit att anpassa de självständiga systemen till existerande centraliserade system vilka är anpassade efter andra förutsättningar.

Enkäten i fas två skickades ut till 17 ekobyar. Vi fick en svarsfrekvens på cirka 30 procent och frågorna berörde exempelvis motiv att flytta till ekoby, miljöintresse och upplevd belåtenhet med boendet. Resultatet visade att de boende är välutbildade med ett stort miljöintresse och att även om det i många fall uttrycktes att uppoffringar får göras på grund av boendet så är det värt det. I svaren uttrycktes lite sociala konflikter men att de tekniska systemen gav upphov till mycket arbete och diskussioner. I några fall verkar systemen varit feldimensionerade från start och något som behövts hanteras lång tid framöver. Just de tekniska systemens prestanda är något som är av stor betydelse för huruvida boende trivs i by eller ej. Det går att sammanfatta det som att byarna startade som en rörelse där det fanns en vilja att göra något annat och vara mer självständig.

Resultaten från de två studierna visar bland annat vikten av kommunikation med och inkludering av boende. Människor är också villiga att anpassa sig till nya situationer så länge det inte påverkar komforten allt för mycket eller om det är för en god sak. Det finns dock stor kunskap bland alla dessa gemenskaper som borde tas tillvara på i andra sammanhang.

### **3 Introduction and Research Field of the project**

Humans lived in small communities for many centuries; from hunters/gatherers to rural villages. Although the sense of community was strong due to close ties between the members and the joint procurement of many of the villages' goods facilitated everyday life, energy provision was normally each individual household's responsibility. With the Industrial Revolution, migration from the rural areas into the cities gained tremendous momentum. Not only new technologies required more energy, but modern industrial processes required a more secure and stable supply of it. In turn, the new, increasing urban population demanded utilities for their dwellings and with new occupations (i.e. factory employments vs. rural activities), the procurement of energy became more difficult, in terms of time and of logistics. With cities came centralized energy provision. New energy systems were to provide a continuous and endless supply of energy in the form of electricity and heat. This made life easier for urban dwellers, which had access to a more stable supply and in most cases to cleaner energy (cf. wood and coal).

The transformation of different energy sources into useable energy has always had impacts on the environment. However, small-scale energy provision from the past, although many times relying on non-renewable sources (e.g. fossil coal), had a relatively low impact on the environment. The ever-growing demand from the new urban era dragged supply with it and required the use of more resources, especially non-renewable. With time, this would become a tremendous challenge for society due to shortages, price volatility and political instability, as we will discuss later on. Centralized systems and "infinite" supply increased the distance between users and the source of energy, and the awareness of costs and impacts that users-producers had before dissipated in between. Besides, unhealthy dependencies were inevitable, as many cities, regions or even countries did not have access to energy sources, while other had it in excess. Modern transmission technologies and infrastructure made it possible to create interregional and international distribution grids, crossing physical and imaginary borders for energy to reach its destinations.

It is clear that the current economic and social systems rely heavily on the supply of energy produced at a larger scale. Technology is one of the cities' most characteristic features and humans have used their ingenuity, through the use of technology, to solve the problems that they encounter. Keeping this in mind, some communities and movements have started to combine the old and the new ways to solve some of the problems they are facing and some of the disadvantages of centralized energy supply.

Energy supply has been long-term organized in a way that has hardly been discussed by customers. However, decision-making about the type of energy supply at the national and local level receive growing dissatisfaction in some categories of citizens in several countries recently. The wish for natural renewable energy supply by wind and solar energy is emerging. Renewable energy can be used again and again, and will never run out. Natural energy – besides wind and solar also hydro, geothermal, tidal and wave energy - does not have a limited supply (Clean Energy Ideas, No date). The concept of "Waste-to-Energy" is also considered as renewable energy, although in essence, Waste-to-Energy is not renewable energy but the application of otherwise wasted energy.



In some countries the self-experienced barriers for renewable energy such as solar energy became a basis for citizens to question the obviousness of decision-making by politicians and energy companies (both public and private) without the involvement of their citizens and customers. Nowadays, citizen's dissatisfaction with certain issues is latently present. The dissatisfaction is expressed via social media such as Internet networks, blogs, Twitter, and Facebook. "Virtual communities" of men and women share similar latent interests, such as the wish of a collective good, even when its achievement will not necessarily benefit their own situation. This might be visible in the realisation of 100% renewable energy self-supply in several smaller communities in different countries in Europe.

The aim of the project is to understand citizen's involvement in sustainability movements and analyse what it means in terms of the demand and supply for renewable energy. The project is designed in two phases:

- 1) A research of five communities in Denmark, Germany, and the U.K. about what we can learn from small communities that have (nearly) reached self-sufficiency in renewable energy. Small communities are defined as communities up till 20,000 inhabitants. The research includes an analysis of the actors, incentives and type of renewable energy in the transition process. The literature framework (3.1) and the research field (3.2) are partly based on the student project group research by Larsson and Nyberg (2014).
- 2) The use of a research questionnaire distributed to residents of "eco-villages" in Sweden inquiring about their motives for taking one step further towards more sustainable lifestyles and their willingness to participate in such types of initiatives with the aim to understand obstacles and driving forces for self-sufficient renewable energy production (Ch. 4).

Insights in consumer wishes provide a base for the feasibility of their integration in the decisions about future energy supply. Factors such as personal wishes, self-realisation and/or security of renewable energy supply need to be considered against issues as pricing, micro grid development, base load security and investments. Increased knowledge of these aspects contributes to better understanding of energy self-interest trends in society and optimal arrangements of supply and demand of renewable energy. The project will generate a greater understanding of the commitment and drivers to go on the pathway of renewable energy applications by communities and their citizens.

## 4 Research Phase 1

### ***4.1 Interaction of policy levels with small communities on renewable energy***

Many cities in the world have a long-term and strategic environmental and climate goal to become CO<sub>2</sub> neutral and “fossil fuel free” in the near future. Local authorities have formulated this policy on their political agenda in most of the cities. It is interesting to see how the dissemination of this policy is performed in practice with respect to the involvement of citizens. The participation of citizens is hardly present in Sweden, while the participation of citizens in small communities in Austria, Denmark and Germany is emerging.

Looking at the national level, we see Austria, Denmark, Germany and Sweden as frontrunners in renewable energy application. The Netherlands and the U.K. are in the rear of the EU with respect to renewable energy. We selected cases in Denmark and Germany to analyse the development of citizen involvement in renewable energy application. We have selected the U.K. as a less advanced case in terms of renewable energy, although also there citizen initiatives are present. Cases in Sweden are not selected in Phase 1 of this research, because we focus on developments in neighbouring countries. In Phase 2, experiences from “green communities” in the form of eco-villages in Sweden are researched.

At the EU level, the 20–20–20 goals require a substantial increase in installed renewable capacity in many countries in the current decade. Green championships have been organized at the EU-level for some years. More than 10,000 municipalities and regions from twelve European countries (the “Northern and Southern” countries are lacking) representing 100 million people participated in the annual “100% renewable energy regions” contest in 2013. In the award ceremony during the international “100% renewable energy regions” annual congress in Kassel (Germany) on the 24th of September 2013, two of the studied cases in this report were called European Champions: Wildpoldsried, Germany in the category until 5,000 inhabitants and Saerbeck, Germany in the category 5,000-20,000 inhabitants.

National governments can support initiatives for renewable energy projects. Renewable energy policies have first mainly experienced with purchase subsidy facilitation and later with mechanisms such as feed-in-tariffs (FIT) and/or the Renewable Portfolio Standard (RPS) (Lipp, 2007).

The FIT is a mechanism that provides a fixed feed-in price, or a fixed percentage of the market price, for suppliers of renewable energy to the electricity grid. The tariffs are set by the government and they normally differ between different renewable energy technologies based on their learning curve. This allows the government to support various technologies at various stages of development. The FIT has a long term guarantee for the supplier, normally eight to thirty years with guaranteed tariff levels, which allows market stability and security for investors. In order to secure market demand, regional electricity suppliers and grid operators are obliged to

purchase renewable energy on the argument of avoided costs. This support mechanism is implemented in the German and Danish renewable energy policies (Lipp, 2007).

The RPS is promoted by free market proponents. The government does not set any fix prices nor provides long term guarantees through the RPS support mechanism. Instead, this mechanism is based on a quota system where the electricity supplier is required to have a certain amount of renewable energy in their electricity mix. Hence, the government leaves diversification of renewable energy sources and price-setting to the market. To motivate suppliers to succeed with this policy mechanism, the government normally sets a penalty cost for those failing to meet the annual target. Trading can be a feature to buy and sell the amount of renewable energy sources between suppliers and thereby avoid penalty costs. The U.K. is using this kind of mechanism (Lipp, 2007).

Going from the national level to the community level, research will be performed in small communities. Based on the analysis of these small (nearly) 100% self-sufficient energy suppliers we ask the question: What can we learn from socio-dynamic processes in small communities for the up-scaling of renewable energy and resources cycles in larger cities? The processes of stakeholder and citizen-driven activities in these small communities will be described and analyzed in Section 3.5. The following research questions are formulated for this analysis:

- What types of renewable energy applications are performed and why were these types of renewable energy applications selected?
- How has the transition been performed in five selected small communities in North-West Europe?
- What actors and incentives played a relevant role in this transition process?
- What are the crucial conditions in small communities, from a socio-dynamic perspective, for a modification and adoption process to up-scale renewable energy and/or resources cycles in larger cities (from 100,000 to 200,000 inhabitants)?

## ***4.2 Are specific societal trends on enlightened self-interest tangible in North-Western Europe?***

“Virtual communities” of men and women of similar interests, who live in different parts of the city and might even not know each other, are now coming together on the Internet. Quite often, they never meet in person, but they get to know each other over time around the issues that they are caring the most about. Such public interest groups seek a collective good, the achievement of which will not necessarily benefit their individual situation. Not only exchanging their care but also supporting private companies through membership donations (e.g. the membership of Plantagon, a Swedish sustainability concept consulting firm, owned by an North American Indian tribe) and arranging collectives to jointly organize the application of renewable energy are illustrations of emergence of new behaviour (e.g. the successful “Sun is Looking for a Roof” private action in the Netherlands, that extends solar energy without a subsidy programme by 5% in 2012<sup>1</sup>, and the CitizenPower/Sunriding project in Germany that sets out to enable ordinary

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<sup>1</sup> More information can be found in e.g. *Ideaal Magazine*, April 2012 issue.

people to team up and plan, finance, build and maintain photovoltaic installations together, especially in high-density urban areas. These activities are referred to as "Sunriding"<sup>2</sup>).

These bottom-up activities jointly cover commitments to address ecological issues and the willingness to pay a premium. Further exploration of these trends can be done for instance in respect to Bo2017.

Another development is the translation of the potential of bottom-up activities into actions stimulated by local governmental representatives and/or local community leaders. This phenomenon in respect to renewable energy can be observed in several communities in North-Western Europe. The study of how such changes to 100% renewable energy supply with support from a diversity of sources and citizen's investments has been realised in a number of small communities will be the basis for the analysis of the possibility for up-scaling dissemination activities in larger cities.

### **4.3 Literature framework Phase 1**

The literature frame presents several fields related to the project.

The emerging environmental problems in the 1960's and 1970's were the basis for "*Grassroots movements*". Carson's "Silent Spring" (1962), Meadows et al.'s (1972) Report to the Club of Rome and grassroots movements were strongly condemned by industry and hardly accepted by society at that time. Terms such as "Prophets of Doom" (Grayson and Shepard Jr, 1973) were used to disqualify those early warnings and grassroots movements. Nevertheless, environmental sciences and grassroots movements grew to an acknowledged position in modern societies. During the development of more participative societies (Cornwall and Coelho, 2007), several environmental advocacy organisations have evolved from protesting via lobby organisations to stimulating citizen's initiatives in transition movements for renewable energy (Devine-Wright, 2011).

Enlightened self-interest is a term used to describe an idealized model where individuals make decisions for the long term (often at some individual expense), that will benefit the individual (and often the group) in the long run. This is the opposite of blind or unenlightened self-interest with a greedier approach that may cause the individual (and the group) to miss out on a valuable long-term benefit (Murphy, 2002). An interest group is an organisation of people with similar goals that tries to influence processes to achieve those goals. Many factors affect the success of an interest group, including its size, its intensity, and its financial resources. Small groups may actually have organisational advantages over large groups (Edwards III et al., 2010). The role of social media is perceived as a new aspect of communication in interest groups: the "virtual" organisation.

A Dutch case study by Oostra and Jablonska (2013) was conducted among actors from both the demand and supply sides in the Dutch energy market including representatives from grassroots movements and representatives from local authorities. This resulted in the description of a

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<sup>2</sup> More information can be found in e.g. [www.consuming-energy.org](http://www.consuming-energy.org).

mixture of the following drivers: concern about energy prices; the improvement of living conditions; the improvement social cohesion; the promotion of local activity; the control over the community's own energy supply; concern about environment; the idea of a more efficient energy production; and the dissatisfaction with large energy corporations. This mixture suggests that there are many drivers associated with the development and independency of the local community (Oostrá and Jablonska, 2013).

Wüstenhagen et al. (2007) argue that while there are ambitious government targets to increase the share of renewable energy in many countries, it is increasingly recognized that social acceptance may be a constraining factor in achieving this target. This is particularly apparent in the case of wind energy, which has become a subject of contested debates in several countries largely due to its visual impact on landscapes. They introduce three dimensions of social acceptance – namely socio-political, community and market acceptance – that needs attention. Musall and Kuik (2011) conclude that while public support for renewable energy measures is high on an abstract level, the situation in the local context is often very different. Here, the impact of renewable energy might cause resistance. Empirical research shows that a community ownership model can have a positive effect on local acceptance. Moreover, Kellett (2007) states that top-down governmental policies and reliance on market mechanisms are failing to produce the reductions in energy demand and shifts away from fossil-fuel reliance that are required. He reports on an approach that could be replicated elsewhere. The method includes estimation of baseline energy demand, energy efficiency potential and renewable energy resource assessment as a precursor to action.

An innovative community-based energy service company is described and the benefits of a community-based bottom-up approach to carbon reduction are outlined (Kellett, 2007). Cooke (2010) concludes that regions with innovative development agencies, e.g. with regard to renewable energy, will prosper from tapping new horizontal cross-fertilisation opportunities turning it into international knowledge portals. With respect to dissemination, Warde (2005) states that the source of changed behaviour lies in the development of new practices. Resuming these observations, attention will be paid to the national context of how governmental renewable energy policies can be coupled with the incentives, transition processes and technology applied that has led to communities that are self-sufficient on renewable energy.

In this line of thought, the Transition Management (TM) approach aims to orient changes happening in the long term in major societal subsystems (Meadowcroft, 2009). By following actors and their interactions, and the heterogeneous and diverse nature of resources and components that mold the adoption of new ways, TM suggests a non-linear model describing the interactions between different levels in society and the continuous feedback systems that nurture the emergence, stabilisation and decay of different societal initiatives toward change. Geels (2002) proposed a framework in which societal activities are analyzed from the perspective of the structuring (complexity) of the activities influencing the emergence and adoption (or rejection) of new ideas. This model, called the Multi-Level Perspective (MLP), describes three different levels of structuring of societal activities. As complexity increases, the ability to influence change diminishes. These levels are:

*i)* The micro-level (niche-innovations): low structuring of activities, thus wider opportunities to influence behaviour. At this level, most innovations and new ideas emerge, normally under protected environments (e.g. labs or think tanks).

*ii)* The meso-level (socio-technical regimes): medium structuring of activities, thus lower possibilities to influence and orient changes. At this level, all societal activities happen within a “regime”, a set of rules and habits that have gained momentum due to technological, cultural or political lock-ins<sup>3</sup>.

*iii)* The macro level (socio-technical landscape): high structuring of activities, thus hardly influenced by most initiatives. Activities at this level have a global nature, and the set of rules that govern it are rigid and complex.

The MLP depicts the interaction between these levels. In fact, disruptions at the macro level (e.g. global financial crises, increasing oil prices, etc.) create windows of opportunity at the meso-level that allow innovations and new ideas from the micro-level to jump in and have a trial in the socio-technical regime. Their acceptance or rejection, flourishing or decay, depend to a great extent on their compatibility and connectivity with other systems already embedded in society (Mejía-Dugand et al., 2013). In line with this project, the transition towards 100% self-sufficient energy supply takes place in the niche of a “socio technical regime” that is the basis of a complex relationship between social behaviour and technical systems (Geels, 2002). The social regime is exemplified by relations within a community and the technical aspect refers to infrastructure and physical systems that are present in the community (Syfang and Smith, 2007).

From another perspective, Mok et al. (2006) argue that the changes that happened with the introduction of the Internet have changed how people communicate. On the basis of data collected from the late 1970’s in comparison to data of a similar type at today’s situation they conclude that distance mattered more before the Internet. However, even though the matter of distance has decreased as an incentive for people to communicate, both in everyday life as well as between communities, the Internet cannot possibly eliminate the role of distance. Factors such as trust and physical contact are too important for human well-being to be eliminated by electronic contact alone (Mok et al., 2006). This plays an important role in this study, as it will be discussed later, due to the importance of the close ties within the community and between citizens and their governments for the successful implementation of renewable energy projects.

An important change for communication that the Internet has provided is that information has become global. Information sources such as Wikipedia, YouTube, Facebook, Twitter and blogs are social media where people can earn reputation and can follow community developments (Kinsey, 2010). That has created a change in the hierarchy of communication; the new social media sources allow people to share opinions not only in the debate section in the newspaper or in demonstrations, but also in a larger extent to express their opinions and describe their activities. This counts for communities as well (Kinsey, 2010). In this way they meet other local individuals interested in exploring all forms of alternative energy in for instance “Alternative

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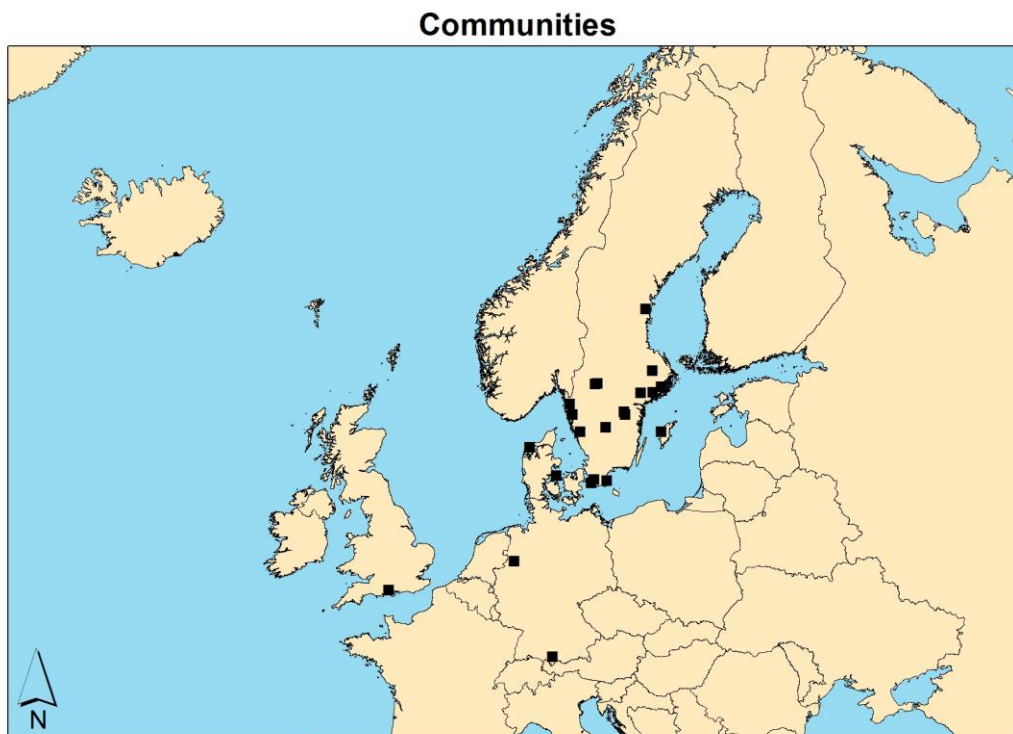
<sup>3</sup> The term “lock-in” refers to systems that gain so much popularity or technical acceptance that changing them is difficult due to impracticalities, incompatibilities, costs and habituation.

Energy Meetup Groups” and they discuss ways to preserve the world's resources and protect the environment<sup>4</sup>. Information and knowledge collection and diffusion in small communities and interest groups ask attention. Small communities may be isolated from some information and knowledge sources and therefore it is important to assess the role that key-actors play.

#### **4.4 Methodology**

The emerging selective enlightened self-interest trends in society and their consequences for the demand and supply of renewable energy is the subject of research in Phase 1.

A literature review on the topic has been focused on grassroots movements, enlightened self-interest, transition theory, renewable energy diffusion, and social media. A student group project research was based on a literature review, Internet exploration and e-mail information exchange (Larsson and Nyberg, 2014). Information was collected about twelve communities in Denmark, Germany, Sweden and the United Kingdom with less than 40,000 inhabitants (see Annex I). From the twelve communities, five were selected on the basis of the number of inhabitants, the scope of the project and the quality and amount of information available for further investigation. Identified key-actors of Samsø and Thisted (Denmark), Saerbeck and Wildpoldsried (Germany), and Lyndhurst (U.K.) (see figure 1) were interviewed via Skype in January and February 2014.



*Figure 1. Studied European communities.*

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<sup>4</sup> A good example of this groups is <http://alternativeenergy.meetup.com>

The interview questionnaire was based on a semi-structured methodology, in which guideline questions were prepared in advance including the most relevant topics for discussions, but the conversation was free to evolve in order to reveal new or unknown aspects of the studied case. Notes were taken and stored in a protocol and subsequently analyzed to identify and highlight important characteristics through a cross-analysis of the cases.

## ***4.5 Case study description on the basis of interviews***

### **4.5.1 Cases in Denmark**

The Danes' first initiator of a policy for alternative energy sources, others than conventional sources, was a result of a grassroots movement interested in wind power. With governmental support and a growing range of wind power developers, the wind sector managed to break the barrier to the energy market in Denmark in the 1980's. Further on, the Danish government started trying ideas for the renewable energy policy and it emerged in a FIT mechanism together with investment subsidy and tax reductions for wind power generation. This broke the barrier further to the energy market, allowing private stakeholders and interest groups to enter it. However, in the 21<sup>st</sup> century, as the market matured for wind power in Denmark, the government chose to draw the FIT mechanism back and reduced its support for research & development (R&D) and investment. This liberalized the market and has become a barrier for private stakeholders and smaller businesses and groups to invest (Lipp, 2007).

Despite Denmark's green credentials in wind energy, the country is still heavily dependent on coal. In 2010, coal accounted for nearly 44% of the country's total power supply. Coal counted together with other fossil fuels for two thirds, while renewables accounted for one third. The government's proposal called for coal-fired power plants and oil-fired heating to be phased out by 2030. Coal heating, which now accounts for 11% of the total heat supply, would be replaced by biomass (Reuters, 2011).

#### **Samsø (Denmark) – ca. 4,000 inhabitants**

Samsø is an insular community located in the Kattegat area. Their economy is mainly based on agriculture and tourism. Being an island, competition for resources is great, so a sense of community was greatly needed for the development of any self-sufficiency project. According to Hermansen (Interview 9 January 2014), the idea of self-sufficiency (or at least a more sustainable energy system) came up already in 1997, after the Kyoto meetings. The by-then Minister for the Environment, Svend Auken, led these types of initiatives in Denmark.

Already that year, the government launched a competition for communities to become test sites for renewable energy projects. The community won this competition by developing a plan that would cover feasibility studies (e.g. solar hours, wind potential and efficiency, improvement potential of buildings, and biomass availability) and would work on three areas: electricity, heating and transportation. The community promised to reach 100% supply of renewable energy in ten years. They did it in eight years.



The original plan included the following measures:

- Electricity: The island is located in a windy area, making it suitable for on-shore wind energy projects.
- Heating: Heating was procured individually before. A whole new strategy was created for a district heating network, in which 60%-70% could be reached using straw, waste and wood chips. Additionally, 2,500 m<sup>2</sup> were allotted for solar collectors to work during the spring, summer and a part of the autumn. The remaining months would be covered later on by the excess electricity produced, by installing heat pumps.
- Transportation: The community rented ten off-shore windmills to offset emissions from transport on land. New projects of biogas and electric cars took place, and even a biogas-fuelled ferry started sailing.

Such measures have led to a substantial decrease on the per-capita emissions of the island's inhabitants. It is estimated that they currently have a negative footprint (in terms of emissions) of -3 ton CO<sub>2</sub>, compared to the national average of +10 ton CO<sub>2</sub>.

The connection from the community to the different projects was very important for the successful outcomes it has had. Hermansen says that very little NIMBY (i.e. "Not In My Back Yard") atmosphere was felt and he actually talks about support and IMBY (i.e. "In My Back Yard") attitudes. What he highlighted as one of the most important features of these projects was communication. Technology and planning were not really the hindrances, but to address local values and address fears, more than idealistic visions, which takes time and effort. In many cases, these fears emerge from the lack of knowledge that particularly lay citizens have. Translating technical and financial concepts into everyday, down-to-earth language is crucial and Hermansen was able to take that role. Technical and planning issues were handled by a "mainland" engineer; it basically took two people to start and fuel the process.

It was of course equally important to develop a functional financing scheme. Winning the competition did not assure large financial resources for this community in the form of subsidies or contributions; the central government supported them by providing progressive energy policies, political support and technical assistance, crucial components for success according to Hermansen. This was a central requisite for these undertaking: the community should show that their strategies were suitable under regular market conditions, i.e. the same as everyone else.

The projects are owned entirely by locals, which decreased the risk of resistance due to the high levels of transparency and governance. It was clear that most people were not interested in the whole strategy, so the plan was divided into (minor) separate projects (e.g. windmills, district heating and solar energy). They looked for those interested in each project and provided room for public meetings with experts. Although it took time and numerous meetings, the outcome was good: with increased education/knowledge, less resistance.

Although the entrepreneurial spirit of local farmers had strong influence on the implementation of these projects (i.e. they are used to work independently, to be their own boss), external events had a great influence on them. In 1997, when the project's inception started, the price of one

barrel of oil was about 30 US\$ in international markets. This would change, and locals were aware of that: “Invest in your own infrastructure. Negotiate with your neighbour instead of with Saudis.”

Different financial schemes were designed, according to each project. Many projects were financed by local banks; the Energy Academy would facilitate the decision-making process from both parties by providing information about pay-back time (considering the savings as a product of efficiency and/or local energy production) and a lifecycle perspective: numerous households were included in different projects, with investments ranging from 50,000 to 100,000 DKK.

On-shore wind power projects were secured a feed-in tariff, which gave banks a guarantee on the investments. About 2,000 shares at 3,000 DKK were sold. Seven shares (equivalent to about 7,000 kWh) would guarantee self-sufficiency for an average household. District heating was promoted by providing no connection fee in exchange for a contractual obligation to buy heat from the straw plant. Off-shore mills are owned 50% by the municipality, 50% by private corporations. The total investments required, for all the projects comprising the plan, an investment of 450 million DKK.

Well-designed financial schemes, information provision and policy support were crucial in Samsø's case. In addition, the new energy sector provided the community with new jobs, which created a stronger bond and sense of belonging. A close cooperation with academia has contributed to improve the technical knowledge and to close the gap between implementers and locals. As of today, more than 100% of the electricity used by locals comes from renewable sources. For district heating, they have reached the 70% mark and plan to increase it by using the excess electricity to drive heat pumps instead of other non-renewable energy sources.

### **Thisted (Denmark) – ca. 13,000 inhabitants**

Thisted is a rural municipality located in the region of Thy, one of the largest in Denmark. Their economy is mainly based on agriculture and tourism.

The transition of the region into renewables was strongly influenced by the oil crisis in the 1970's. Almost all the energy consumed in the country was based on imported oil, which was costly. During the second half of the decade, political consensus was reached to decrease this dependence: 30 years later, about 40% of the energy used came from oil, mainly for transportation. Such political support came together with stable energy policies helping the transition into renewables (except in the time frame 2002-2011). A new government started the support for renewable energy again in 2011.

The transition in Thisted started by focusing on “low hanging fruits”, i.e. easily achievable goals. Thus, programs for a more rational use of energy started to take place. Then, as technologies improved and investment opportunities arose, different interests started to emerge. Such interests have evolved in time, from private corporations in the 1980's, to numerous investors in the 1990's, to citizens in the 2000's. The top-down approach at the beginning demotivated many

locals, since they were not included in the ownership and decisions and could not compete against large corporations.

The region received financial support from the government. Up to 30% of the initial projects were supported in this way. However, the model for investment in the region's energy project is clearly focused on local ownership: only residents or inhabitants of nearby municipalities can own energy infrastructure. At the beginning of the transition process, the municipality performed a general survey, in which 80% of those surveyed supported the initiatives. Around 25% of the population got directly involved with energy projects. One share in the energy projects would cost ca. 3,000 DKK and each household is allowed to own a maximum of nine. Farmers are allowed to own maximum one wind turbine. On average, the investments have a return rate of around 16% (5,000 DKK), which is not much for a modern Danish family, but many households are satisfied, according to Maegaard.

According to the interviewee, the involvement of citizens and local companies in the different projects was the key to success in the case of Thisted. In addition, the use of mature technology and the help of the Folkecenter were crucial. These made it easier to overcome fears by providing technical security, knowledge and awareness. The interview adds that, surprisingly enough, the closer people lived to the planned turbines, the higher the acceptance: no NIMBY. This, together with other conditions of the energy and land market, has actually had an impact on the cost of the land, which could cost more than the actual turbine. In many cases, according to Maegaard, farmers opt for energy projects not because of the projects as such, but because they want to keep their land. Unfortunately, the impact on the price of land has created some resistance to on-shore projects. Although investors make money, land close to wind parks might suffer from this closeness. One alternative, i.e. off-shore wind parks, can be up to three times more expensive, so the community is looking for feasible options.

Although a lot of focus has been put on wind power (Denmark has the goal to achieve 50% of electricity from wind by 2020), the municipality has also numerous projects for other sources like waste, biogas and solar power. Around 76% of the thermal energy supplied to the municipality's district heating grid comes from non-fossil sources, serving more than 50% of all households in the municipality. The remaining households have reached a 63% share of renewables in their energy supply. In total, the Folkecenter estimates that the municipality has surpassed the 80%-mark of non-fossil energy sources. Today, the municipality's energy system consists of 219 windmills and a CHP with an installed capacity of 113 MW and 36 MW, respectively.

Additional projects are taking place but are more on a research phase, like wave energy projects in the coast line. The country has set a goal of reaching independence of fossil energy by 2050, out of which 5% is expected to come from waves. The 5% wave energy is meant as a stabilizer in the supply variation process of wind and solar energy. Wave energy is still in the research phase of new technology. One of the projects takes place in Hanstholm, near Thisted, with the aim of a full-scale wave energy regime. A debate on wave energy with citizens has been organized. The wave energy device is close to the shore and asks for big investments, partly by locals. The wave energy research institute IENC has a good relationship with the Hanstholm

harbour city. The mayor is chairman of a forum where major stakeholders of the community are involved in the continuous dialogue about the application of wave energy.

According to Krogh, the “Thisted model” was based on the continuous interaction with the local citizens, using known technology (the local blacksmith made the windmills, maintenance by local people), good business (the bottom line is economic, not environmentally), and planning by the local municipality.

#### **4.5.2 Cases in Germany**

Germany started, similar to Denmark, to consider alternatives to oil after the oil crisis. They started a support program for R&D to find alternative sources which mainly led to advances for coal and nuclear power generation. Any particular renewable energy policy did not emerge until the late 1980’s, after explosive resistance against nuclear power motivated by the Chernobyl accident. Germany introduced the first FIT bill in a new law in 1990. However, the mechanism did not provide much guarantee of fixed prices or considered different technologies maturity for the energy market. Not until 2002 Germany designed a really barrier-breaking policy by the introduction of the Renewable Energy Sources Act (RESA). RESA changed the FIT-mechanism so that fixed feed-in prices were set for renewable energy suppliers, as well as it provided greater support for R&D and investments. A further guarantee was that the nearby regional energy suppliers were forced by law to buy back renewable energy from small-scale suppliers. RESA also guaranteed long-term agreements for the price-setting of different technologies, based on their learning curves and market stability. This became a successful policy for Germany (Lipp, 2007).

Windpower provides the largest contribution to the renewable energy input of approximately 23% of Germany's electricity supply at the end of 2012 (see development in Figure 2) (Focus, 2012). Solar energy accounts for 9.3% of all energy produced (Statistic Brain, 2013). Germany added some 47.7% more solar in 2012, because there was huge customer demand for storage of cheap photovoltaic (PV) energy, which customers want to store in the day and use in the night. The German government expects incentives to drive down the initial cost of energy storage and encourage innovation, thereby driving the costs even lower and helping storage become reality. The CitizenPower movement has continuously evolved: starting off with a few “strange” people erecting wind turbines (so-called “*Bürgerkraftwerke*”) in the late 1980’s and moving to more mainstream photovoltaic (PV) installations in more recent years.

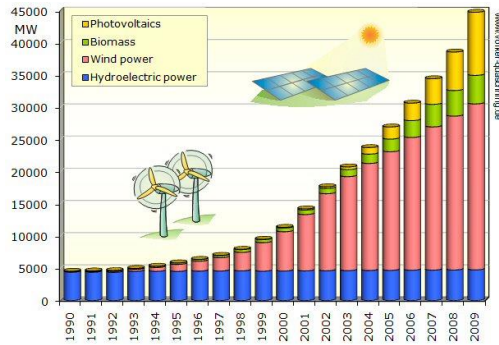


Figure 2. Left: Renewable energy capacity development 1990-2009 in Germany (note the behaviour of wind and PV capacity). Right: Wind power ownership in Germany, as of 2010 (note the difference between Private individuals and Utilities ownership, i.e. 52% vs. 7%) (Sources: <http://www.volker-quaschnig.de/>; <http://ramblingsdc.net>)

### Saerbeck (Germany) – ca. 7,300 inhabitants

Saerbeck is originally a rural community, and its economy based on agriculture. However, more recently, the region has received different industries ranging from software to wind power. Moving into an “Energy Autonomy” was a community initiative. In the year 2000, the community decided to invest 20,500 Euro in energy efficiency measures for schools. At the beginning, there was not much faith in the initiative from local politicians, but the results showed to be satisfactory in two years, convincing them of the potential benefits from this. Inhabitants requested also the use of PV technology in public buildings.

The municipality decided to participate in a regional competition from the Ministry of the Environment in 2008. A plan to turn into a renewable-energy self-sufficient community, including 115 projects won in March 2009. The goal was reaching 100% renewable energy use by 2013. Although the central government was more interested in large, centralized projects, the municipality received 1 million € as financial support from the regional environmental protection agency to advance on some of them.

Participation from locals has been a priority since the beginning in Saerbeck, so different schemes for citizen participation were designed. The first step was to perform a survey through which the project leaders wanted to assess the knowledge that locals had regarding renewables and their will to participate in the different projects that were being promoted. This survey had a response rate of about 25%. In addition, local students were engaged in the discussions through research projects and the presentation of results in public meetings, in which as much as 200 people showed interest in participating. In these and subsequent meetings, the focus was on giving answer to questions about the objectives of each project, costs and financial projections, and implementation.

The approach to implementation took the shape of different networks, in which both citizens and local companies got involved with each project. Overcoming fear and distrust (especially of a NIMBY nature) was a challenge at the beginning, but was confronted by testing technologies and approaches in public facilities first. With time, citizen resistance was overcome and the real

challenge shifted into politicians, who had a difficult time coping up with the fast-changing environment (e.g. modifying policies, incentives, controls). For those individuals interested in investing in the different projects, a financial scheme was designed in which they could invest up to 20,000 €. 4 million € were collected in total, mainly from local inhabitants. External actors were interested, but priority was always given to locals. A local heating system with ten renewable-energy stations on the basis of wood pellets started in 2010 is an illustration of one of the projects.

Finally, an important component of these projects was the implementation of a “showcase”, a path in which information about renewables in general and about the technology used by the municipality was presented for anyone interested. The involvement of pupils (youth) in this process has been crucial, as they are seen as an important stakeholder, to which these efforts are ultimately directed. In addition, an old ammunition shelter was bought from the military and transformed into a Bioenergy Park, with an installed capacity of 6MW from solar energy.

Most of the efforts at Saerbeck had to be made by the municipality and its inhabitants. The central government is not always willing to support their initiatives with policies and regulations, so they had to look for solutions to address the difficulties. For instance, the community bought the local electricity network from the corporations that owned it. Guido Wallraven feels that bottom-up and top-down approaches barely connect, and states that the advantages for large corporations are barriers for the small ones. This has led them to trust more on participatory, bottom-up approaches, as they involve locals and strengthen their sense of belonging and their care for the projects. However, these investments and initiatives have had good results and have created job opportunities in the new energy sector. Up to 1,000 jobs have been created in the sector, including an important manufacturer of components for the wind power industry. This has had of course a tremendous impact on the locals’ acceptance of the projects. The current mayor has played an important role in this process, especially by working on closing the gap between banks and investors.

Up to the year 2013, the community had reached a supply capacity of twice their actual demand. Reaching independence was planned for 2030. This capacity includes up to 8.5 MW of peak supplementary power from photo voltaic panels in roofs in houses and farms, seven windmills and two biogas production facilities to digest household waste for the CHP plant. The municipality is looking to benefit from this fact by selling the excess energy to the regional grid. Research projects are under way, especially focusing on energy storage. Another focus is on transportation by car-sharing, a local bus and a “village car” available for rent.

### **Wildpoldsried (Germany) – ca. 2,500 inhabitants**

Wildpoldsried is a small agricultural community located in southwest Bavaria. The community started their current direction into self-sufficiency and renewable energy production already in 1997. With the election of a new mayor (who is still the mayor as of 2014) and a new council, the municipality became more engaged in energy and environmental issues. The most evident feature with the entering administration was a more participatory administration, where citizens were more involved in decisions.

In this line, in 1998 the administration developed what they called “brainstorming weekends”, a set of workshops where everyone willing to participate was allowed to provide ideas without constraints or budgetary concerns. The idea of energy independence came up and was accepted. However, the need to involve citizens in this process was immediately identified. Thus, a public survey was conducted and numerous projects were identified as possible. Although money was clearly a limitation, the administration decided to approach them from a long term perspective, prioritize them and start developing them, one by one. All points in that list are covered as of today. In particular, renewable energy projects were in the minds of many inhabitants, which facilitated those kinds of projects.

These plans were founded on three fundamental pillars:

- A focus on renewable energy and energy efficiency projects.
- Local resources were to be used for energy and building purposes.
- Protection of water resources would be a priority.

As in every project, there was a need for pioneers, innovators and early adopters willing to take a risk. Some farmers took the lead and invested in biogas plants and windmills (the first one around the year 2000), without subsidies from the authorities. Early starters help the projects develop with less resistance, since they can acquire experience and translate what they have learned into the community’s own language. According to Günter Mögele, fear is overcome after two to five years, when the projects show economic and environmental results.

With time, workshops started taking place around these topics every month. Different groups were set for each subject (e.g. renewables, culture, events), where anyone could participate on a voluntary basis. Each responsible group elects a board which decides what to do with the revenues. The municipality took these groups’ members on field trips in which they would look for good ideas in surrounding municipalities. Universities and external experts were involved as much as possible: Siemens, some local universities (*inter alia* Aachen) and the local energy provider are important allies in some of the projects that the community has undertaken, since the main obstacle, according to Mögele, has been the use and development of information technology (IT). Siemens’s office in Munich developed a smart grid (had never applied that earlier). Also “e-cars” were tested in the first phase of the renewable energy implementation plan.

The return on the investments has been estimated to be between 5% and 10%, and the conditions for this return are translated by the authorities to citizens, who understand the particularities of this sector. There are eleven windmills owned by the municipality, seven of them inside the community and totally financed by citizens of Wildpoldsried. These projects were financed 60% by banks, 40% by private investment. The last two windmills required an investment of €7.2 million. The maximum investment allowed per individual was €5,000, and the maximum 100,000. These limits have the intention to allow all citizens to participate and keep large investors away. The return on investment showed many changes. The last two years, the return on the investment was of around 10%.

Despite the good success of some of the energy projects started by the community, Günter Mögele thinks that the up-scaling of some projects cannot happen without subsidies. For example, a large PV project, costing €4 million, took place in 2004, but could not have happened without subsidies. Back then, 1kWh-peak would cost more than four times what it costs today, when almost no subsidies are needed. In fact, locals prefer to use as much of the energy they produce as possible, since they do not receive good prices when selling it back to the grid. One of the reasons is that they have not been able to negotiate feed-in tariffs.

As of 2013, although some detached houses had reached an 80% level, the community as a whole had reached 60% of their use of thermal energy provided from renewable sources. The case for electricity is a dramatic 500%. However, the community is facing challenges to stay within the established boundaries: they are already close to the sustainable limits of wood use and increasing the biogas capacity has proven to be expensive. There are projects to work on a better insulation of buildings, the use of heat pumps and solar-thermal energy with the aim to reach 100% renewables use by 2020.

### **4.5.3 Cases in the United Kingdom**

The development of renewable energy policies in the U.K. started later than in Denmark and Germany. This can be explained by the high abundance of coal and lower public resistance against nuclear power, as it was commercialized. This never pressed the government to consider any support programs or policies for renewable energy technologies. However, with time coal was changed to natural gas in order to reduce CO<sub>2</sub>-emissions and a restriction against coal power was further introduced. However, as resistance against nuclear power remained low, the obligation mainly led to further R&D support to nuclear power generation. After a lot of concerns on limited innovation diversity outcomes from the obligation it was further changed to only consider renewable energy sources. A quota system was thus introduced, forcing energy suppliers to feed in a certain amount of renewable energy in their mix. This was complemented with a penalty and trading system.

Failing to meet the quota meant penalty fees that were supposed to be paid back to successful suppliers. This led to short term contracts in order for large suppliers to be able to control the prices easier. The least-cost criterion emerged which limited diversity and created uncertainty for R&D markets for other technologies than the already more mature wind turbines and biomass technologies. This market-based policy has limited the diffusion of renewable energy applications since it has not succeeded to give any incentives for small suppliers and the major market power still lies in large actors' and stakeholders' hands (Lipp, 2007).

#### **Lyndhurst (United Kingdom) – ca. 3,000 inhabitants**

Lyndhurst is a small rural community located in South-western UK. The triggering event regarding renewables in the community happened in the 1990's, when there was a proposal to improve the energy performance of the Community Centre (built in the 1960's), which had no insulation and thus a high energy consumption, mainly in the form of natural gas. The director started then programs for the realisation of feasibility studies looking at biomass, solar heating,



heat pumps and better insulation of the building as possible alternatives. At the end, biomass and PV technology were not implemented due to concerns about availability and costs.

A lot of these projects are done with the help of the National Park Authority, which finances sustainability projects around the country and acts in a proactive way to promote the implementation of environmental technologies. The community centre project was attractive at that time because it was the first time it was performed at a community building. After seeing the benefits from the improvements, and considering the overcapacity of the boilers installed, there was a discussion about the option of extending the network to adjacent buildings, but some technical and supply issues hindered this development. This hindrance was reinforced by the general conditions of district heating systems and the people's understanding of them in the UK.

However, with time PV technology started to gain interest from the citizens as it became more feasible and less costly. The community started projects within the renewable energy sector, where public shares were available in the range of £250 to £20,000. There were discussions whether only local investors should be allowed in these projects.

Most of these projects, especially regarding solar energy, have received no NIMBY, mainly due to the nature of the land: farmland that is scarcely populated. There were numerous supporting letters and no formal opposition to these projects. An important characteristic of the communication of the plans was that they were publicly informed and consented with other surrounding towns through council meetings, explaining the content of the plans and clarifying questions and doubts among the participants. The project can deliver 2.4 MWh against a guaranteed prize for 20 years.

Renewable energy is in debate in the U.K. An important issue for bigger cities is the guarantee of the connection to the national grid. It is remarkable that there has been almost no involvement of local universities in the development or monitoring of these projects, nor suggestions for their further expansion.

#### ***4.6 Analysis and conclusions of Phase 1***

From the cases, it was found that energy crises such as the oil crisis in 1973 have laid a first layer of awareness for the need of energy independency. Although events of this nature shake the foundations of the energy systems mainly from an economic perspective, the reasons for moving resources and influencing change into a self-sufficient community can take also other shapes. For example, special events such as the national or regional renewable energy competitions in Samsø and Saerbeck provided strong incentives for these communities to set the goal of establishing a 100% renewable energy self-sufficiency policy. From the presented cases, two reasons are transversal: environmental concern, and political and financial concerns (i.e. dependence on foreign resources).

A significant outcome is that in all cases in Denmark and Germany, the central role of the interaction between the municipality and the citizens for the successful implementation of the renewable self-sufficiency targets is highlighted. Such interaction has a very important component: citizen ownership. Such mechanisms generate confidence for the retraining of local construction companies for the installation and the maintenance of the new renewable energy

systems. Together with the price guarantee system of the produced energy (i.e. feed-in tariffs), it also creates trust for the involvement of local banks. Such banks also benefit from the close relationship between citizens and politicians in some cases. The latter help overcome fears and bring funders and investors closer together. This is aided by other actors that provide technical support, help to properly calculate pay-back times and what is most important, help translate the complicated technical language into laypersons' language, which facilitates the negotiation processes. Furthermore, the foundation for the connection to external renewable energy experts is laid. Another important result is the creation of new jobs. The new renewable energy systems do not only bring new employment in that sector, but is also attractive for new companies in other sectors to settle there.

Interest groups for citizen's enlightened self-interest for renewable energy have their limitations. The interest group can be successful and individual citizens can apply renewable energy such as solar energy. In general, (co)ownership is an important facilitator of projects aiming to reach 100% renewable energy self-sufficiency. However, it does not guarantee the achievement of this goal by itself. Interaction between the community and citizens takes a longer time and bigger effort to show the citizens the advantages of the aim of developing towards 100% renewable energy self-sufficiency.

An interesting development occurred in Denmark, when a process of up-scaling of windmills and their required space, created the need to attract bigger investors from outside the community. Citizens developed a NIMBY attitude (80% of the Thisted citizens were against on-land windmill parks in 2012), which had not been shown in the earlier (co-)owned smaller scale windmill situation. The Thisted municipality decided to refuse permissions for big on-land windmill parks against the interest of the people in September 2012. They started the "new" development with investments by locals again.

With reference to evidence from the evolution of renewable energy consumer and producer awareness and action, it is suggested that the basic thesis about innovation gains from such regional knowledge spill-overs is relatively easy to find in exemplar renewable energy regions. It is concluded that those regions with innovative development agencies of the kind discussed will prosper from tapping new horizontal cross-fertilisation opportunities which are relatively costless and are easily turned into international knowledge portals (Cooke, 2010). We find this conclusion also in the Danish and German cases. Moreover, national and international knowledge-transfer activities started to take place in these communities, which is an additional contribution to local knowledge and capacity-building. In some communities this knowledge transfer was institutionalized, for instance in the Folkecenter in Denmark and the Energy Academy in Samsø. The director of the Energy Academy was also co-editor of an international book, called "Wind Power for the World: The Rise of Modern Wind Energy". In the German cases the knowledge sharing is performed by the key actors in the community organisation, through fairs and national and international visits.

In general, socio technical systems are constructed for large-scale centralized energy (especially electrical) supply. The legislation is also adapted to this system, which can be challenging for small organizations with limited resources and knowledge on how to handle it (Oostra and

Jablonska, 2013). In discussions with representatives of the small communities in Denmark and Germany this aspect was also acknowledged and overcome. The representatives suggested that the renewable self-sufficiency system could work in cities of up to approximately 200,000 inhabitants under the conditions that such cities are not too close to bigger cities and that they are connected to agricultural areas. A good concept for the balance between bottom-up and top-down approaches needs new communication frames (politics are distant from citizens).

Self-sufficiency is not a topic free of further discussions. For example, one might ask what to do when the goals are reached and there are still possibilities and resources to continue expanding the system. A clear case from this study would be Wildpoldsried, which according to the sources is now producing the equivalent of 500% of their electrical energy needs. An important question arises: when should these projects stop expanding? The risk of becoming a new large-scale provider in the region or the country is evident and must be taken into account if the problem that was attacked in the beginning is to be avoided. On the other hand, the transformation of regional and national systems from fossil-based into renewable can bring enormous benefits. The dilemma thus might become more political than environmental and the allocation of public financial resources could create discontent and incentivize the emergence of new problems.

It is clear from the cases discussed that solar and wind technologies are the most appreciated and mature in technological and financial terms when it comes to electricity. Regarding thermal energy, biogas and biomass, boilers are important sources. However, the goal to replace fossil sources on a larger scale requires a multi-modal perspective. Thus, projects to make the most out of other sources are crucial. Wave, tide and chemical energy transformation are being explored by some of these communities. Such research projects lie without a doubt on the foundations established by the former technologies, which have shown the viability of a system change, have broken through the paradigms of fossil-fuelled energy systems and have started important financial and political momentum to continue in the path towards more sustainable energy systems.

## 5 Phase 2: What can we learn from “eco-villages” communities in Sweden?

### 5.1 Introduction

The eco-village movement has a long international history. It started as a reaction against environmental degradation with a wish for collective living. The ideas arose quite early in Sweden, as the first ideas of an eco-village were started in the mid 1970's, and at this point, it is a well-established concept. The strong national debate regarding lifestyles effects on the environment in the 1970's inspired the movement, focusing on oil crises, a general environmental concern and present was also ideas of global solidarity, which arose in several other western countries. The idea of eco-villages, communities with high ambitions concerning social, environmental and ecological aspects started as a reaction to these concerns; it is fair to say that there were ideological ideas behind this movement (Persson & Karsten, 1990; Söderholm et al, 2008).

The concept of eco-village is quite ambiguous and was to a large extent used differently during the 1980's and 1990's. In order to find a common definition, the Swedish National Board of Housing, Building and Planning, decided upon a definition, stat that a community should, for example, consist of maximum 50 households that are administratively connected through e.g. a housing cooperative; there should be possibilities for small-scale farming, if possible, usage of ground water as drinking water purification; nutrients from sewage should be returned to the organic cycle. The importance of cooperation concerning water purification and composting is stressed, as well as usage of alternative solutions for heating. Social aspects are stressed as important in eco-villages, through cooperation and shared responsibility (Boverket, 1991; Palm, 1998). The first Swedish community of this form was Tuggelite in Karlstad and Tidäng (1992) stresses that, as one of the residents in that community argues, that the eco-village should not be seen as an ideal village, it is rather a part of a process; it should be an inspiration and the experience should be utilized. Other definitions exist, for example by the Gaia trust, which founded the Global Eco-village Network (GEN), where they identify eco-villages as:

*“... a human scale, full-featured settlement, in which human activities are harmlessly integrated into the natural world, in a way that is supportive of healthy human development and can be successfully continued into the indefinite future” (Gilman & Gilman, 1991).*

There have been three waves of eco-villages in Sweden. The first generation of villages were started during the 1980's, mainly focusing on energy saving, and the villages were started on the initiatives of citizens. The developments were not without obstacles, as the regulatory framework left little room for these kinds of initiatives, but the hard work and conviction from key actors and driving spirits were considered crucial for their success. During the 1990's several building companies took notice in the concept and started eco-villages. These were, however, often failures as the residents were not involved in the planning. As the first generation of communities had been started as grass root developments, with high social ambitions, the larger projects were lacking this rooting, and the community feeling was lost. The ecological ambitions were

however higher in these new settlements, aiming more for local circular flows (e.g. usage of earth-closets instead of regular toilets). The third generation of eco-villages took notice in inclusion of future residents in the planning process, and even though the processes were not without conflicts, these projects were more successful. Understenshöjden in Stockholm was a good example of this kind of planning (Berg et al, 2002).

The eco-village movement has, arguably, come to a halt in Sweden at the moment, as our mapping shows that few new communities are starting or are being planned. However, it is also a case of “re-branding”, as it can be argued that a new trend is rising at the moment. The *transition movement* is gaining attention and members, and a few small communities are planned, as well as off-grid communities, but most of them are in early stages. The common idea is that a transition is inevitable, due to peak oil, climate change and sustainable development and that by changing now it is possible to shape the future. Focus is on local initiatives as arenas for change (Omställning Sverige, 2014). However, few new communities have been started from this initiative yet.

Swedish eco-villages have been subjected to several research projects over the years (cf Berg et al, 2002; Berg, 2004; Berg & Nycander, 1997; Ibsen, 2010; Norbeck, 2009; Persson & Karsten, 1990; Söderholm et al, 2008). Focus has been on technical solutions, social dimensions, planning processes and everyday life. However, no studies have tried to approach all villages at the same time, using a survey, and there is a need to update the knowledge on the residents.

The reasons to study residents in the eco-villages are that they have experience from actually having made an environmental effort. They have invested time and money in these communities and it is thus interesting in this project to understand their experiences from that. If these residents which have arguably made substantial sacrifices for the sake of the environment still argue that it is worth it or not even a problem, it may be a guideline for others. The villages are pilot-projects that can be used as inspiration for similar ecological solutions and the experience from the residents in the villages are thus crucial. Several other studies have focused on the general public’s opinion on environmental and energy concerns, for example through the yearly SOM-surveys, but through our study we have the opportunity to learn from the experiences of those living in the villages. Research questions posed in the phase are:

- Which are the crucial factors and conditions for up-scaling of self-sufficient renewable technologies from a socio-technical perspective?
- What are the motives for moving to an eco-village?
- How are residents in eco-villages experiencing living there?
- What can be learnt from the experiences from residents in eco-villages?

### **5.1.1 Swedish eco-villages**

The number of existing eco-villages is not clear, but it will be further discussed in section 4.3, but it is often mentioned to be around 25 today, with sizes spanning from 2 to 50 households. In this section we will give a short introduction to one of the villages, to give a background to social, technical and organizational solutions that are often used in the eco-villages.

Tuggelite, in the outskirts of Karlstad, was the first completed eco-village in Sweden. It was started with inspiration from the Centre for Cross-disciplinary Research at University of Gothenburg in the 1970's. The researchers at the Centre argued that the Swedish housing policy, especially concerning energy, was unsustainable, and criticized it on terms of the large-scale, resource intensive and sterile "million public housing program" carried out from the mid 1960's and over the next ten years. The program aimed at building one million dwellings, most of them built in public regime with no influence from citizens, and the ideas of sustainable villages was a counter-reaction to this planning and policy (Ibsen, 2010).

The research group in Gothenburg wanted to implement the idea of a sustainable village with low energy and resource usage. Karlstad municipality was approached in order to anchor the project but the project was later put on hold. However, some of the ideas continued to live among the involved actors and the ideological foundations from the Gothenburg group were used in planning of the Tuggelite eco-village. Ten households, all with some relation to the research performed in Gothenburg, started an interest group in 1981 which worked towards the common goal of starting a community, despite several crucial obstacles, e.g. top-down planning structure and bureaucratic planning ideology. However, a number of strong driving forces made them continue the planning process. First of all, the group had a strong ideological foundation and had a strong wish to design its own residential area, with knowledge from the research performed earlier. Secondly, the members of the interest group had a strong environmental concern, for example through involvement in the anti-nuclear movement and alternative energy sources were in the top of the agenda also in this group. Thirdly, the significant competence and relevant education in the group made it possible to run a bottom-up-process. Lastly, several members had previous experience from collective living and shared an ideological basis, making it realistic to think about a true community in some sense (Ibsen, 2010).

Tuggelite was finished in 1984 and contains 16 households in five houses, surrounding a common house with a community centre, laundry facility, sauna, kitchen and some storage units. The high ambitions concerning energy usage was implemented in various ways. The houses are built in a similar way as today's passive houses, although not as efficient, trying to use as much of the heat energy from humans and electrical domestic appliance as possible. This can be done through insulation, construction using as much solar insulation as possible, wind sheltering and heat storage in the foundation of the houses. Each dwelling also has a glass room in which the air going into the ventilation is being preheated. During the winter months there is a need for additional heating and this is also necessary for warm water production. Two pellets fuelled furnaces, placed in the common house, is the common heating system and the water is being transported in a pipe grid to the dwellings. The total effect is 100 kW in the main furnace and 60 kW in the back-up. The community has also invested in 120 m<sup>2</sup> of solar panels with two accumulator tanks. The village is connected to the municipal sewage system, but uses grey water for watering the farming lots. In the beginning, composting toilets were used, but they have been replaced by ordinary toilets (Fittschen & Niemczynowicz, 1997; Norbeck, 2009; Tidäng, 1992).

Tuggelite is organized as a housing cooperative, where residents are buying shares in the community and pays a monthly fee. It consists of a board of directors and working units are implementing decisions. The common house is frequently used, as the mailboxes are located

there as well as laundry facilities, day-care for children recycling or social gatherings in wood shops or usage of the sauna. It is the central hub, and most other eco-villages do have a common house like this. The maintenance and work is shared among the residents, through working units that are mowing or shovelling snow, smaller repair work or working with the heating system (Norbeck, 2009).

Tuggelite was, as mentioned, the first eco-village of its kind in Sweden, but several have followed in recent years. Table 1 is summarizing the common features in existing or past eco-villages.

*Table 1. Common features in eco-villages. Sources: Berg et al, 2002; Haglund and Olofsson, 1997; Norbeck, 2004.*

Size	5 – 50 households
Organization	Home owners association, renter´s cooperative, individual ownership
Initiators	Municipality, private developer, potential residents
Heating	Biomass furnace, wood stove, heat pumps, electric furnace, ceramic stoves, resistance heating, solar panels, municipal district heating
Water	Municipal water, deep drilled well
Sewage - toilets	Water toilets – own purification facility or municipal sewage, composting toilets, urine separating water toilets, septic tank, infiltration
Grey water <sup>5</sup>	Municipal sewage, drain field, infiltration, septic tank, small biological purifier, some irrigation, ponds
Insulation	Standard, passive house standard
Recycling	Composting, municipal recycling,
Common house	Sauna, kitchen, day-care centre, meeting room, laundry room, library, weaving, photography dark room, storage
Farming	Individual plots, common plots, greenhouse,
Electricity	Photovoltaic solar cells, energy efficient lights and appliances, standard, separate electric meters, electricity possible to be shut of completely, minimizing electric magnetic fields
Other	Earth cellars

Tuggelite was presented as an example of Swedish ecovillages, and even though there are differences in design and size, much is similar. In the next section we will present previous studies on residents in eco-villages.

### **5.1.2 Previous studies on residents in eco-villages**

Ibsen (2010) has interviewed some of the households that were a part of the initial planning in Tuggelite. The initial motives, they stress today, were environmental concerns. There were interests in moving to the countryside, but Tuggelite, in the outskirts of Karlstad, was an attractive middle option. There were also a sense of “walk the talk”, to show that it was possible

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<sup>5</sup> In Swedish called BDT-water – bath, dish and wash

to create an alternative path; it was expressed that living in Tuggelite was environmental activism in practice (cf. Tidäng, 1992). Other interviewees, that live in Tuggelite but were not part of the planning, stress the social aspect higher and they had previous experience from collective living. Ibsen further argues that the possibility to establish the village was due to the fact that they had committed individuals, with environmental interest and high intellectual capacity when discussing with the municipality (Ibsen, 2010).

Ibsen (2010) further investigated how behaviour was affected by living in an eco-village. She identified changes in structural behaviour, even though the environmental concerns have remained high. Abandoning composting toilets and composting systems has been done due to convenience and as the municipal service had become better since they started the village, and thus the system could be supported by the village. The residents are generally focused on saving energy, reducing material usage, buying organic products but they experience dilemmas concerning transportation as car is often needed for practical reasons.

Persson and Karsten (1990) investigated expectations among the persons moving the eco-village Solbyn in Dalby close to Lund in southern Sweden, before moving in. The ideological goals were environmental concern, through balance between nature and humans, as well as resource reduction, recycling and energy reduction. A lot of the future residents were a part, as in Tuggelite, in the anti-nuclear movement. Social and communion aspects were important as well, but not in the initial phase as much as later, and these aspects became increasingly important. However, cooperation and democracy were a part of the initial by-laws. The residents was to a large extent academics, e.g. teachers, psychologists and natural scientists, a third of the households were families with children and a significant high rate of single households were present. Most of the residents had lived close to Dalby before and the cost was expected to rise when moving there, due to the investment in the apartment, and 24 percent stated that they had hesitated in moving there because of the cost. The reasons for moving there varied, but environmental concern and closeness to nature were prominent, as well as social community and also to have to opportunity for gardening and small-scale farming. What was notable in the interviews was that the technical systems were not mentioned before moving in.

Kirby (2003) studied an eco-village in Ithica, in New York, USA and found that social reasons outweighed purely environmental considerations as residents' reasons for moving to an eco-village. Importance of connecting to like-minded individuals were important, in order to create a satisfying community life. Often, the individuals talked about a degree of disconnectedness and alienation from conventional social patterns, and social and environmental activism were common. Kirby concludes a surge for connectedness or reconnections among the residents, either to the wild landscape through a spiritual connection to the natural world, connection to community, connection with a cultivated landscape of benign human activity or a sense of personal integration.

Van Schyndel Kasper (2008) studied eight American eco-villages. She found similar evidence as in above cited studies; importance of social cooperation and interaction, high quality of life and environmental stewardship. Design practices are often unique in relation to its locations, but there are commonalities in each eco-village that mirror an overarching paradigm; systemic



thinking, ecosystem health, sense of respect for others, both humans and non-humans. She finds evidence for an expanded notion of society in the villages as well as accompanying ethics. The understanding of the world, quite different from the dominant western world-view, is:

*“...consciously articulated and embodied in eco-village practices, relations, and the physical setting itself (...) eco-villages suggest the necessity of a paradigm that facilitates a sense of community wider than the traditionally human one. It means that not only do people have a more accurate understanding of the complex interrelations between themselves and the land, but also that they feel obligated to steward the land that gives them so much. And this obligation is largely motivated by a conviction that it is the right thing to do.” (Van Schyndel Kasper, 2008, p. 23).*

It is, according to Van Schyndel Kasper, importance of walking-the-talk and implementing paradigms into practice.

To summarize the previous research on eco-villages, it is often stressed that the factors of environmental concern and social community are equally important. They are often based on strong ideological foundations, commonly from either left-wing oriented individuals being nuclear power opponents. The residents in the above mentioned studies seldom talk about sacrifices. Whether that is nothing that is being thought of in those terms, or if it is thought of as something that comes with the living is not clear, but it is notable.

The cooperation in the villages is stated as important, as social community is the purpose of the village, and some have lived collective housing earlier. The level of education, at least among residents in Swedish eco-villages is often high, which has been important in the communication and negotiation when establishing the eco-villages. This has especially been the case in terms of the technological systems. The systems have in some cases been quite far-reaching, but several of the villages have abandoned for example compostable toilets.

In the next section we will focus on a literature review concerning consumer’s energy behaviour.

## **5.2 Literature framework phase 2**

In order to contextualize and understand processes for up-scaling we have conducted a literature review with focus on crucial factors and conditions that are influencing a possible up-scaling of self-sufficient renewable technologies. What sort of literature is there concerning citizen’s willingness to pay and participate in energy transitions? And what are crucial factors for up-scaling?

### **5.2.1 International and national surveys**

In order to frame to context, we are below presenting results from international and national surveys that are being performed yearly. From these surveys we may get an overall picture of attitudes towards environmental and climate concerns. They are the largest of their kind and due to their rigorous methods and large samples, the results may be compared with smaller surveys.

The largest international survey is the Eurobarometer surveys, and the last survey was presented in early 2014 (EC, 2014), and approximately 28 000 persons were interviewed face-to-face. The

results showed that climate change still is considered a serious problem, as 50 percent thinks it is one of the most serious problems while 16 percent think it is the single most important problem, in Sweden 81 percent thinks it is one of the most serious problem. 25 percent of the European citizens think that they do have a personal responsibility, which has increased since previous surveys, and half of the respondents state that they have taken some form of action in the past six months to tackle climate change, which is a small decrease. Respondents in Sweden are most likely to state they have taken action (80 %). Most likely actions are reducing waste and regularly recycle (69 %), trying to cut down on disposable items (51%). Sweden is one of the countries where the respondents' answers proved of the highest climate change awareness (EC, 2014, cf. EC, 2007).

Similar results can be found in the survey concerning attitudes towards the environment (EC, 2011). Most respondents (95 %) find that protecting the environment being very important for them personally and association with "the environment" spanned from protecting the nature to the state of the environment for future generations. Generally, the respondents thought that more funding should be allocated to protecting the environment and that the most efficient way to deal with environmental problems being introduction of heavier fines for offenders (36 %) while it in Sweden was by ensuring higher financial incentives (e.g. tax breaks, subsidies) to industry, commerce and citizens (49 % compared to 26 % in the EU).

The international surveys point to respondents thinking that economic factors are being the most important factors in fighting climate change and preserving the environment, but the level of responsibility differs somewhat, from national level to the EU (EC, 2011; 2014).

The national surveys are performed by the SOM-institute at University of Gothenburg and are held annually. The survey is nationally representative and sent to 3000 persons, spanning from 16 to 85 years old. The results are published in reports covering various themes.

Harring et al (2011) concluded, in contrast with the Eurobarometer-studies presented above, that environmental concern, including climate change awareness, among general public has decreased significantly from the late 1980s until 2010, from around 62 percent in 1988 stating the environment as one of the most important societal problems, decreasing to around 14 percent in 2010. They also found that persons with higher education seem to generally be more environmentally aware. When the Swedish financial crisis hit in early 1990's, the awareness decreased significantly, as did media reporting on the subject. In the report they are making a connection between media coverage and environmental awareness and finds that the number of newspapers discussing the environment or climate varies around important events, such as the 2009 United Nations Climate Change Conference in Copenhagen, which also Anshelm (2012) concludes but he also finds diminishing reporting after the conference. Harring et al (2011) argue that it seems like environmental concerns have gone through a cycle, as to most political questions. The question is raised, engagement among public increases, the question is handled politically, and then concern decreases as the question gets competition from other topics (cf. Downs 1972). Other research (cf. Bennulf & Selin 1993, Elliot et al, 1995) has also pointed towards that environmental concerns seem to be a question that people are concerned about when the economy is strong, as citizens and the society can afford to deal with other issues.

Sundström et al (2011) reports on Swedes attitude towards paying more for green electricity, being it through the electricity certificate system or “green” electricity contracts. In the SOM-survey, a question was asked regarding voluntary green electricity purchase, and how much the respondent is willing to pay for that. Thus, involuntary systems, like the green certificate system is not included in this question. Around 1/3 are not willing to pay anything extra for the green electricity, and combined with persons with no opinion that is half of the population. Out of the persons that were willing to pay extra, around 50 percent of the population, the accepted effort is rather limited as approx. 200 SEK per year is the most common answer, which would be 15 SEK per month. 18 percent are willing to pay up to 500 SEK and 10 percent up 1000 SEK. Divided into categories, it is possible to see some patterns. The willingness not to pay is higher in the groups over 50 years, and the will to pay up to 500 SEK more is highest between 20 and 50 years. Persons living in rural areas are a little less willing to pay than those living in urban area and the higher the education, the higher the willingness, same goes with income.

In the survey, questions in recent years about the attitude towards energy sources for electricity production have been asked. The most recent report (Hedberg, 2013, cf. Hedberg & Holmberg, 2012; Hedberg & Holmberg, 2013a; Hedberg & Holmberg, 2013b) showed that there is a continually strong support for renewable energy, especially for solar power, wind power and hydro power. Support for investment in fossil fuels have gradually decreased in the last 15 years, and support for nuclear power decreased significantly after Fukushima (19 to 12 percent support) but have actually gained some percentages again in recent surveys (cf Holmberg, 2013). A general conclusion in the surveys was that the higher the education, the more support for wind power and that support is also strong in urban regions.

At county level, support for various energy sources varies. A north-side divide can in some aspects be seen, support for wind power is strong in the north but weaker in comparison to national levels in Skåne, Halland and Gotland, while on the other hand support for more hydro power is weaker in the northern counties compared to the Götaland counties (Hedberg, 2012).

### **5.2.2 Consumer studies**

There is significant research done in the field that could be defined as consumer studies. It is the field that is relevant to Phase 2, as the users are put in the centre, and our overall focus is on understanding potential for up-scaling towards more self-sufficient renewable energy supply. The research can be divided into three disciplinary categories: economic, psychological and cultural/sociological, and in all fields, energy research has been conducted.

#### **Economic studies**

It is fair to say that most studies have been performed using an economic perspective. The epistemological assumptions are often relating to rational choice, for example taking start in Rogers S-curve of diffusion of innovations. Price elasticity of energy demand is often studied through modelling household behaviour in relation to rising or declining prices (Gram-Hansen, 2010; Micklewright 1989; Narayan et al. 2007).

Most of the studies using this perspective have focused on households' willingness to adopt energy related measures, using economic measures. The most common factors to adopt are environmental concern, economic aspects, grants, increase comfort, and that the main obstacles being payback times, lack of information, high investment costs, uncertainties about performance and reliability of unfamiliar products and systems, and disruption or hassle due to the instalment. All these studies have, however, concluded that there is increasing interest for renewable energy technology, but that the adoption rate is still low. It was also concluded that there were need for stronger government role, for example through tax breaks, increased subsidies, lower council tax bill. Mandatory standards for product performance, reliability and durability, better regulation to control "cowboy" installers of renewables, notably solar thermal water heating systems, are also important. Financial penalties on inefficient technologies and higher demands on new buildings are often proposed as measures (Central Office of Information, 2001; Orexa, 2006; Defra, 2004; DTI, 2006, Sea/Renue, 2005; EST, 2007; Watson et al, 2006).

Demographic features may, for example, help understanding perception and attitudes towards green technologies. Several studies have concluded that an elderly population, with strong finances, using a long-term perspective for energy efficiency, seeing it as an investment and payback and they had a desire to live green. There also seem to always be a core of early adopters, willing to try new technology. These are technology enthusiasts and often high income earners and predominantly men (Diamantopoulos et al, 2003; Faires & Neame, 2006; Faires et al, 2007)

Palm and Tengvard (2009; 2011) interviewed 20 Swedish households with focus on investigating how users, retailers and electricity grid owners perceive domestic small scale electricity production. Conclusions are that, at the time of the study, the market for small scale electricity production was not mature. A company, "Egen el" got some media attention during 2008 which did increase awareness and the requests made to retailers and electricity net providers have increased. It was still difficult to make a living on selling these production systems to households but actors were optimistic regarding eventual changes in legal framework as well as IKEAs PV-project. The motives from the households were foremost environmental concerns. The interviewed households did often have an especially environmental friendly lifestyle and small scale production did thus suit well with their lifestyle. To some others the investment was symbolic, as they wanted to make a stand and lead by example. In some cases the investment was a case of protest against the system with large, dominating actors or as a way to become more self-sufficient. Obstacles are often economic aspects, concerns towards neighbours and problems finding a place to install them. In order to diffuse the technology there is a need for reduce the economic obstacles (high investment costs), administrative routines and rules needs to be simplified and clarified.

To sum up, the economy-oriented research on consumers has focused mostly on adoption of green technology, in a supply perspective. It focuses on changing to more energy efficient technology, who is adopting, what sort of technology, mostly from a perspective of technical fixes rather than behaviour changes. Another more critique is that these studies ignore differences in consumer attitudes.

## **Psychological studies**

Consumer studies on energy focusing on psychological factors have, according to Gram-Hansen (2010) been inspired by the work of Ajzen and Fishbein (1980), focusing on the theory of reasoned action. Behaviour and attitudes has been studied using the perspective, and, as with the economic studies, humans are seen as rational beings. They make use of information and act on basis of particular intentions, but more aspects are included than economic, like comfort, pleasure and safety.

Stern (1992) concluded in an influential article that most research made up until the 1990s had focused on technic economic perspectives in energy policy. It was shown that effects of financial incentives, e.g. loan subsidies, are influenced by consumer attitudes and knowledge. Energy is often misinformed, leading to ineffective policies. Most studies had focused on information and money. Information among consumers is not only a case of how much there are, but also how it is delivered. The most effective information was specific, vivid and personalised information, and the framing of the information is also important. Information is multidimensional, as are economic factors. Costs take different forms and are responded to differently. Consumers think of their utility bills in dollars per months rather than terms more familiar to the utilities, meaning that when energy prices are increasing, consumers perceive their energy conservation efforts as ineffective as their bills are not getting smaller. Other nonfinancial motives exist. Consumer preferences are one, and influence investments in technology that may not be as efficient as others. Group membership is another one, as friends and families opinions matter. Personal values matter as well as problem avoidance, which may keep people from taking actions that may be a larger hassle.

Abrahamse et al (2005) concluded in a literature review that different measures have been differently effective. Interventions have, for example, been successful in some cases; information results in higher knowledge but not necessarily in changed energy behaviour; rewards have had impacts, but seldom in the long run; and frequent feedback has been rather successful in several cases (cf. Abrahamse et al, 2007).

Critique has been raised against an overly individualistic understanding of consumer behaviour in these kinds of studies (Gram-Hansen, 2010). What they seldom take into consideration are materiality of the technical systems that the users need to handle.

## **Cultural-sociological-sociotechnical studies**

Cultural approaches towards consumer studies have applied sociological and anthropological theories to understand collective structures of consumer behaviour. This is different to economic and some psychological studies, and instead focus is on how different groups are identifying status and identity through consumption. This has been criticised for being too narrowly focused on communicative aspects of consumption and thus ignoring ordinary consumption (Gram-Hansen, 2010).

A reaction towards this has been taking in a wider perspective with interdisciplinary aspects, often using a socio-technical perspective. Socio-technical perspectives take in technological as well as social factors, and it is stemming from the idea that society is made up of a seamless web, with technical systems, social norms and behaviours, institutions and laws entangled:

*“...technological systems contain messy, complex, problem solving components. They are both socially constructed and society shaping. Among the components in technological systems are physical artifacts, such as turbo generators, transformers, and transmission lines in electric light and power systems. Technological systems also include organizations, such as manufacturing firms, utility companies, and investment banks, and they incorporate components usually labeled scientific, such as books, articles, and university teaching and research programs. Legislative artifacts, such as regulatory laws, can be part of technological systems,” (Hughes, 1987, p. 51).*

One of the more influential theories in recent years is the practice theory. A main difference between the practice theory and economic or psychological theories of reasoned action is the degree to which individuals are seen as independent and rational actors or to which degree they are seen as actors taking part in jointly shared structures of knowledge, engagements, or technologies. The theory sees practices as collective, but it is still open for individual differences and for seeing rational knowledge input and aspects of attitudes as part of an explanation of practices. Practice theorists, inspired by Bourdieu and Giddens, emphasize that both body and things (or technologies) are important for understanding practice, through mind, knowledge, structure, and agency (Gram-Hansen, 2010). Gram-Hanssen (2010) shows that rationality alone cannot explain the extent to which people change their habits with respect to standby consumption in appliances. Previous studies based on socio-technical and cultural approaches to understand household energy behaviour, have shown how individual behaviour is bound up in technological and cultural structures. Problems in these studies have been that it has ignored and undervalued actions of individuals.

The terminology for elements focused on in these studies varies, but they can be concluded as being habits/know how/understandings, rules/institutional knowledge, engagements/meanings/discourses and technologies/products (Gram-Hanson, 2010; Reckwitz, 2002; Schatzki, 2002; Shove & Pantzar, 2005; Warde, 2005).

When studying stand-by consumption Gram-Hansen (2010) found how these elements were influencing the behavior. *Know-how and embodied habits* were formed by technological design, as it emerged in the 1980s and 1990s where remote controls became normal in TV usage, and users handled the technology as it was intended and a routine of not turning of the TV and leaving it in stand-by mode emerged. In the studied project, when behaviour changed, it was often because a change in knowledge and motivation, which often occurred together with a technological rearrangement. *Knowledge* about energy consumption and energy production is limited, as it is often hidden and unrecognized. Users take part in the system and have to trust experts and the system itself. Changes are happening, energy savings in households have been part of the general knowledge disseminated to the public and standby consumption has been added. Knowledge transfer takes place in many venues, primary schools, general education, and public campaigns. *Engagement* and motivation is important for changing the practice of standby

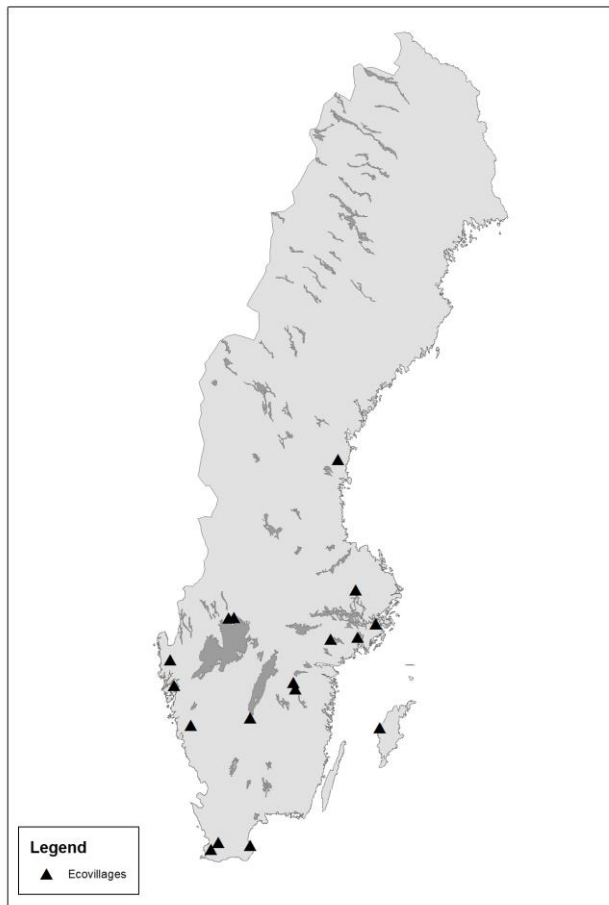
consumption. Social relations are important, as consumers are influenced by others with whom they relate or sympathize. Content of motivation can also relation to the private economy. *Technologies and material structure* means that the components themselves are strong components for holding this practice (standby consumption) together. Technologies do not determine a specific use but are open to individual interpretation. When standby consumption emerged in the 1990s it could have been viewed primarily as a consequence of technology design. People simply used the technologies in the easiest and most straight-forward way: it required less effort to leave the appliance in standby mode than to turn it off, because this was how it was designed to be used. The practice has developed since. Knowledge and engagement have come to influence standby practices. Technologies have developed over time.

### **5.3 Survey to eco-villages**

The literature framework showed that a significant amount of research has been carried out focusing on citizens' energy behaviour and their will to either invest time or capital into energy reducing artefacts or systems. It could be concluded that few knowledge gaps existed here, and that by focusing on citizens that have already done something, that have invested time, money and social capital into their residency, we could generate interesting new knowledge. We did thus decide to focus on eco-villages in Sweden. This is a more specific sample, but these persons' opinions can be an interesting guidance to understand what people are willing to invest and put up with. It takes effort to get out of the mainstream and these residents have done so.

It was decided to perform the study as an online questionnaire due to time restrictions and in order to be able to cover more respondents than would be possible when performing interviews. The questions asked focused on the following: general interest in environmental concerns, background information about their residency, why they moved to the eco-village and eventual sacrifices due to living in the eco-village, functionality of systems in the village, eventual extra environmental investments and background questions such as age, gender and education. The questionnaire contained 28 questions in total. The questionnaire was sent out on December 16 and a reminder was sent out on February 4. The method regarding the questionnaire is described in more detail appendix IV.

The selected eco-villages were 17 in total, see figure 3, using the criteria that they should identify themselves as an eco-village and that they should have some sort of energy production within the village.



*Figure 3. Swedish eco-villages included in the questionnaire*

We received 116 responses, out of 396 residents, which give a response rate at approx. 29 percent, which is lower than expected but still enough to be able to draw relevant conclusions.

### **5.3.1 Survey results**

In this section we will present the results from the survey. As mentioned above, we had 116 responses on the 28 questions and below we will present the results thematically.

#### **Information about respondents**

First of all, the gender distribution among the respondents was basically equal, with 49, 1 percent respectively and 1, 7 percent that did not respond. The distribution in age among the respondents can be seen in figure 4. As seen, the distribution is rather even, with the largest category being 1955-1959 but there is a significant group born 1975-1979. Few are born in the 1980s and later and there are no persons born before 1941.



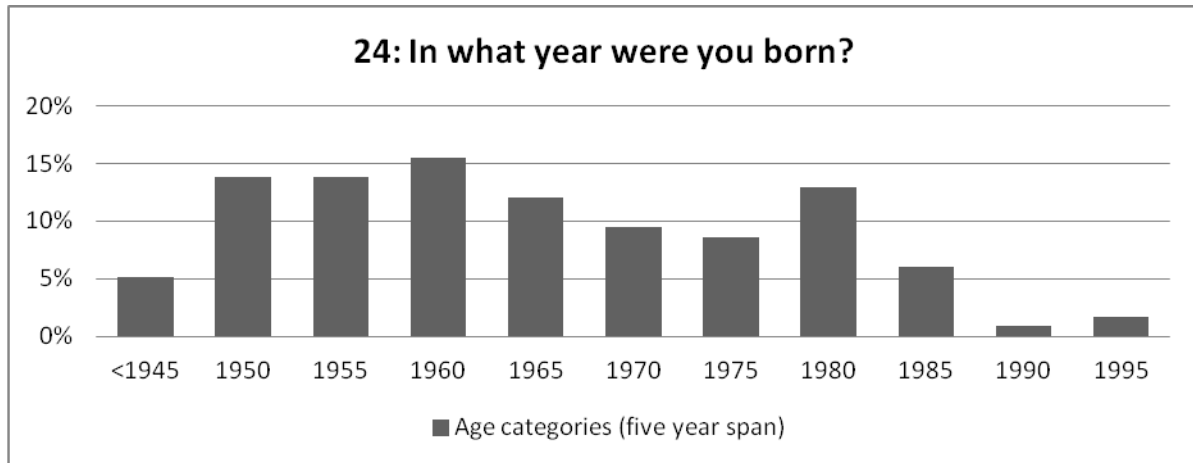


Figure 4. Age categories of the respondents. Each category represents five years, the one on the left being before 1945, the next 1946-1950 and so on.

The respondents were to a large extent married or living in partnership (57 percent), 22 percent being single, 18 percent being cohabitant or living apart from their partner. Only one percent was widows/widowers and three percent did not answer the question. 16 percent of the respondents replied that one person live in their dwelling, 28 percent that two persons, 20 percent that three persons, 24 percent lived four persons and 12 percent answered that there lived more than four persons in the dwelling.

Evident in the survey is that the respondents have a high education, significantly higher than the general population, which also goes in line with the SOM-institute survey (Harring et al, 2011). In 2011, 35 percent of the persons in Sweden had some education from college or university or two years of post-high school education (Swedish Higher Education Authority, 2012). Among our respondents the equivalent was 88 percent, where 54 percent had graduated from college/university and 13 percent had studied or graduated at postgraduate level. The orientation of the education was highly diverse, with the highest share being 17 percent in natural science/mathematics/computers, health care (13,8 %), education (11,2 %) and technology/building/industry/transport (11,2 %) having substantial share among respondents as well.

### Interest in environmental questions

The first sets of questions in the questionnaire concerned the respondents' interest in environmental questions, their concerns in specific environmental topics and their own environmental activities.

The first question concerned the respondents' interest in environmental questions. It was evident that it is a group interested in environmental concerns, especially compared to a national level. While 63 percent stated that they were very interested, the equivalent in the national survey Riks-SOM (hereafter called Riks-SOM) was 14 percent (Göteborgs Universitet, 2012). 34 percent stated to be somewhat interested compared to 58 percent in Riks-SOM, which also showed 25 percent not being very interested, as our result showed only 2 percent. This is not surprising of

course, as the respondents are living in eco-villages, but there are substantial differences to the national level.

The next sets of questions concerned how serious a threat against the environment in Sweden a number of environmental problems were experienced to be. These were: climate change, consumption and waste, overfertilization, discharge of pollutants into water, toxins in the environment and extinction of animals and species. All these were considered as threats, as all of them got more than 50 percent response rate as the highest rate, “very serious”, and more than 80 percent experienced the threats as “somewhat serious” or “very serious”. The ones with the highest rates of concerned respondents were consumption and waste, and climate change, with a total of 95 percent as somewhat or very serious. Toxins in the environment got the highest share of “very serious”, at 63 percent.

In the third question we asked how often the respondents personally did different things for environmental reasons and the results can be seen in table 2. The question could be answered as: always, very often, quite often, sometimes and never. The questions and answers were the same as in two different Riks-SOM surveys to be able to compare. Question 1, 5, 7 and 8 are from Riks-SOM 2011 (Göteborgs Universitet, 2012) and the rest from Riks-SOM 2005 (Göteborgs Universitet, 2006) and even though that could be considered as old data, the results still gives an indication of the relation between our respondents and the national surveys.

*Table 2. Answer to questions regarding how often the respondents conducted different actions for environmental reasons (all answers in percent). Sources: Göteborgs Universitet, 2006; 2012*

<b>Q3: How often do you do the following actions for environmental reasons?</b>	<b>”Always” or ”very often” Survey</b>	<b>”Always” or ”very often” Riks-SOM</b>	<b>”Sometimes” or ”never” Survey</b>	<b>”Sometimes” or ”never” Riks-SOM</b>
<b>Abstain from eating meat</b>	35,3	4,4	44,0	90,8
<b>Choosing to walk or bike instead of taking the car</b>	37,1	20,3	37,1	50,2
<b>Choosing to travel by public transport instead of the car</b>	31,9	13,1	44,8	63,3
<b>Choosing to travel by train instead of flying</b>	37,1	11,5	31,0	73,2
<b>Sort household waste</b>	94,8	71,1	0,0	14,9
<b>Eat organic vegetables/fruits</b>	79,3	12,9	7,8	65,3
<b>Shopping environmental labelled goods</b>	78,4	24,2	5,2	47,9
<b>Reducing my electricity consumption</b>	47,4	20,5	17,2	45,8

It is obvious that our respondents are stating that they are doing things out of environmental reasons to significantly higher degree than the national surveys. The most significant differences can be seen concerning organic vegetables and environmentally labelled goods, on the positive side, but meat is also one factor that differs a lot. Sorting of household waste is quite often stated in both sets of data, but still significantly higher in the eco-villages. To not change travel patterns has the smallest difference on the negative side.

The comments (a total of 17) in question 3 focused on various topics, such as biogas and farming, but the answers that stood out concerned the location of the eco-village, which reflects the answers in table 2 well. The concerns were focused on the rural location, leaving little option for cycling or public transport, meaning that there is a need to own a car.

The fourth question concerned how often the respondents were trying to reduce the energy use in some various situations, see table 3. Like question 4, the question could be answered as following: always, very often, quite often, sometimes and never. This question is the same in Riks-SOM 2011 and the results could thus be compared.

*Table 3. Answer to questions regarding energy consumption (All answers in percent). Source: Göteborgs Universitet, 2012*

<b><i>Q4: How often are you trying to reduce your energy consumption in the following context?</i></b>	<b>”Always” or ”very often” Survey</b>	<b>”Always” or ”very often” Riks-SOM</b>	<b>”Sometimes ” or ”never” Survey</b>	<b>”Sometimes ” or ”never” Riks-SOM</b>
<b>Space heating in dwelling</b>	64,7	26,1	16,4	42,9
<b>Usage of electrical appliances/lightning</b>	45,7	27,8	15,5	34,1
<b>Purchase of electrical appliances/lightning</b>	58,6	24,1	16,4	42,8
<b>Hot water consumption</b>	50,0	23,3	27,6	43,9
<b>Transports/travelling</b>	43,1	19,3	21,6	52,2

Table 3 shows, as earlier questions, that the respondents are environmentally concerned. In all aspects, the answers points to be taking more actions then the answers in the national survey. Reduce energy use in space heating is the most common action. The heating systems have always been important in the eco-villages (cf. Norbeck, 2009; Tidäng, 1992) and out of total energy use in one- or two dwelling buildings, heating makes around 60 percent in Sweden and hot water 20 percent (SEA, 2014), so it is fair to say that space heating makes different. A few comments relating to this question stated that the respondent had solar heating panels, meaning that they had a surplus of heating in summer and hot water was thus an important way for using the surplus.

We wanted to know if the persons living in the eco-villages were getting involved in different organizations and which they were. This is also a question posed in Riks-SOM 2011 and the answers of the categories that differ from the most from Riks-SOM 2011 can be seen in Table 4.

Table 4. The numbers represent the shares of the total respondents in the survey, including non-answers, but those categories are not in this table for increased clarity. All answers are in percent. Source: Göteborgs Universitet, 2006; 2012

<i>Q5: Are you a member in any type of organization or association?</i>	<b>“Yes” Survey</b>	<b>“Yes” Riks-SOM</b>	<b>“No” Survey</b>	<b>“No” Riks-SOM</b>	<b>“Yes ... and I do have some sort of assignment” Survey</b>	<b>“Yes ... and I do have some sort of assignment” Riks-Som</b>
<b>Environmental organization</b>	44,0	5,1	52,6	94,6	5,2	0,3
<b>Political party/alliance</b>	6,9	5,5	78,4	93,0	2,6	1,4
<b>Union</b>	52,6	39,6	41,4	57,2	6,0	3,1
<b>Cultural association</b>	29,3	11,7	63,8	86,2	0,9	2,1
<b>Village community</b>	50,9	14,1	42,2	83,0	13,8	2,2
<b>Retiree association</b>	1,7	12,1	87,1	86,7	0,9	1,2
<b>Humanitarian aid organization</b>	38,8	14,5	51,7	84,4	0,0	1,1
<b>Other type of organization/association</b>	36,2	19,6	48,3	74,5	14,7	5,9

The results are showing some significant differences. First of all, the respondents in the survey are to a larger extent involved in various organization compared to the national survey, and they do also have some sort of assignment in higher degree than the national survey. The categories that stood out the most was environmental organizations, humanitarian aid organizations and village communities, although the last answer is surprising as they would all, most likely, be members in their own village. One question that stood out as lower than the national shares was retiree organizations, but it reflects to population in the villages, as there are few retirees among the respondents.

In Table 5 below, frequencies of how respondents answered a question concerning the most significant actions in order to influence people’s environmental behaviour are shown. The respondents could only grade three of the five options.

Table 5. Responses regarding influence on environmental behaviour. 1 - best way, 2 - second best way, etc.

<b>Q6: Which way do you consider being the best way to influence people’s actions concerning environmental impact?</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Total frequency</b>
<b>Taxes</b>	30	27	18	75
<b>Subsidies</b>	20	26	20	66
<b>Laws and restrictions</b>	28	25	22	75
<b>Information</b>	19	15	23	57
<b>Leading by example</b>	18	16	24	58

“Taxes” has the highest frequency among the “best way”-options, but “Laws and restrictions” follows close behind. These two are the most answered categories in total, and this is reflected in the comments to this question (13 in total). These reflected a rather pessimistic view on the effectiveness of other measures than imperative ones. It is a case of carrot and stick, and the answers tend to argue that carrot is not enough. Subsidies are being considered as the third best option while information and leading by example being the least most effective ways.

### Moving to an eco-village

The next set of questions concerned the reasons for moving to the eco-villages, to get an understanding of the expectations and hopes before moving there.

Figure 5 presents the result in question 7, regarding for how long the residents had lived in their present home. The result shows that a large proportion, around 60 percent, had lived in their home for a long time; more than ten years. This is perhaps not that surprising, as these are not ordinary homes. It can also be expected that several of the respondents have lived in the eco-village since it was started, which will be discussed further below.

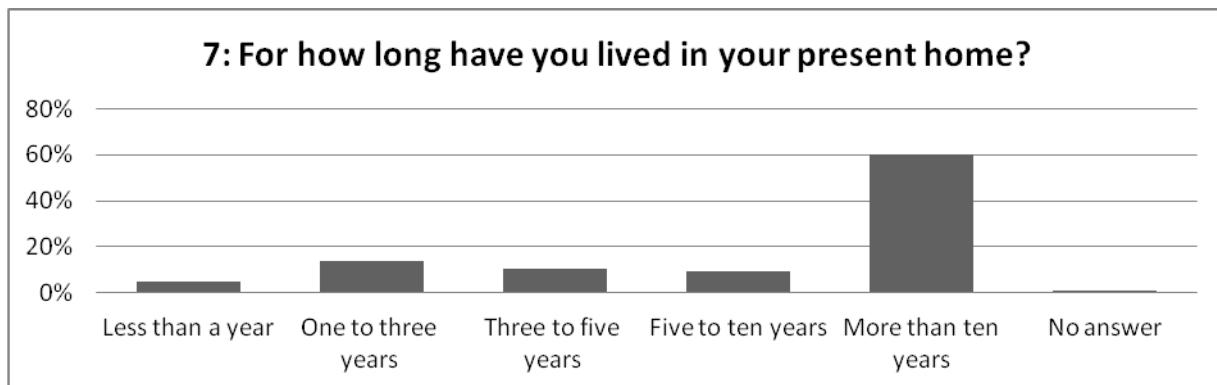


Figure 5. Responses for question 7.

The next question concerned if the respondents were familiar with the concept of eco-village before moving there. More than 80 percent knew about the concept, but that around 20 percent were not aware of it might be surprising, considering the special components in the villages. The comments (10 in total) varied, but the most common was that they had been a part of the

planning of the eco-village, which can be related to the fact that a large proportion had lived there for a long time.

In the next question we wanted to know if the respondents previously had lived in an eco-village and the results show that almost 90 percent had not. However, some of the comments (7 in total) pointed to that they moved to one of the first Swedish eco-villages when they were planned, leaving no room for the chance of previous eco-village living. In some of the other comments it was stated that they had previously lived in collective housing before moving to the present home, which is points to favouring living with high degrees of communion components.

Question 10 and 11 concerned the motives for moving the present dwelling. Around 74 percent of the respondents had moved there because it was an eco-village and the rest stated that it had not influenced their decision. The question had a follow up question: If yes, in what way? We received 49 answers, and the comment that stood out the most was, not surprisingly, environmental concerns. It was often stated that they wanted to live as environmentally friendly as possible and lead by example. Social aspects, to live among equally minded persons were the second most common answer. Possibility to small-scale farming and good environment for children were other factors and some moved there by chance and found that it was a bonus that it was an eco-village. These comments relates to the next question, in which the respondents should rank the most important reasons for moving to the eco-village. Each respondent had to rank and prioritize their responses as they had to decide on the five most important categories among eight. The results can be seen in table 6.

Table 6. Main reasons for moving to the eco-village (1 – most important, 2 – second most important etc).

<b>Q10: What was the main reason for you to move to your current accommodation?</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Total frequency</b>
<b>Environmentally friendly living</b>	30	22	26	9	9	96
<b>Closeness to nature</b>	23	19	17	10	11	80
<b>Social community</b>	17	15	14	17	10	73
<b>Welcoming living environment</b>	15	12	9	22	16	74
<b>Family friendly</b>	14	20	13	6	5	58
<b>Good location</b>	8	8	4	14	12	46
<b>Cheap living</b>	4	7	13	3	15	42
<b>Attractive dwellings</b>	2	6	7	7	6	28

The fact that the dwelling is considered environmental friendly was the most important factor, both in relation to the first ranked factor but also in total responses. Closeness to nature is also considered important, as most of these communities are located in either the outskirts of cities or in more rural areas. Social community is also important, which is often reflected in previous

research on eco-villages, but here it is third most important feature. A welcoming living environment is also considered important. Least important was attractive dwellings and location, which has been stated in other questions as negative, and economy are not important factors for moving here. We received 18 comments of rather various forms for this question. The most common comments stated that it was impossible to grade in this question, as it was rather all factors that influenced and that it was a holistic reason for moving there rather than a single one. A few had moved there because of their partner.

### Living in an eco-village

The next set of questions concerned the living situation in the eco-village. We wanted to know if they felt that they had to do any kind of sacrifice because of their living and whether or not it was worth it. By asking this, we may say something about tradeoffs in order to live more environmentally friendly, in order to learn for possible up-scaling.

The answers from question 12, if the respondents feel like that they are making any kind of sacrifice because of the fact that they live in eco-villages, can be seen in figure 6.

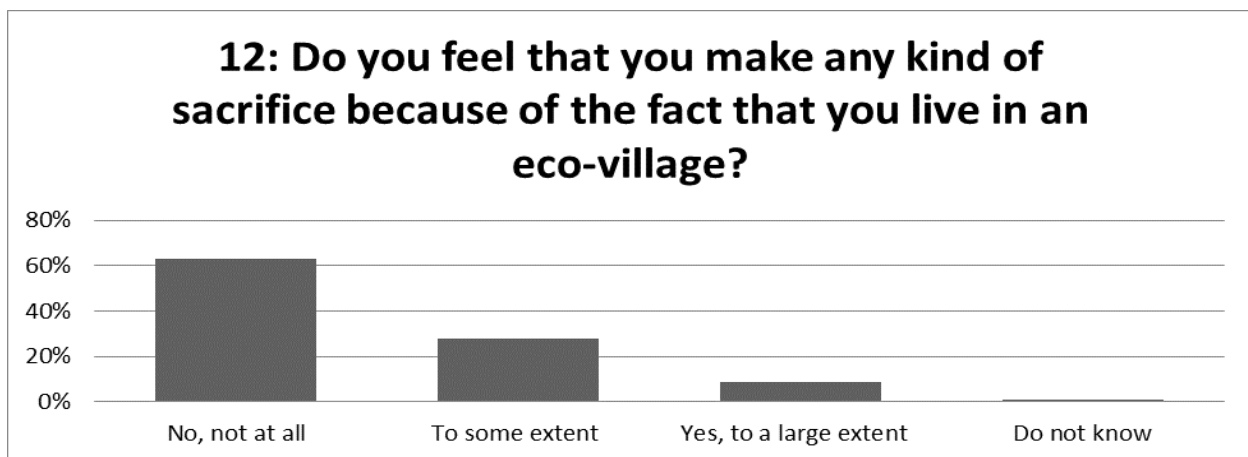


Figure 6. Answers to question 12.

Most of the respondents, 63 percent, did not experience that they were making any kind of sacrifice. Around 36 percent stated that they were experiencing that they were making a sacrifice in some extent or to a large extent. These results are somewhat surprising considering the often rather specific technical solutions which are requiring a little adjustment in everyday practices. This will be discussed further below.

In the comments (a total of 20) one aspect stood out more than others, and it was the question of the heating system. In some cases there had been trouble with functionality and in other there were just a matter of hassle, from carrying wood or keeping the warmth at even levels. The other technical systems, such as water, sewage and toilets were also mentioned, but just a few answers. The location were also mentioned by some respondents to be problematic, as there was further distance to work or city and often need for car.

The next question was a follow up question to those that answered that they were making some sort of sacrifice, to understand the reasons for it, see figure 7.

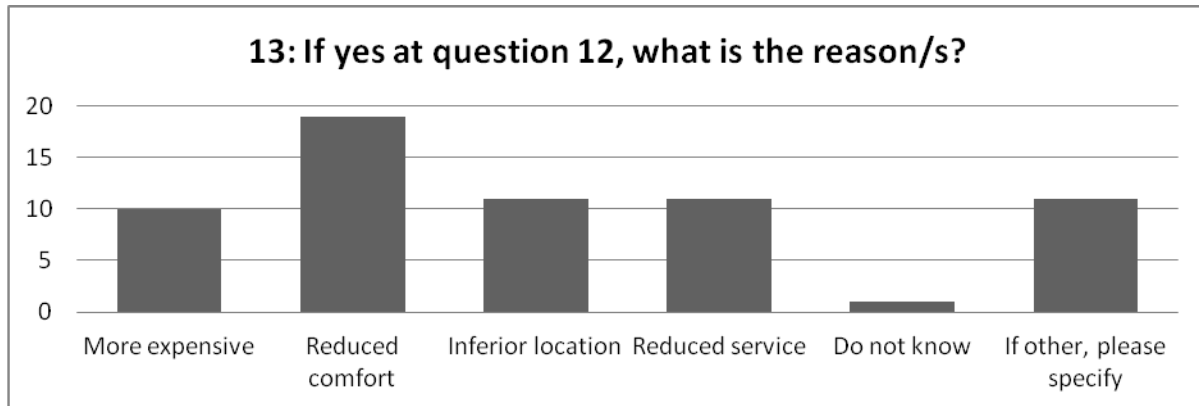


Figure 7. Frequency of answers to question 13 (number of respondents per category).

Respondents could answer more than one option. The results show that reduced comfort is the most common answer, which can be related to the comments on the previous question, that there were often problems with the heating systems and this could explain the reduced comfort. Other answers showed quite similar frequencies, regarding pricing, location and service. The specified answers (11 in total) showed a wide range of answers, but the most common answer was that it took extra time with the cooperative work in the village, which was considered a sacrifice.

Question 14 was to be answered by the ones stating that they experienced they were making some sort of sacrifice in question 12. The result show that even though some of the respondents experience some form of sacrifice, it is worth it, 48, while 6 answered that it is not worth it. The notion of making a sacrifice is highly subjective, but cooperation and the technical solutions are a part of the whole idea of the eco-village, and that seem to be why they can put up with it. That was the most common comment to this question, that it was worth it because of the fellowship among other residents, but a few were critical regarding the technical systems, especially heating systems. A few negative comments arose regarding social disputes and reduced privacy.

Question 15 concerned economic aspects on living in the eco-village, whether it was experienced as economically different living in the village than in “regular” residential areas. The answers can be seen in figure 8.





Figure 8. Answers to question 15 (percentage).

Most of the respondents stated that it was less expensive, but 19 percent experienced it as more expensive. It should be taken into consideration that the included eco-villages are quite different in technical systems, age and insulation, creating quite different situations. 34 respondents commented on this question. The most common answer was that the monthly fee is lower and/or that that costs for heating or other services are lower. That they do a lot of work themselves was stated as a reason for costs being lower, and that they had local production of food or energy was another. A few answered that the monthly fee was rather high and that the technical systems made it more expensive, as they were either getting old or that they were not correct from the beginning.

We wanted to know something about the involvement among the respondents in the governance of the village. The results showed that 59 percent were involved, while 41 percent were not. As the villages are most often built upon cooperation and community sense, it was somewhat surprising that as many as 40 percent stated that they were not involved. All villages are, however, quite differently organized, as some have moved further towards “regular” residential areas in terms of organization and technical solutions in recent years. We received 64 comments to this question, were respondents stated their various positions. It spanned from being chairman, secretary or part of various workgroups. Among those who answered no they often stated previous positions. The comments did also show a sense of the variation in organization in the groups. The community feeling is evident through working groups in the villages, and these spanned from farming, café, water, general maintenance, landscaping and in various community associations (roads etc).

## Context and technical systems

Question 17 (see Figure 9) concerned the relation to the municipality, as we wanted to get an idea of how the respondents experienced that relationship.

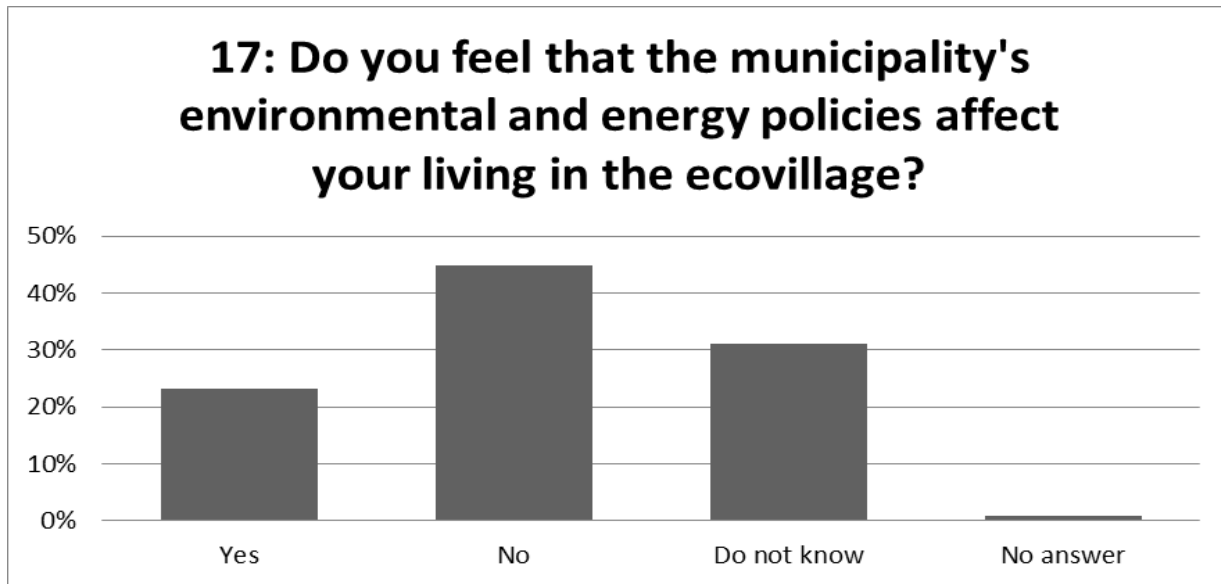


Figure 9. Responses to question 17.

Most respondents state that they do not feel that the municipality's policies are affecting them that much and around 30 percent state that they do not know. It could suggest that the connection is not that strong. Among the comments (26 in total) to this question, the most common concerned sewage or fetching urine or other rests from toilets. However, the second most common answer was that they were uninterested or even were hindering the development, through to rigid rules. Others answered that they experienced good support, economically, generally or e.g. that the municipality helped arranging more frequent public transport.

Question 18 concerned if the respondents had taken any extra measures in order to reduce environmental impact, for example through purchases of shares in wind power. Around 44 percent stated that they had not and 54 percent stated that they had done so and we asked them in follow up question to comment and we received 62 comments. Respondents could answer several options and the most common was that they had bought shares in wind power (24 answers), green electricity (17), solar panels for heating (14) or individual biomass stove (11). It was fairly common to combine several measures, for example wind power share and green electricity or several solutions for heating. A few had invested in solar PV.

Compared to the results on the Riks-SOM, the respondents in our survey were somewhat more willing to invest in extra measures. 1/3 in the Riks-SOM study were not willing to buy green electricity and combined with the ones that did not know, it was 50 percent but among those that were interested, the willingness was quite limited in economic terms (Sundström et al, 2011).

Question 19 concerned the satisfaction with the technical systems in the eco-village, see figure 10.

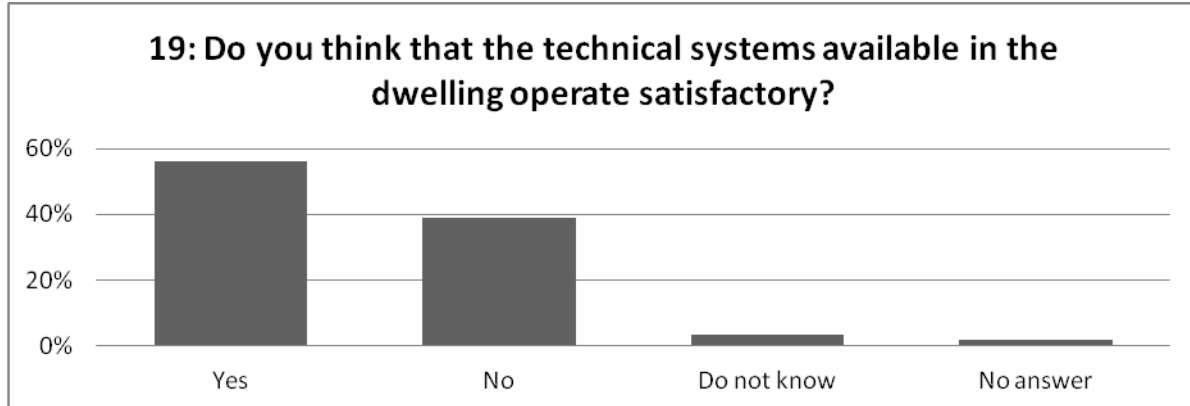


Figure 10. Response rates to question 19.

Most of the respondents were actually satisfied, but almost 40 percent were not. The comments to this question gave some answers to this, as 50 respondents commented and the single most commented system was the heating system. 2/5 of the respondents stated that they either have problems or have had, and that the systems have been under-dimensioned from the start. The communal furnaces seem to be a problematic as well. The toilets are the second most common, either from general functionality or smell, and often the composting toilets had been replaced. A lot of comments regarded replacement of systems, either toilets or other, and that the systems are ageing and needs to be replaced soon. Concerns about the economic situation in relation to this were raised. Several answers stated that the systems were wrong from the start, either under-dimensioned, poorly installed or that “wrong” system had been installed, like a specific furnace or resistance heating radiators.

Despite some the systems are getting old, most people are stating that the systems are operating satisfactory. When testing the relation between finding the systems satisfactory and feeling that they are making some sort of sacrifice through a chi-square test we found a significant correlation, see figure 11, with a critical value at 0,95 being 5,991. It does mean that they that were satisfied with the system to a larger extent experienced that were not making any sacrifice and the opposite is true. Satisfactory systems are thus one factor that might affect attitude towards living in eco-villages.

#### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10,034 <sup>a</sup>	2	,007
Likelihood Ratio	10,013	2	,007
Linear-by-Linear Association	9,252	1	,002
N of Valid Cases	109		

a. 1 cells (16,7%) have expected count less than 5. The minimum expected count is 3,63.

Figure 11. Chi-square test for question 12 and 19.

The next question was an open question: What further action would you like to see the eco-village took with regard to environmental friendliness? We received 76 comments and each respondent could state several measures and answers spanned from lightning to a new treatment system, but the single most common answer regarded electricity production, a total of 44 answers. Among those, 25 respondents wanted solar PV, 10 wind power and others asked for higher degree of self-supply. 14 respondents talked about transport, especially car-pooling, and a few asked for electric cars. Quite a few wanted to upgrade or change the heating system, either because of age or out of not being environmentally friendly enough. Social aspects were mentioned by nine respondents, as they either wanted more dialogue, that they should work more with information or that new residents did not care about the eco-village.

In question 21 we asked the respondents about if they experience that they are making a difference through their choice of living (see Figure 12). This question was deliberately a little provocative, to see if they really were convinced to the importance of their living or if they were pessimistic, as this may say something about the attitude towards environmental work.

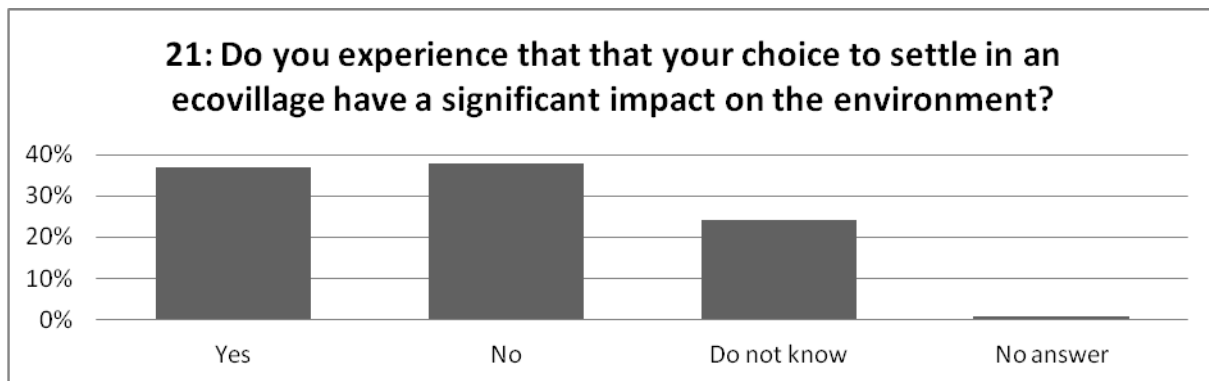


Figure 12. Responses to question 21

Surprisingly, the share that did not agree was somewhat higher than those who did experience they are making a difference. A significant proportion, 24 percent, did not know. Out of the 40 comments we received, the most common answers were being quite hopeful about their contribution. Almost as many stated that the most important work was that they were leading by example and spreading information. However, almost as many were quite pessimistic about the actual impact. The quote below, from one of the respondents, mirrors a common view; that they are doing a small contribution, but in the whole it is not enough:

*“In relation to countries and corporations that do not give a crap about the environment; no. But in relation to people living without thinking about the environment; yes. “(Authors’ translation)*

That it is good for their own conscience was mentioned by several respondents. An interesting reoccurring comment was that the systems installed were quite extreme when they were installed, but now they are almost standard in the municipalities, for example biomass heating solutions or sorting household waste.

Question 22 was asked in order to know about the networking with residents in other eco-villages, if they are in contact with other persons living in other eco-villages. Most of the respondents were not, 67 percent, even though around 33 percent stated that they are. Here we received 17 comments, and a few examples were mentioned and that they had had several study visits over the years. Compared to the work being done in the “Transition movement”, where networking through internet is a common thing, this is a little lesser than one could expect but it does show that far from all the residents are deeply involved in the environmental work in a larger scale than the local level.

#### ***5.4 Analysis and conclusions of phase 2***

There are several conclusions from this survey. First of all, one can discuss the future of eco-villages. Berg (2002) concluded that Swedish eco-villages have been built in three generations. However, when mapping eco-villages, we found that some of the communities had been given up on the concept of being an eco-village, through phasing out of technical systems and organisation structure. This was the case in at least five communities and even though we could not perform any deeper studies to analyse the reasons for this, it was indicated through contact persons and homepages that many of the initial pioneer people and key actors, had moved and that the new residents were not as interested in that particular way of living. The development of the eco-village concept could be discussed from a life-cycle perspective (cf. Baas, 2005), meaning that it has passed the phases of birth, growth, maturity and decline/restructuring/re-birth. The villages have been started by pioneers, have overcome obstacles of structuring and organising, and have passed through a growth phase into the maturation phase. Some of these villages have not changed significantly, but a few have for various reasons gone into restructuring phases. The materiality of the villages is still there, but initial, innovative systems are being replaced by more “mainstream” ones, and the residents are giving up on ideas of social involvement. This does not mean that “mainstream” systems are not innovative in their ways or environmental friendly, but the idea of the eco-villages was to do something different, and that is changing. Deeper knowledge about these “phasing-out” processes has been outside the scope of this study, but could be interesting to study in future research.

In relation to practice theory (cf. Shove, 2010), the implications of residents being replaced can be discussed. The initial idea of the eco-villages was the combination of environmental friendly and communal lifestyles. The technical structures might still be there, in forms of better isolated buildings or various technical systems, but if the usage is not correct or if the components that are tying the community together are not considered important any more, then the original purpose of the community is lost. Socio-technical structures are stabilising behaviour and affecting possibilities for change. The eco-villages are composed both by its material structure and its residents; more efficient systems can also result in social, economic and environmental impacts when poorly managed”.

A further discussion would be if the “Transition Movement” could be the start of the “fourth” generation of eco-villages. Numerous local initiatives, mostly for the provision of relevant information regarding climate change and environmental concerns, have emerged in recent years (Omställning Sverige, 2014). Such initiatives would mark a new beginning of the eco-village concept’s life cycle, from the birth phase. The mapping of the eco-villages showed that some of

the discussions are leading towards creation of new eco-villages. There is, however, a long way to walk until they are “born” and can enter a growth phase. In this development key actors will be crucial.

The survey showed some additional interesting results. First of all, the inhabitants are, as mentioned in previous studies (cf. e.g. Ibsen, 2010; Norbeck, 2009; Persson & Karsten, 1990), generally highly educated citizens that are more aware about environmental issues than the general public. The residents are generally quite satisfied living in eco-villages, and the results from this study did not point towards too many conflicts, something that was also evident in other studies. Although this can be due to the fact that no direct question was posed regarding this issue, there were opportunities to comment on relating topics and the residents seemed to be satisfied in general with their living.

There was an interesting aspect concerning the technical solutions in the villages. Several comments indicated that the systems installed in the first place had been under-dimensioned or that the eco-villages should take further actions towards sustainability. Is it a case of being caught up by the “mainstream”? The mainstream would in this case be municipal systems. Most eco-villages started with individual systems for sewage, heating or water, but our study, as well as previous studies, found that several of the villages had abandoned the initial independent systems in favour of municipal systems. Several comments indicated that the eco-villages may not be as extreme anymore, and that they may have had a role in inspiring the municipalities moving towards more environmentally friendly and innovative systems, willing to try out new solutions.

The respondents pointed towards several further actions that could be taken in order to reduce environmental impact, e.g. more self-sufficient electricity production, which could be interpreted in two ways. One of them is that they do think that they could actually do more for the environment; that the surrounding has caught up with them to some extent. By investing in community electricity supply, the idea of self-supply would be closer. When the villages were built, the main focus in terms of energy seem to have been on heating; biomass fuelled furnaces were rather innovative at that point, which is not the case today. It is however difficult to take further steps towards sustainability in the improvement in heating systems in several villages, as they already use biomass and on the majority of cases well insulated dwellings. Electricity would thus be the next step towards more renewable energy production.

It can also be concluded that the suggested additional actions are focused on solutions that are mostly technical, rather than social, and on technologies that are well established, rather than on innovative/alternative ones. This is an important aspect to consider, considering that when the villages were started, the technologies were state of the art, but now the suggested actions are existing, well-established technologies. This might be due to the fact that the physical structure is there and it is difficult to do more about that, without large investments or choosing highly complex systems, and these would be further steps towards sustainability rather than more “extreme” as the pioneer projects were viewed.

The inspiration from the eco-villages on its surroundings is an interesting aspect. The responses regarding the relation to the municipality varied, and as mentioned above, some of the municipal systems have caught up with the development in terms of sustainability. Today in Sweden, several large scale residential districts are being planned with high ambitions concerning climate effects. Vallastaden in Linköping, Hyllie in Malmö and the Royal Seaport in Stockholm are good examples. The technical solutions are of a much larger scale than the eco-villages, but ideas of closed energy and material loops are evident in all. The eco-villages might have inspired the projects, but that is something that would be highly interesting to study further.

On a different note, the physical location of the eco-villages seems to bother the residents, as it generates need for car use. These kinds of settlements require more space in order to have access to small-scale farming or community houses, and thus they would require to be located in the outskirts of cities. A few exceptions exist, like Smeden in Jönköping or Understenshöjden in Stockholm (Berg, 2002), both being rather central. However, these locations are getting increasingly difficult to gain access to through a general policy for densification of the Swedish cities.

Regarding previous studies (cf. EST, 2007; Watson et al, 2006) and their conclusions stating that economic factors are often considered as the most important ones for up-scaling, both as drivers and obstacles, and the majority of residents in our survey argue that it is generally not more expensive to live in eco-villages than in other, comparable dwellings. This can be seen from several perspectives. First of all, the work put in by the individuals themselves reduces cost and social aspects are continually important in order to keep the organisation working. Secondly, the utilities costs may be lower due to individual solutions and, in many cases, well insulated dwellings, which generally leads to lower costs. As long as the system is working properly, the comfort is not reduced in a large extent. Thirdly, it must be taken into consideration that the age of the villages plays an important role, considering monthly costs. The physical structure here might differ, but older villages with already depreciated technical solutions, could probably have lower costs. Fourth, the high level of education and the income level of the residents influence the willingness and ability to pay for a more environmentally friendly way of living. The cost might thus be something that is not thought as much about.

The functionality of the systems is of major importance. If they are not functioning, the residents are obviously not as happy living there. There we found a significant statistical correlation between functionality and the feeling of making sacrifices, and also in relation to the costs of living there. If there is too much hassle, it might not be worth it. These are subjective aspects, as some seem to put up with it, while others that might have doubts living there in the first place are experiencing it as a larger problem. The systems are also costly upon replacement.

The functionality relates to another issue: that of visibility and understanding of energy and environmental concerns. Infrastructure services such as electricity, water or heating, are often considered invisible and taken for granted among users, at least until breakdown (Star, 1999). In Sweden, for example, publicly owned multi-dwelling buildings include the cost of heating in the rent and the tenants thus are not aware about the real costs for heating. The residents in the survey seem to be interested in the technical system performance, it is almost required in order to

live there, but it does mean that they are aware of costs and functionality. This is not to be underestimated. The awareness of technical systems is highly important in understanding climate and environmental impact. However, when the residents are replaced by new ones, it might take time for them to learn and understand the systems.

When the first eco-villages were started, it was a counter-reaction towards globalisation, capitalism and nuclear power. It was a matter of principle to have individual solutions and higher degrees of self-supply; the pioneers did not want to be a part of the “system”. The residents were often politically active, for example in the anti-nuclear movement. This can be discussed in terms of being part of the “mainstream system” or not, which is still visible today. But it has changed to some extent, as it is now accepted to get rid of some of the non-functional technical solutions for the sake of convenience.

To sum up the survey, there are numerous drivers and obstacles for residents starting and moving to eco-villages, as shown below.

### **Drivers**

- Environmental interest
- Social factors
- Closeness to nature – green wave
- Willingness to participate more than willingness to pay
- Cooperation and internal organisation necessary
- Highly educated citizens

### **Obstacles**

- Technical system underperformance
- Tensions when the “old” residents are being replaced by “new”
- Pessimistic view about environmental development in general



## 6 Overall conclusions of Phase 1 and 2

There are some general conclusions that can be drawn from the two phases. One difference in the studied communities is how they started. The eco-villages started with a specific plan based on the combination of environmental friendly living and being a social community in the 1970s and 1980s. The renewable energy communities started often with an event such as a national environmental award contest or the loss of a big employer that led to new ideas of independency of energy supply. The development involving citizens started in the 1990s and 2000s (the energy crisis in 1973 functions as example in the background).

The size of eco-villages has been small by definition (maximum of fifty households) and they became more or less closed communities as way of living. There were never any intentions of growing. The size of renewable energy communities in this research has been up to 40,000 inhabitants in the Thisted region in Denmark. The renewable energy developments generated the need of being an open community to stimulate creative activities, while, even though the eco-villages have been open to new residents, there has always been a sense of clear boundaries in relation to the surroundings.

Inhabitants of eco-villages are generally highly educated citizens that are more environmental aware than the general public. They are generally quite satisfied in the eco-villages based on a significant statistical correlation between functionality of the system in which they live and the feeling of making sacrifices for a good environment. Inhabitants of renewable energy communities show larger-than-average involvement in both participation in community meetings about and investments in renewable energy projects. In both these cases, it is obvious that it is inhabitants who are willing to participate in sustainable transition processes. The residents have taken further steps towards less environmental impact, and all seem to be generally satisfied with the situation and that they are not making that many sacrifices.

A life-cycle concept can be detected in both eco-villages and renewable energy communities. The eco-villages are in a mature phase and some are declining or even phased out. The life-cycle of eco-villages is very much connected to and dependent on the involvement of pioneer key actors. The assumption can be discussed whether elements of eco-villages are nowadays internalised in the design of living areas such as Vallastaden in Linköping, Hyllie in Malmö, and the Royal Seaport in Stockholm, or if it has been an inspiration for projects in creating sustainable urban districts.

The renewable energy communities in Denmark and Germany are in a growth phase: either still having to reach the 100% self-efficiency or continuing producing beyond their own needs. The life-cycle of renewable energy communities is based on new ways of involving citizens in the communities' renewable energy developments. Either citizens or community representatives are key-actors in this process. This seems to create a new institutional framework for co-operation between citizens and community representatives.

The development of the knowledge about the needed technology systems and infrastructure and how to develop and make use of local skills is an important aspect. Inhabitants in eco-villages had originally the idea of spreading the knowledge of their systems, but it is unclear about the ambitions today as initial residents are starting to be replaced. National and international knowledge-transfer activities have started to take place in renewable energy communities, which is an additional contribution to local knowledge and capacity-building. In some communities this knowledge transfer was institutionalized, for instance in the Folkecenter in Thisted and the Energy Academy in Samsø. In the German cases the knowledge sharing is performed by the key actors in the community organisation, through fairs and national and international visits.

A last common feature in the two phases is the underlying ideas of system relation. Even though the different kinds of villages stems from quite different ideological positions, as eco-villages often were started with strong ideological bases, as a reaction towards environmental degradation and strong communal ambitions, while the renewable energy communities started in order to be more self-sufficient. The aims have still been similar: to do something outside of the mainstream, to take an initiative and show that different developments are possible, outside of the centralised systems. No matter the size and the actual impacts, these are role-model communities that have the potential to inspire other communities, municipalities and nations into another, more sustainable direction.

## **7 What do the conclusions teach us for new developments and what type of recommendations can be based on that?**

Our findings show that there are various kinds of movements aiming towards higher degrees of self-sufficiency and reducing environmental impact. The sizes differ, but the important lesson to be learned is that the interest does actually exist, but in various forms, scales and sizes. Below, we note a number of things that can be learnt from the study.

- Give people the opportunity to get involved. The studied communities in this report are special cases due to highly involved residents, but can be used as inspiring examples when developing new areas.
- Make use of people's interest in their home and neighbourhood and let them interact also with the technical systems. Let people choose PVs on the roofs and benefit from the electricity produced. Visualize flows of energy, water and waste for higher understanding and interest in how the systems functioning.
- Use previous knowledge from the eco-villages when developing new (or old) residential areas. The studied communities are important sources of inspiration for municipalities and developers. The residents have several years of experience of trying out new technical and organisational solutions and a lot can be learnt from that. The residents seem to be more than willing to share that knowledge and this is something municipalities should try to utilise.
- Invite the residents to create inviting attractive and including living environment. This give potential for residents for staying a longer time and thus, potentially, gets more involved in the residential area. Involvement and interaction with innovative technical solutions are crucial.
- People are flexible. They learn to adopt quickly, but the technical systems need to function properly in order to keep people satisfied.
- Up-scaling takes time. Sustainable developments are important, no matter the size, and the impact of even small settlements should not be underestimated.

### **7.1 Further research**

We have in this study found a number of potentially interesting future research topics.

- Maturation and phasing out of eco-villages? In the mapping of existing Swedish eco-villages we found that some of the old communities had abandoned the eco-village concept. A deeper study of these villages in order to understand factors driving these processes can potentially bring insights about the organisation of the communities.
- Emerging transition towns – driving actors and obstacles. The Transition movement has gained attention around in Europe, sometimes called “Low Carbon Communities” and some initiatives have been started in Sweden. Although research about the movement has

been carried out internationally, deeper studies in Sweden are lacking. What are the drivers and obstacles from these movements? Is there any knowledge transfer from e.g. eco-villages?

- Up-scaling of communities? Several of the Swedish cities are planning large scale urban areas with high ambitions concerning sustainability and innovative system solutions. Hammarby Sjöstad and Royal Seaport in Stockholm, Hyllie in Malmö and Vallastaden in Linköping are examples. What knowledge is brought in from our studied movements into these projects? Is that a case of massive up-scaling?

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## Annex I: Overview of sixteen cases of self-sufficient renewable energy communities in North-Western Europe

A brief overview of sixteen cases of self-sufficient renewable energy communities in North-Western Europe (see for more information about similar communities in Europe: <http://www.go100percent.org/cms/index.php?id=19>)

- *Lathen* in North Germany, 6,000 inhabitants:  
The mayor took initiative for a solar panel park five years ago (Hansa Green Tour, June 2012 & 2014).
- *Zschadraß* in East Germany, 3,300 inhabitants:  
The mayor of the village of Zschadraß (part of the town of Colditz) wanted to improve the local economy and the environment for current and future generations, making renewable energy development a priority since 2007. The village has also already surpassed the 100% renewable target in the electricity sector. Part of power mix is supplied by a 2.2 MW wind turbine, which at 138 meters tall is one of the largest in the region. The community invested 20% of the project's total costs of approximately €3.2 million through a local foundation and association, with a private operator from the village covering the rest. Solar photovoltaic systems, owned by the community, are on nearly all public buildings.
- *Wildpoldsried* in South Germany, 2,600 inhabitants:  
Solar and wind energy, biogas digesters both through public and private initiatives. The district also benefit from three small hydro power plants, ecological flood control and a natural waste water system. The village produces 500% more electricity than it needs with €4 million annual revenue by selling it back to the national grid.
- *Saerbeck* in West Germany, 7,000 inhabitants:  
Moving into an “Energy Autonomy” was a community initiative in 2008. A plan to turn into a renewable-energy self-sufficient was set and reaching 100% renewable energy use by 2013 was the goal. An old ammunition shelter was transformed into a Bioenergy Park, with an installed capacity of 6MW from solar energy. Up to 2013, the community had reached a supply capacity of twice their actual demand. This capacity includes up to 8.5 MW of peak supplementary power from photo voltaic panels in roofs in houses and farms and biogas production from household waste for the CHP plant.
- *Juehnde* in Lower Saxony, Germany, 750 inhabitants<sup>\*\*</sup>:  
Juehnde is a small village in a rural area. The idea to become self-sufficient utilizing local assets in Juehnde came from the nearby located University of Göttingen, in 1997. The challenge from the university was taken and the main approach to include the citizens was to make them feel like they were included and responsible for this transition project. Juehnde reached their goals in eight years, by 2005, and became the first renewable energy self-sufficient community in Germany. They annually supply over 200% of its electricity demand

and over 100% of its heating demand. Juehnde is nowadays an object for inspiration to other governments and communities internationally.

- *Feldheim* in Brandenburg, Germany, 145 inhabitants \*\*: The local energy supplier, *Energiequelle GmbH*, developed a project plan, with the aim to convert Feldheim into a 100% renewable energy self-sufficient community. Already from the beginning this project met positive reactions from the municipality of Treuenbrietzen (Feldheim is part of that municipality) as well as from the inhabitants of Feldheim. The key actor in the beginning of the conversion has been the local energy supplier that together with other enterprises and municipality of Treuenbrietzen made the project's feasibility sure. The crucial conditions were the possibilities to utilize the local resources and the vision of decreasing the community's unemployment. The communities in the region have a mean-unemployment of around 30%. The transition has reached self-sufficiency for heating and electricity by 100% renewable energy. Renewable energy is acquired from a wind energy park (with partly private investments, a solar energy park and a biogas plant). The community has installed both a local district heating grid as well as a local power grid.
- *Effelter* in Northern Bavaria, Germany, 280 inhabitants \*\*: Effelter is an agricultural village located in north-eastern part of Bavaria near Kronach, Lower Bavaria. In 2002 a biogas plant was deployed in the village and one citizen connected his private household to the plant. This started interest among the citizens and the village-council invited them to workshops where the citizens could discuss and brainstorm around what measures the village could take to further install renewable energy technology. The local inn and the fire department connected to the biogas plant in 2005 and from that time also other citizens connected to the biogas plant. The key factors for the opportunities to the transition were the growing interest from citizens and the renewable energy investment organisation *Energievision Frankenwald*. Effelter has achieved a supply of 200% of their annual electricity demand and about 100% of their heating demand nowadays. This gives a net sale back for the village of 100% electricity annual demand.
- *Samsø* Island in Denmark, 4,000 inhabitants: Wind, Solar energy, and Waste-to-Energy incineration generate the elements for producing 10% more energy than the residents are using each year. The results are disseminated by a privately initiated Samsø Energy Academy. According to the director of the Samsø Energy Academy, "*Samsø's lesson is that environmental change can only come from the ground up.*" (see also Radzi, 2009).
- *Thisted* region in Denmark, 40,000 inhabitants: A brief overview learns that a Folkecenter started wind energy projects in 1982. The Folkecenter had a strong influence on development of Wind, Solar and Wave energy, Waste-to-Energy via Incineration of household waste and Citizens initiatives on bio-gas digesters. The Municipality is now strongly stimulating/ facilitation renewable energy business links.

- *Ærø* (“Aeroe”) in Denmark, 7,000 inhabitants<sup>\*\*</sup> :  
In the beginning of 80’s a small group, including one blacksmith, a farmer, a couple of teachers and a bank director, sat down to find practical and economically sustainable energy solutions on Aeroe in Denmark. They were little driven by ideological ideas but wanted to find a sustainable solution regarding the energy issue on the island. The supply is diverse and consists of approximately 55% solar, 45% biomass (wood chips based on energy crops) with a backup oil burner for peak load situations. The wind mills on Aeroe are owned in different constellations including inhabitants and by corporations in different size. The electricity production is greater than the demand on Aeroe on annual basis and the installed power is 12 MW. The success factors at Aeroe are described to rely on the ability for the citizen to communicate with each other and that they were able to identify the main problems for the society.
- *Vestenskov* in Lolland, Denmark, 500 inhabitants<sup>\*\*</sup> :  
After an extensive development of wind power on the island Lolland there is an over production of electricity (around 150% of local demand) and limited export possibilities from the island. To utilize this energy in some useful way, discussion rose among citizens and the local authority. One idea was to convert the excess electricity to hydrogen via electrolysis which is possible to store in contrast to electricity, regarding these quantities. This gas was then distributed to household in a grid similar to a district heating grid. In the household the gas is utilized according to the actual need in fuel cell where either heat or electricity can be obtained. These modules are called “micro CHP” and have an output of approximately 2 kW.
- *Moss* in Norway, 31,000 inhabitants:  
A private company is utilising geothermal heat from rock ground and landfill gas from the waste disposal site for electricity, steam, cold for refrigeration, district heating and district cooling in the north eastern part of the town of Moss. The energy system is based on three facilities: a bio-energy plant, a heating and a refrigeration station.
- *Hoonhorst* in The Netherlands, 1,100 inhabitants:  
Citizens in Hoonhorst have stimulated the initiative for seventeen projects which include solar power, district heating, fiber glass to facilitate e.g. care-to-the-home, bio fuels, biogas from manure, reduction & harvesting of waste, grey water system, village garden etc. (Oostra & Jablonska, website). A knowledge center with 10-12 inhabitants advises the local inhabitants about environmental issues and renewable energy applications.
- *Lyndhurst* in the United Kingdom, 2,500 inhabitants<sup>\*\*</sup> :  
Lyndhurst is a small rural community located in South-western UK. With time, photovoltaic technology started to gain interest from the citizens as it became more feasible and less costly. The community started projects within the renewable energy sector, where public shares were available in the range of 250 to 250,000 British pounds. An important characteristic of the communication of the plans was that they were publicly informed and consented with other surrounding towns through council meetings, explaining the content of the plans and clarifying questions and doubts among the participants.

- *Neilston* in Scotland, UK, 5,200 inhabitants:  
The Neilston Community Wind Farm utilizes their natural wind resource. The four turbine wind farm will significantly reduce the Town's carbon footprint and will generate substantial revenue from the sale of green electricity. Neilston Development Trust has formed a 49.9% / 50.1% joint venture with a specialist renewables developer, Carbon Free Developments Ltd. Carbon Free is responsible for the technical development, planning and construction aspects of the project. The cooperation is a unique collaborative effort. The structure has been designed to ensure that the Neilston community qualifies for grant and loan funding to invest in the wind farm and also receives 49.9% of the pre-tax profits generated by the wind farm.
- *Gigha* in Scotland, UK, 160 inhabitants\*\*  
The small island Gigha on the western coast faced a great decline of the population in the beginning of the 2000's which went so far that the landlord who owned the island set it out for sale. The whole island suffered from bad economies and the standard of the living in the society was not very high. This was a crucial event where all the inhabitants went together and bought the island. To make the budget go together and to secure the supply energy to the island, a local energy company established three wind mills. This wind farm is the first community owned, grid connected, wind farm in Scotland that uses a quite new and unique business model. The financial model is a mix from grant, loans and private investments from the local citizens.

\*\* Cases from the student group project by Larsson & Nyberg, 2014

## **Annex II: Overview of respondents in Skype interviews**

Interview (January 8, 2014): Søren Hermansen, native and Director of Samsø Energy Academy, Samsø.

Interview (January 9, 2014): Guido Wallraven, head of planning at Klimakommune, Saerbeck.

Interview (January 10, 2014): Preben Maegaard, native, Founding Director of the Nordic Folkecenter for Renewable Energy, Thisted.

Interview (January 14, 2014): Jan Krogh, technician and researcher, former official of Thisted Municipality.

Interview (January 23, 2014): Günter Mögele, Deputy Mayor since 1996 in Wildpoldsried.

Interview (January 27, 2014): Rob Ewing, Technician in Lyndhurst and Volunteer Member of the New Forest Park Authority.

## Annex III Survey methodology

The project ran over a limited amount of time and it interviews practically impossible to conduct with sufficient amount of residents. Interviews could be of interest as it gives a possibility to reach deeper than a questionnaire may do and you have the opportunity to ask follow-up questions (Kvale & Brinkmann, 2009). However, the time frame is a restricting factor, and as we wanted to receive as much responses as possible, we decided that a questionnaire to residents in identified relevant eco-villages in Sweden would be a more suitable method. Questionnaires have several advantages, expect that more respondents can be reached, but also that they can describe or explain features or opinions among a population. They may be divided into four categories of focus: facts, attitudes, socio-psychological and explanatory (May, 2001). Our study is explanatory, we want to know which people that have moved to the eco-village, why they have chosen to do so and finally to understand the advantages and disadvantages in this aspect.

We decided to send out an online questionnaire due to restriction in budget as it is costly and time-consuming and the fact that the responses are already in electronic format reduces the time for process (Kaplowitz et al, 2004). Sending out questionnaires by mail also requires address lists that needs to be obtained. A problem related to web surveys have earlier been that it raises concerns regarding uneven access to internet (Shih & Fan, 2008) but as internet access have increased rapidly since year 2000 the restriction becomes less. However, age differences might still occur as well as the risks of “spam filters” (Kaplowitz et al, 2004). Despite some risks, we found web-survey advantageous in this study and we could expect the response rate to be similar to a mail-survey.

The advantage we had in this study is the focus on specific communities, which meant that the delimitation was not an issue. We could expect, which was true, that all the communities had e-mail lists to the residents and the concern was to get access to these. By contacting the communities and finding a key-person that would allow us access, this could be handled. We did not get access to the email-lists directly, rather the key-persons forwarded our email to the list. This meant less control for us, but on the other hand the email was sent from someone within the community, meaning that there were less anonymity.

The first step in this process was to identify which are the relevant ecovillages that could be of interest in our study. The definition “eco-village” is quite broad, as the span from quite mainstream dwellings to “off-grid” establishments can be found in this category. There is also a question of time, whether they have been around for some time or if they are being established at the moment. Several communities, often self-labelled as “low carbon communities”, are in the planning phase but have not been started. We decided to choose communities that are established and do have residents living there at the moment. Another important definition was that they should have some sort of energy production, either from solar panels, solar cells, wind-mills or similar. This was important as they do thus have made investment in technical systems that are not “only” the mainstream systems.

In this process we used different databases and publications online to identify the relevant eco-villages. In this first collection we identified 23 relevant communities, which we closer examined. Using criteria's for existing residents and energy production we could narrow it down further, and five of these could no longer be defined as eco-villages as they had either been sold and changed the composition or had simply "stopped" being an eco-village. It left us with 17 eco-villages, which can be seen in figure 2.

These 17 eco-villages were all approach through phone or email to contact persons mentioned on the homepage in order to help them send out the link to the questionnaire. Unfortunately, not all eco-villages were interested in participating: 4 did not respond despite several attempts to several of contacts. The reason might be several, but some of these communities have been studied in other projects before and might feel tired with research projects.

The first emails were sent out around 9 December and then the links were sent as soon as possible after that, and the latest link were sent out in the 16 December. A reminder was sent to all the villages on 4 February.

The total amount of possible respondents in the eco-villages that did send out the questionnaire was 396. The span is from around 5 to 65 persons in each community.

In total, we received 116 responses, which give a response rate of approximately 29 percent. This is in the lower edge of response rate, but still acceptable. The reasons for the low response rate might be several. Studies have suggested that mail-surveys on average might receive a little higher response rate (Shih & Fan, 2008), but in this case we do not feel that a mail-survey might have increased the response rate. One of them is that we were not able to control the lists ourselves, which gave us less control of the process. On the other hand, the ones that did send out the questionnaire are persons that they know, either from the board of directors or as a neighbour, which gives a sense of familiarity.



## Annex IV: The Survey



Hello,

At Linköping University we are now conducting a research project on critical factors for up-scaling of more self-sufficient energy supply. It is an interdisciplinary collaboration between researchers in the departments of Environmental Technology and Management and Department of Thematic Studies – Technology and Social Change. The project is financed by Tekniska Verken AB.

We are interested in understanding the factors that have been decisive for those who have already taken the decision to invest in environmentally friendly technologies, or who have chosen to in any way participate in projects related to the creation of more sustainable living environments. With this background we are interested in your experiences of living in an Eco-village. Therefore we ask you to answer this questionnaire containing 28 questions about your experiences in your current accommodation.

All responses will be treated anonymously.

If you do have any questions, feel free to contact the researchers in the project; Dick Magnusson or Santiago Mejia Dugand.

**Thanks for your participation!**

Best regards

Dick Magnusson

Santiago Mejia Dugand

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1. How interested are you in environmental issues?

Options: Very interested, Somewhat interested, Not very interested, Not at all interested

2. The list below contains a number of environmental problems. How serious threat to the environment in Sweden do you think these problems are?

	<b>Very serious</b>	<b>Somewhat serious</b>	<b>Not especially serious</b>	<b>Not serious at all</b>	<b>No opinion</b>
<b>Climate change</b>					
<b>Consumption and waste</b>					
<b>Overfertilization</b>					
<b>Discharge of pollutants into water</b>					
<b>Toxins in the environment</b>					
<b>Extinction of plant and animal species</b>					

Comment:

3. How often do you do the following actions for environmental reasons?

	<b>Never</b>	<b>Sometimes</b>	<b>Quite often</b>	<b>Very often</b>	<b>Always</b>	<b>Not relevant</b>
<b>Abstain from eating meat</b>						
<b>Choosing to walk or bike instead of taking the car</b>						
<b>Choosing to travel by public transport instead of the car</b>						
<b>Choosing to travel by train instead of flying</b>						
<b>Sort household waste</b>						
<b>Eat organic vegetables / fruits</b>						
<b>Shopping environmental label goods</b>						
<b>Reducing my electricity consumption</b>						

Comment:

4. How often are you trying to reduce your energy use in the following context?

	Never	Sometimes	Quite often	Very often	Always
Space heating in dwelling					
Usage of electrical appliances/lightning					
Purchase of electrical appliances/lightning					
Hot water consumption					
Transports/travelling					

5. Are you a member in any type of association/organization?

	No	Yes	... and I have some sort of assignment
Sporting or outdoor organization			
Environmental organization			
Political party/alliance			
Union			
Cultural association			
Village community			
Immigrant association			
Retiree association			
Humanitarian aid organization			
Other type of organization/association			

Comment:

6. Which way do you consider being the best way to influence people's actions concerning environmental impact? (1 - best way, 2 - second best way, etc)

Options: Taxes, subsidies, laws and restrictions, information, lead by example

Comment:

7. For how long have you lived in your present home?

Options: Less than a year, One to three years, Three to five years, Five to ten years, More than ten years

8. Where you familiar of the concept of eco-village before you moved to your current home?

Options: Yes, No

Comment:

9. Have you previously lived in an eco-village (or similar)?

Options: Yes, No

Comment:

**10.** Where your decision to move to your present dwelling influenced by the fact that it is located in an eco-village?

Options: Yes, No.

**10b:** If yes, in what way?

**11.** What was the main reason for you to move to your current accommodation? (1 - most important, 2 - second most important etc.)

	1	2	3	4	5
<b>Social community</b>					
<b>Environmentally friendly living</b>					
<b>Cheap living</b>					
<b>Good location</b>					
<b>Family friendly</b>					
<b>Closeness to nature</b>					
<b>Welcoming living environment</b>					
<b>Attractive dwellings</b>					

Other reasons for moving to current residence:

**12.** Do you feel that you make any kind of sacrifice because of the fact that you live in an eco-village?

Options: No, not at all, To some extent, Yes, to a large extent, Do not know

Comment:

**13.** If yes at question 12, what is the reason/s?

Options: More expensive, Reduced comfort, Inferior location, Reduced service, Do not know,

If other, please specify:

Comment:

**14.** If you are doing any kind of sacrifice, do you think that it is worth it?

Options: Yes, No

Comment:

**15.** Do you experience it as any economic difference living in an eco-village compared with equivalent dwelling in a residential area that is not an ecovillage?

Options: More expensive, Same cost, Less expensive, Do not know

Comment:

**16.** Are you in any way involved in the governance of the eco-village (in the board, working groups, etc.)?

Options: Yes, No.

If yes, in what way:

**17.** Do you feel that the municipality's environmental and energy policies affect your living in the eco-village?

Options: Yes, No, Do not know

In what way?

**18.** Have you, apart from the technical systems that are standard in the dwelling, taken any extra steps to reduce the environmental impact? (For example, the purchase of shares in wind energy, green power, small-scale electricity)

Options: Yes, No, Do not know

If you have taken any action, which one is it?

**19.** Do you think that the technical systems available in the dwelling operate satisfactorily?

Options: Yes, No, Do not know

If no, why not?

**20.** What further action would you like to see the eco-village took with regard to environmental friendliness?

**21.** Do you experience that that your choice to settle in an eco-village has a significant impact on the environment?

Options: Yes, No, Do not know

Comment

**22.** Are you in contact with other persons living in other ecovillages?

Options: Yes, No, Comment

**23.** Are you female or male?

Options: Female, Male, Wish not to respond

**24.** In what year were you born?

**25.** What is your marital status

Options: Single, Cohabitant/living apart from partner, Married/partnership, Widow/widower

**26.** How many people live in your accommodation today?

Options: 1, 2, 3, 4, More than 4

**27.** What education do you have? (Choose highest initiated or completed)

Options: Not completed elementary school (or equivalent compulsory school)

Elementary school (or equivalent compulsory school)

Studies at high school (or equivalent)  
Graduate from high school (or equivalent)  
Post-secondary school (not college/university)  
Studies at college/university  
Graduate from college/university  
Graduation/studies at postgraduate level

Comment:

**28.** What orientation has your education primarily?

Select the option that best describes your education

Options: Economy/business/administration

Aesthetics/design/crafts/art

Hotel/restaurant/service/beauty care

Health care

Humanities/culture

Agriculture/forestry/environmental care

Technology/building/industry/transport

Media/journalism/advertising

Natural science/mathematics/computers

Education

Social science/law

Social work/care giving/psychology

Other: