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AUSTRIAN ENERGY AGENCY
in Cooperation with
Austrian Energy Agency

# Energy Autonomy in Austria: Socioeconomic Impacts on Rural Development and Barriers

Master Thesis of Karin Mottl for the Requirements of the
Master of Natural Resources Management and Ecological Engineering

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Vienna, 2011-03-14

# EXECUTIVE SUMMARY

The socio-economic impacts of energy autonomy on rural development and its barriers impeding further progress in Austria are the objective of this master thesis which presents a comparative case study of two municipalities in Upper Austria. In 1986, Windhaag bei Freistadt implemented the first wood chip heating plant within Upper Austria, which was built and maintained by the municipality (BIOENERGIE WINDHAAG REG.GEN.MBH, 2010). In the same year Steinbach an der Steyr started to plan the renovation of one of the municipality's buildings which was to be heated by locally produced biomass (SPES, 1994). 24 years later it can be said that these single projects were the municipalities starting point on their way towards energy-autonomy. Steinbach remained with its use of biomass and constructed four further decentralised heating plants (NAHWÄRME STEINBACH, N.D.). In addition, the two already existing hydro power stations were renovated and several buildings owned by the municipality were insulated and modernised to reduce their energy demand (MUNICIPALITY OFFICE STEINBACH, 2010). Windhaag broaden its view and also introduced projects to produce energy by sun, wind and water (ENERGIEAUSSTELLUNG WINDHAAG, 2007). Three decentralised heating plants, two wind turbines, 523 m² panels for solar power as well as the re-construction of two small hydro power stations are now used to produce power and heating locally (BIOENERGIE WINDHAAG REG.GEN.MBH, N.D., ENERGIEAUSSTELLUNG WINDHAAG, 2007). Furthermore, insulation of municipality's buildings was modernised and thus, they demand less energy now (MUNICIPALITY OFFICE STEINBACH, 2010). In addition to all these projects, both municipalities set up private initiatives to provide heating and power, along with reductions in energy demands.

Years before the "Austrian Energy Strategy 2020" was introduced in March 2010 (BMWFI AND BMLFUW, 2010) or the "Austrian Climate and Energy Fund" was established (CLIMATE AND ENERGY FUND, 2010), Steinbach and Windhaag tried to adapt their existing energy systems and switch to a self-supply. In the meantime it can be seen that:

- Steinbach is 100% self-sufficient (for the balance sheet), whereas Windhaag is partly self-sufficient for power;
- Both municipalities are partly self-sufficient for heating;
- Both municipalities still are 100% dependant on external energy for mobility;

(AEA, 2009a+b, ENERGIEAUSSTELLUNG WINDHAAG, 2007)

These results demanded a high investment. To tackle the part-autonomy technical problems, criticism and changing general conditions (e.g. legal framework or the system for allocation of subsidies) had to be overcome. Furthermore, a continuous involvement and a rethinking for self organisation were necessary. But finally, a broad range of socio-economic impacts is

given. It could be evaluated that these impacts are in part the same and partly they vary between the two municipalities. Furthermore, their needs are different, depending on the municipality's methods and goals that were chosen to reach a part-autonomy. Out of the 15 socio-economic impacts which could be evaluated, the most common stated by the interviewees can be seen in Figure 1:

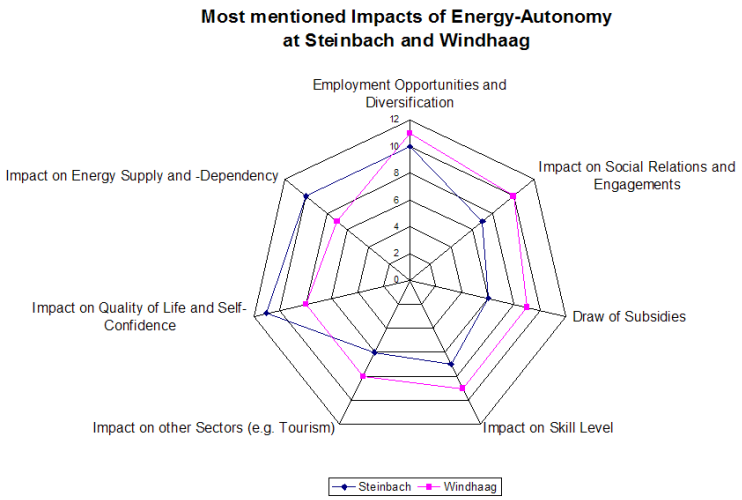


**Figure 1: Main Impacts of Energy-Autonomy at Steinbach and Windhaag (119 mentions)**
**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SC4 AND WP3), 2010**

Thus, the main areas covered such things as the impact on social cohesion, skills and quality of life as well as a contribution to the security of energy supply and employment opportunities.

The construction and maintenance of the above described infrastructure led to high costs. Even if it was not possible to evaluate all the costs, EUR 2,072.683,-- (including tax) was spent to construct the eight decentralised heating plants at Steinbach and Windhaag (NAHWÄRME STEINBACH, N.D., BIOENERGIE WINDHAAG REG.GEN.MBH, N.D.). Of this, 39,47% (EUR 818.171,-- including tax) was from local investments (INTERVIEWEES (SF1, WF2), 2010) and thus, supported small trade (e.g. local builders, plumbers, roofers and electricians) and also jobs in tourism. In addition, the creation of new jobs was evaluated. Ten full-time jobs were found in the energy and wood processing sector as well as in the regional management and education sector at Steinbach and Windhaag. However, they were shared between 88 people and thus are either part-time jobs or an additional income (INTERVIEWEES (SP1-4, SF1, SM, WM, WF1-4, WC1+3, WP1+2), 2010).

Even though Steinbach and Windhaag are part-autonomous at a power and heating level, there is still a long way to go to become fully independent from fossil fuels. This can be clearly seen when one looks at the mobility sector, where both municipalities have yet to

find any viable solutions. If one considers the other barriers impeding further progress there are a multitude of problems, which have to be resolved. During the study, barriers which are stated in the literature were adapted to internal barriers ("created" and thus, manageable within the municipality; see yellow circle) and external barriers (acting from outside the municipality; see red oval) to give the municipalities a manageable instrument for further development. According to the interviewees the main barriers faced can be seen in Figure 2:

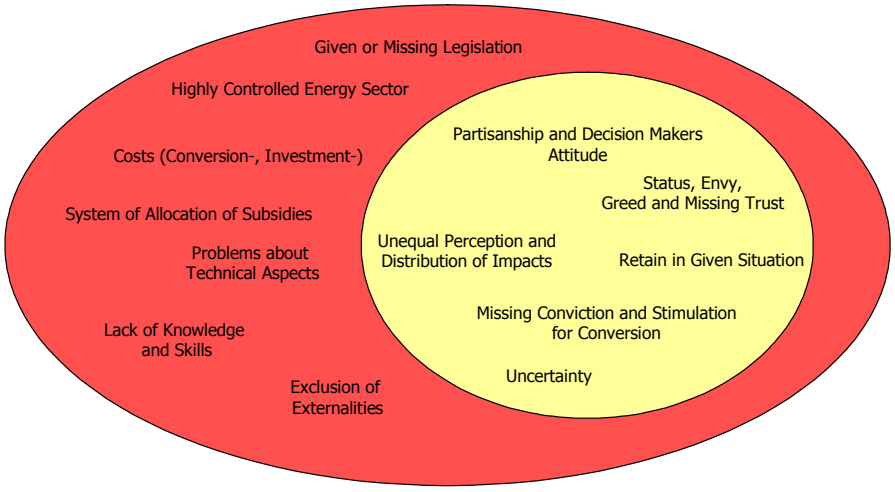


**Figure 2: Main Barriers of Energy Autonomy at Steinbach and Windhaag**

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SP5 AND WP3), 2010**

At the start of the projects both Steinbach and Windhaag found that the main barriers were due to partisanship and decision making attitudes, technical problems, uncertainty and a lack of knowledge and skills due to the projects pioneering character. Nowadays, the main problems are financial aspects (costs), a limited power grid, diverging legal regulations, a mainly continuously changing subsidies system and further motivation for the people.

To sum up, the case study showed that there are interested and motivated people who have the necessary will to focus on reaching energy-autonomy. Evaluated socio-economic impacts and barriers differ partly between Steinbach and Windhaag but overall it can be said that both municipalities have a clear focus on the supply side and thus, potential for further progress. Hopefully, this thesis may support them in overcoming – at least – several of the existing barriers and thus, make further steps towards energy autonomy which was defined for this thesis as "Independence in energy for heating, power and mobility by using renewable, local energy resources in combination with a reduction in demand through energy efficiency and energy saving measurements".

# CONTENTS

# ABBREVIATIONS

| | |
|---|---|
| a | Year |
| AEA | Austrian Energy Agency |
| AG | Public Company |
| BMLFUW | Federal Ministry of Agriculture, Forestry, Environment & Water Management |
| BMWFI | Federal Ministry of Economy, Family and Youth |
| CDM | Clean Development Mechanism |
| $CO_2$ | Carbon Dioxide |
| EA | Energy Autonomy |
| EBF | Energie Bezirk Freistadt |
| EC | European Commission |
| e.g. | For example |
| E-GEM | Energy Municipality |
| ESCO | Energy Services Company |
| EU25 | European Union comprising of 25 member states |
| EU | European Union |
| EUR | Euro |
| GWh | Gigawatt hour |
| IPCC | Intergovernmental Panel on Climate Change |
| km | Kilometer |
| km² | Square kilometer |
| KW | Kilowatt |
| KWh | Kilowatt hour |
| KPC | Kommunalkredit Public Consulting |
| m | Meter |
| m² | Square Meter |
| n.s. | Not specified |
| MW | Megawatt |
| NREAPs | National Renewable Energy Action Plans |
| O&M | Operation and Maintenance |
| OECD | Organisation for Economic Co-Operation and Development |
| OÖ | Upper Austria |
| PT | Petajoule |
| PV | Solar Power |
| R & D | Research & Development |
| RE | Renewable Energy |
| RES | Renewable Energy Sources |
| RET | Renewable Energy Technologies |
| RIS | Rechtsinformationssystem (which stands for information system about law) |
| Srm | Cubic Meter |
| TJ | Terrajoules |
| UNFCC | United Nations Framework Convention on Climate Change |

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# ACKNOWLEDGEMENTS

This thesis would not have been possible without those, who enabled higher education to me. Those, who supported me in the decision to quit the job I've had for eight years to "go back to university once again". Those, who supported me during my study and finally in writing this thesis.

First of all I would like to mention the most important people and thus, my family. Erika, Franz, Gerlinde and Valentin gave me continuous help and several times another view about topics I am struggling with. They helped me to broaden my view and see the overall aim: learn as much as you can but do not forget to have fun in life.

In addition, I would like to mention those, who helped me in writing this thesis. Marianne, who continuously was available, always supported me and gave me feedback, I could work with. Jean-Paul, who helped me with his critical view to improve the quality of this thesis. Graham, who always found the right words and did not despair because of my "German" English.

Last, but for sure not least, I would like to thank all the interested and motivated interviewees who offered their time and were very willing to provide me with relevant information. Without them, this thesis would not have been possible.

# 1 INTRODUCTION

## 1.1 Setting the Scene

There is still some debate regarding the mitigation measures of global warming and climate change (see for example last IPCC report). According to the International Energy Agency, fossil fuels will still account for more than 90% of the total primary energy demand in 2020 without new policy initiatives (PAINULY, 2001). This may lead to high environmental risks due to political conflicts and fluctuating energy supplies. Furthermore, improvements to the standard of living of rural populations are a key issue in many OECD countries (DEL RIO AND BURGUILLO, 2008). This is necessary, due to the decline in the agricultural sector and shrinkage in rural regions.

Projects focusing on a supply with renewable energies and a reduced demand in energy due to energy efficiency measures may have a positive impact on these rural regions. The European Parliament acknowledges this by stating that they "recognise the need to promote renewable energy sources as a priority measure given that their exploitation contributes to sustainable development. In addition this can also create local employment, have a positive impact on social cohesion, contribute to security of supply and make it possible to meet Kyoto targets more quickly" (EUROPEAN PARLIAMENT, 2001, p. 1).

In Austria, there are several successful examples of rural projects that focus on renewable energies and energy autonomy (MCCORMICK & KABERGER, 2007, KOCH ET AL., 2006, SERI, 2007). It is generally agreed (see among others PAINULY, 2001, ADAS, 2003, DEL RIO AND BURGUILLO, 2008, TISCHER, STOEHR, LURZ & KARG, 2006) that these projects may have a positive impact on rural development due to the fact that they:

- reduce unemployment;
- reduce social-economic differences among regions;
- modernize the regions and promote the establishment of new services and businesses in rural areas;
- support converting and restructuring of the rural economy;
- reform agricultural production, manufacturing industry and market structure;

These projects offer a broad range of impacts and synergistic effects on the community and region, namely economic, ecological and social impacts. DEL RIO AND BURGUILLO (2008) suggest that the ecological impacts are well researched, but that there is a fairly incomplete picture regarding the socioeconomic impacts, especially on those in developed countries and at a local level. Furthermore, there are several factors that may influence these projects. These are internal factors such as local acceptance as well as external factors such as

macrostructure (UNIVERSITY OF KASSEL, 2009). This paper attempts to highlight these aspects and to provide an encompassing review of the contribution of energy autonomy on rural development on the level of municipalities by a comparative case study analysis in Upper Austria.

## 1.2 Objectives

The main objective is to show if and how energy autonomy can promote rural development at a local level. This will be done through research of existing literature and evaluation of two municipalities in Austria, Steinbach an der Steyr[1] and Windhaag bei Freistadt[2]. These municipalities are attempting to become energy-autonomous. Focus will be given on evaluation of socioeconomic impacts on *municipal* level *since 1986* because this was the year at which both municipalities started there main steps towards energy autonomy (Windhaag started its first decentralised heating plant and Steinbach started to plan necessary adaptions at the "Alter Pfarrhof" and thus, its first decentralised heating plant, too).

The second objective is to evaluate the barriers/constraints which impede municipality's way towards energy autonomy. Thus, a comparative case study will be conducted (based on literature, secondary data as well as own qualitative research).

There are three objectives, which will not be evaluated by this thesis, namely;

- impacts of energy autonomy at a larger than municipal level (e.g. regional, federal state or national level);
- ecological impacts of projects focusing on energy-autonomy;
- impacts and barriers on rural development in developing countries;

## 1.3 Methodology

Focusing on methodology, this thesis consists of several parts. The theoretical review (see chapter 3) and status quo about energy autonomy in Austria (see chapter 2) were done by reviewing the existing literature focusing on the topic. For the empirical study (see chapter 4) a case study approach was chosen.

[1] To reader's comfort named "Steinbach" for the rest of the paper.
[2] To reader's comfort named "Windhaag" for the rest of the paper.

### 1.3.1 Method of Qualitative Analyses

As mentioned, the overall method – in comparison to research design, which focuses on data acquisition, data preparation and evaluation – was based upon case study research. In contrast to experiment, survey, archival analysis or history, "case studies" are the preferred method when (a) "how" or "why" questions are being posed, (b) the investigator has little control over events, and (c) the focus is on a contemporary phenomenon within a real-life context (YIN, 2009, p. 2). All three aspects are given for this thesis. According to MAYRING (2002), qualitative analyses allow for analysing singular cases when compared to quantitative analyses and thus, fit to the focus of the thesis. Another important aspect is that it is possible to modify the existing designs and research methods to the given question and thus, gain results which suit the subject matter (MAYRING, 2002). This allows for focusing on the singular case (a municipality) but also allows for a comparison about the overall impacts and barriers in the two municipalities. Other designs did not fit because they follow different basic ideas (e.g. documentary analysis only works with given information and does not collect new data, action research focuses on an active change during the research process, field research demands a stronger interrelation between researcher and the local population which may not be necessary in regards to the given research question) (MAYRING, 2002). Finally, one has to consider two further aspects which are important to mention. First, there was a time-frame of six months to finish the thesis. Second, there was no available funding provided for the empirical study.

### 1.3.2 Research Design

According to YIN (2009, p. 27) there are five components of a research design that are important for case studies. These are the study question(s), proposition(s), the unit(s) of analysis, the logic linking of the data to the proposition(s) and criteria for interpreting the findings. The last two will be found in the empirical study and its case study protocol, the others will be described as follows:

The main (study) question is if and how energy autonomy has had an influence on rural development at a local level and why municipalities are impeded in further progress in Austria. To answer this question, the following sub-questions are:

- What are the socioeconomic impacts of energy autonomy on rural development at a municipal level in Austria?
- What are the barriers impeding further progress on energy autonomy at a municipal level in Austria?

Focusing on proposition(s), the first one is that projects focusing on energy autonomy have a positive impact on rural development in Austria. The second proposition is that there is a broad range of barriers impeding further progress. The third proposition is that those impacts and barriers vary from municipality to municipality due to the local aspect, socio-economic context, given resources and a broad range of technical opportunities to gain and save energy.

There were two units of analysis that were examined and compared. These were the two municipalities in Upper Austria. Their developments as well as impacts within the municipality's boarders were evaluated based on information starting from 1986. They are two out of a number of municipalities and regions mentioned in the report "Energieautarkie-Vorreiter Gemeinden und Regionen 2009" (BÜRBAUMER ET AL., 2010). This report analyzed those municipalities which are the cutting-edge concerning energy autonomy within Austria and thus, are one of the first with this aim. Based on criteria (see 4.1) Steinbach and Windhaag were chosen for the poll with Dr. Heimo Bürbaumer of the Austrian Energy Agency (AEA).

### 1.3.3 Process of Investigation

Focusing on the process of investigation, data collection was done mainly by problem focused qualitative interviews and evaluation of secondary data which was provided by the interviewees, municipality offices and AEA. Data preparation was done by literal verbatim transcription and evaluation by qualitative content analyses. How it was done in detail can be seen at chapter 4.1.

### 1.3.4 Design Quality

According to YIN (2009) there are four critical conditions that are related to design quality and thus, the empirical study. These are needed to maximize the quality of the case study design, and to construct validity, both internal and external as well as reliability. During the whole process of investigation, those conditions were kept in mind and were acknowledged as can be seen in Table 1:

**Table 1: Consideration of Research Quality**

| Tests | Case Study Tactic | Phase of research in which tactic occurs | Guaranteed by… |
|---|---|---|---|
| **Construct Validity** | Use Multiple Sources of Evidence | Data Collection | Data used from interviewees, municipality offices, Austrian Energy Agency; Main questions were the same for all interviewees; Interviews were transcribed and sent back to interviewees for review; |
| | Establish Chain of Evidence | Data Collection | |
| | Have key Informants Review Draft Case Study Report | Composition | |
| **Internal Validity** | Do Pattern Matching | Data Analysis | Differentiations were challenged; Contrary and Critical Questions have been made; |
| | Do Explanation Building | Data Analysis | |
| | Address rival Explanations | Data Analysis | |
| | Use Logic Models | Data Analysis | |
| **External Validity** | Use Theory in Single-Case Studies | Research Design | Theory was used as well as comparison between the two cases; |
| | Use Replication Logic in Multiple-Case Studies | Research Design | |
| **Reliability** | Use Case Study Protocol | Data Collection | Both was used / developed; |
| | Develop Case Study Database | Data Collection | |

**Source: based on YIN, 2009**

## 1.4 Report Structure

After the given description of the objectives and non-objectives, as well as the chosen research methodology, chapter 2 gives a brief overview of the definition, legal framework and status quo of energy autonomy in Austria. Chapter 3 provides the reader with the theoretical background on this topic, found in literature whereas chapter 4 illustrates the results of the empirical study. Case studies were done in two Austrian municipalities who are attempting to become energy self-autonomous within a given time. By using qualitative analyses, the socioeconomic impacts as well as barriers which constrain municipalities on their way towards energy autonomy were analysed. For those who do not have the time to read the whole of this thesis, chapter 5 (discussion) and 6 (conclusion) may be the most interesting ones as they compare theory and the results of the studies and thus, give a comprehensive view about the topic.

# 2 ENERGY AUTONOMY IN AUSTRIA – STATUS QUO

## 2.1 Introduction

To provide the interested reader with information about the status quo of energy autonomy in Austria, the following chapter starts with explanations of how this term is defined (see chapter 2.2). Followed by a comprehensive overview about the energy situation in Austria, statistics about municipalities which already focus on energy autonomy will be given (see chapter 2.3). Finally, chapter 2.4 highlights the legal framework, which is relevant for energy autonomy - on European as well as on national level.

## 2.2 Energy Autonomy – a Definition

According to The Concise Oxford English Dictionary one of the definitions for the term energy is "power derived from physical or chemical resources to provide light and heat or to work machines". Autonomy is defined as "freedom of action" or the "possession or right of self-government" (COED, 2008).

Up until now, the term "Energy Autonomy" has no broadly accepted definition. Each region, municipality or state which aims to become energy autonomous has its own definition (see for example BMLFUW (2011), SERI (2007), CIPRA (2010)). The report described above, "Energieautarkie-Vorreiter Gemeinden und Regionen 2009" defines energy autonomy as "Ambition of a municipality or region to make its energy supply in the areas of heat, power and mobility to a large extend independent from fossil fuel and energy imports. This does not mean that there should be an encapsulation outward. But rather there should be an optimal and efficient use of given local and regional potentials and renewable energy resources" (BÜRBAUMER ET AL., 2010, p. 3).

The definition of energy autonomy, used for this thesis, is defined as "Independence in energy for heat, power and mobility by using renewable, local energy resources in combination with a reduction in demand by energy efficiency and energy saving measurements".

## 2.3 Status Quo of Energy Autonomy in Austria

The energy flow diagram[3] shows that there was an overall energy volume of 1,665.535 Terrajoules (TJ) in 2005 in Austria. Of this, nearly three quarters (1,241.472 TJ or 74,5%) were imported, 412.347 TJ (or 24,8%) were produced within Austria and 11.716 TJ (or 0,7%) of the energy volume was taken from stock. Fossil fuels counted for a high proportion of the overall energy volume: 76,2% (1,269.063 TJ). 19,4% (323.042 TJ) were produced from renewable sources and 4,4% (73.341 TJ) were imports of electrical energy. These numbers show that due to the lack of fossil fuels in Austria (own energy supply was fulfilled by 76% by renewable energies), it is highly dependent on imported energy (AEA, 2011a).

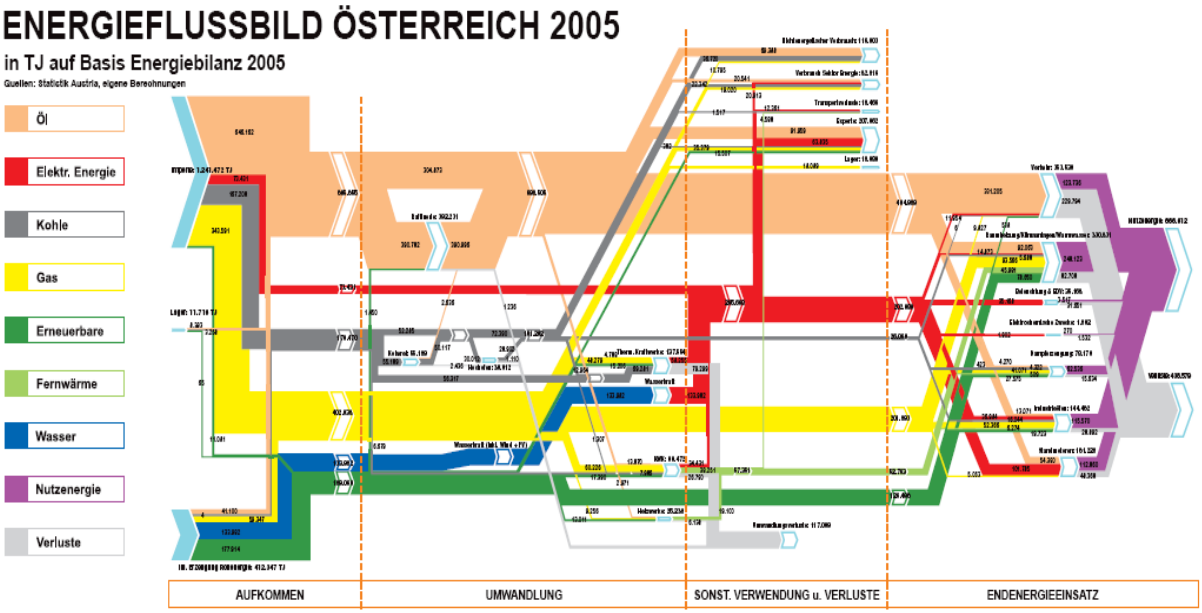


**Figure 3: Energy Flow Diagram 2005**

**Source: AEA, 2011a**

Based on these numbers (as well as the development over the years prior) and various reasons (see chapter 1) municipalities, regions and politicians began to focus on energy autonomy. In 2009, AEA identified a 2-digit number of Austrian municipalities which are on the way to become energy autonomous. Out of these, a few municipalities are nearly autonomous (BÜRBAUMER ET AL., 2010).

[3] The interested reader is referred to the Appendix (8.1) which shows the energy flow diagram in more detail.

To promote further development several instruments were implemented. The most relevant on municipality level may be e5. Started in 1998, it is an initiative which engages and supports municipalities "to modernize their energy policy, to use energy more efficient, to define and reach their goals concerning climate protection, and to increase their amount of energy made from renewable sources" (E5 ÖSTERREICH, n.d.). Even if Steinbach and Windhaag are – up to now - no members of e5, 94 municipalities across seven federal states already participate in this initiative as can be seen in Figure 4. In 2010, Burgenland and Lower Austria started to work within this initiative and thus, increase the amount of engaged municipalities across Austria (E5 ÖSTERREICH, n.d.).

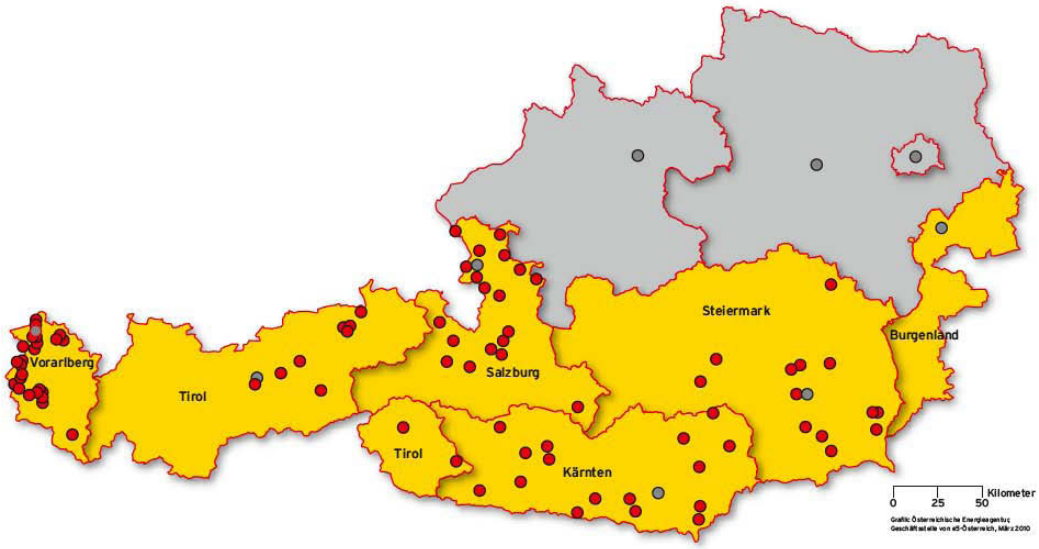


**Figure 4: Participating Municipalities of e5 across Austria**
**Source: E5 ÖSTERREICH, n.d., based on Austrian Energy Agency**

At the already involved municipalities, around 800 members of local energy teams participated and worked for above described goals in 2010. Their efforts and thus, the way towards energy efficiency and share of energy made by renewable sources are reflected by bestowed "e" for each municipality. Several of the municipalities already achieved to reach five "e", which stands for the highest reachable points. Up to now, eight of 94 municipalities reached this high award. They were able to reach a degree of 75% to 86% implementation (E5 ÖSTERREICH, n.d.).

On regional level, the most relevant initiative may be by "The Climate and Energy Fund". This initiative, called "Climate and Energy Model Regions" was introduced in 2008. It is a program which supports Austrian regions in developing and implementing an optimal use of their given resources, thus being able to tap into the full potential of energy savings and allow for sustainable economic activities. The Climate and Energy Fund makes annual

tenders and gives financial support of up to EUR 100.000,-- over two years. This shall allow municipalities to implement the regions concept and engage a manager for the model region (CLIMATE AND ENERGY FUND, 2010).

According to Climate and Energy Fund, there were 37 regions which were supported with the tender in 2009 as can be seen in Figure 5. Out of the 4.5 million Euros, which were provided for this tender, 2.6 million Euros will be paid to chosen regions till end of 2011 (CLIMATE AND ENERGY FUND, 2010). If one focus' on the differences among states, there was a clear concentration of projects in the middle of Austria. 28 out of 37 regions were at Styria, Upper- or Lower Austria.

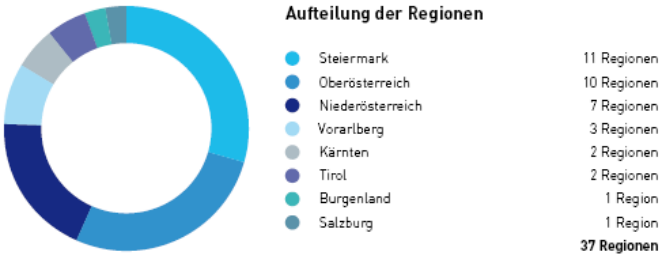


**Figure 5: Number of Promoted Regions of Tender 2009**
**Source: CLIMATE AND ENERGY FUND, 2010**

This trend continued through the following year. 3.6 Million Euros have been provided for the "tender 2010" and 31 regions have been chosen to be supported. Out of these regions, about three quarters will be within Styria, Upper- and Lower-Austria (CLIMATE AND ENERGY FUND, 2011).

Common for these regions is that there is a multitude of legal regulations and goals that have to be kept in mind. This is valid for the different levels and thus, on European and national level as well as at state levels as can be seen in the following chapter.

## 2.4 The Legal Framework and Goals concerning Energy Autonomy

### 2.4.1 On European Level

In the 1970's and 80's the European Union (EU) policy focused on research and technological development. After that the 90's saw a shift towards implementation (BLOK, 2006). Further changes saw such things as UNFCCC's Kyoto Protocol. In 2000[4] the EU started the new century with a dedicated framework concerning energy aspects.

Due to little concrete policies a number of directives have been introduced looking at both, the demand as well as the supply side. They began to focus on renewable energies and thus, the supply side had the following directives:

- European Directive 2009/28/EC on the so called 20/20/20 goals. These are a 20% reduction of greenhouse gas emissions by reducing its energy consumption by 20% and obtaining 20% of its overall energy consumption from renewable energies – this to be achieved by 2020. It reflects the long-term aim of combating climate change as well as reducing vulnerability against imports and promoting development and occupation (EU, 2009). The responsibility to achieve this target is shared differently among EU member states. E.g. Austria has a target of 34%. Thus, National Renewable Energy Action Plans (NREAPs) have to be submitted from each member state (EEA, 2010). By the 13th of December 2010, 26 of 27 member states had submitted their plans (ECN, 2011).
- European Directive 2001/77/EC looked at the promotion of electricity produced from renewable energy sources in the internal electricity market. This directive aims for an indicative share of renewable sources in electricity consumption of 22.1% by 2010 (compared to 13.9% in 1997). Instruments to reach this goal have not been prescribed to EU's member states (EUROPEAN COMMUNITIES, 2001).
- European Directive 2003/30/EC attempts to promote of the use of biofuels and other renewable fuels for transportation requirements. A target of 5.75% being made up of biofuel was set for all countries (EU, 2003a).
- European Directive 2003/87/EC establishing an emission trading scheme for greenhouse gas emissions which sets national caps on those emissions (e.g. large power plants) (EU, 2003c).

[4] like the White Paper for a Community Strategy and Action Plan (Energy for the future: renewable sources of energy) or the European Directive 1996/92/EC on the liberalisation of the energy markets

Focusing on the demand side and thus, energy efficiency there has been among others:

- European Directive 2003/54/EC on the energy performance of buildings which focus on certain minimum energy requirements for new (and partly existing) buildings, energy certification in case of sale and inspections (EU, 2003b).

### 2.4.2 On National Level

According to RIS ("Rechtsinformationssystem des Bundeskanzleramtes") (2011) which is a database containing legal regulations on a national, state and municipality level, there is a broad range of regulations and laws which cover the legal framework concerning energy autonomy. There are

- 234 documents relating to renewable energies;
- 193 documents relating to energy savings;
- and 181 documents relating to energy efficiency.

Thus, there is a broad range of regulations and laws concerning energy autonomy. Table 2 gives an overview of the more important regulations and laws in RIS.

**Table 2: Most Mentioned Regulations and Laws about Energy Autonomy in Austria**

| | |
|---|---|
| o Ökostromgesetz (2. Ökostromgesetz – Novelle 2008) | o Energie-Versorgungssicherheitsgesetz 2006 |
| o Energieförderungsgesetz | o Einspeiseverordnung (pro Bundesland) |
| o Energie-Control-Gesetz | o Statistik-Elektrizitätsgesetz |
| o Bestimmung von Mindestpreisen für die Einlieferung elektrischer Energie | o Energieeinsparungs- und Wärmeschutzverordnung (pro Bundesland) |
| o Elektrizitätswirtschafts- und –organisationsgesetz 2010 (pro Bundesland) | o Staatsrechtliche Vereinbarung über die Einsparung von Energie |
| o Luftreinhalte- und Energietechnikgesetz (pro Bundesland) | o Vereinbarung nach Art. 15a B-VG: Einsparung von Energie |
| o Vereinbarung gemäß Art. 15a B-VG über Maßnahmen im Gebäudesektor zum Zweck der Reduktion Gesetz über die Erzeugung, Übertragung und Verteilung von elektrischer Energie | o Vereinbarung zwischen Bund und Ländern gemäß Art. 15a B-VG zur Umsetzung der Richtlinie 2006/32/EG über Endenergieeffizienz |
| o Starkstromwegegesetz | o Energieliberalisierungsgesetz |
| o Elektrizitätsstatistikverordnung 2007 | o Einspeise- und Zuschlagsverordnung |
| o Energie-Regulierungsbehördengesetz | o Wohnbauförderungsgesetz (pro Bundesland) |
| o Elektrizitätswesengesetz (pro Bundesland) | o Heizungsanlagen-Verordnung 2010 |
| o Elektrizitätsgesetz (pro Bundesland) | o Vertrag über die Energiecharta |
| o Kraftstoffverordnung 2010 | o Baugesetz und Feuerungsanlagengesetz (pro Bundesland) |
| o Alpenkonvention – Protokoll „Energie" (P8) | o Bautechnikgesetz (pro Bundesland) |
| o des Ausstoßes an Treibhausgasen | o Gebäudeenergieeffizienzverordnung (pro Bundesland) |
| o Landesentwicklungsprogramm | o Wasserrechtsgesetz |
| o Landeselektrizitätsgesetze (pro Bundesland) | o Bauordnung (pro Bundesland) |
| o Stromkennzeichnungsverordnung | o Abgabenänderungsgesetz 1980 |

**Source: RIS, 2011**

In addition to these regulations the Austrian Energy Strategy 2020 was introduced in March 2010. Based on the 20/20/20 goals of the EU (see chapter 2.4.1) there was need to find solutions how the 34% target could be reached within given timeframe. Thus, the Minister for Environment and Minister for Economy generated the Strategy.

It bases on three pillars: energy efficiency, expansion of the use of renewable energies and security of the energy supply and thus, attempts to promote development towards energy autonomy. Based on an aim of 1.100 Petajoule (PJ) of the final end energy demand, different measurements for different aspects have been identified. These aspects are buildings, private houses, small and medium enterprises, area of agriculture, energy-intense companies and the aspect of mobility (BMWFI AND BMLFUW, 2010). Figure 6 shows how the aim shall be reached.

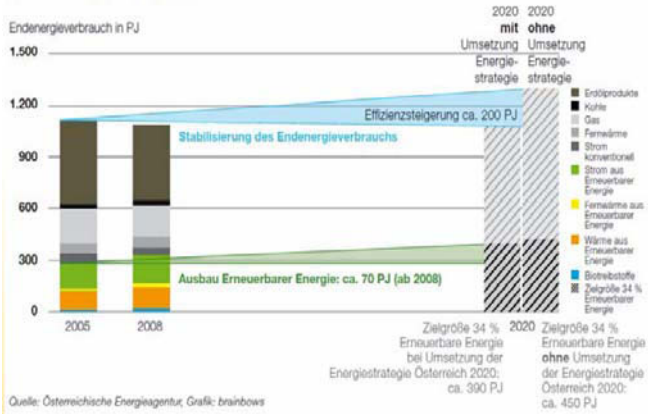


**Figure 6: The Model of the Austrian Energy Strategy 2020**
**Source: AEA, 2011b**

The strategy was generated by a broad involvement of stakeholders (like involvement of working groups and experts of different sectors) (BMWFI AND BMLFUW, 2010). Its success can not be evaluated yet, but should be seen within the next few years.

Returning to the charge of regulations and laws, the "Green-Electricity-Law (Ökostromgesetz)" will be highlighted in more detail because it is the most relevant in the context of this thesis. The Green Electricity Law was introduced in 2002 (BUNDESKANZLERAMT, 2002). According to §4 (1) its general aims are an increase in the amount of energy produced by renewable sources up to 78,1% in 2010 and a technological and political focus on the attainment of marketability of new technologies. It specified renewable energy feed-in tariffs (which are assured for 13 years) as the primary instrument for the advancement of green electricity. Furthermore, a duty for demand and refund is stipulated (BUNDESKANZLERAMT, 2002).

Up to now there were four amendments - in 2006, 2007, 2008 and 2009 (OEMAG, 2010). Thus, there have been continuous changes - and re-changes. An example is the way subsidies are allocated. In 2002, there was no announcement regarding how subsidies are allocated between the different energy sources (BUNDESKANZLERAMT, 2002). In 2006, a restriction of subsidies was made for each technology to allow for better forecasts (BUNDESKANZLERAMT, 2006). In 2009, those restrictions were lifted – but not for installations of solar energy, which remained at 2.1 million Euros (BUNDESKANZLERAMT, 2009). These re-changes were made for other aspects as well such as the period renewable energy feed-in tariffs are assured (In 2002 13 years (BUNDESKANZLERAMT, 2002), in 2006 it was changed to 10 years plus 2 years with a reduced tariff (BUNDESKANZLERAMT, 2006) and in 2009 it was changed to 15 years for energy made from biomass and agricultural products – so called "rohstoffabhängige Technologien" (BUNDESKANZLERAMT, 2009)). The actual valid regulations can be seen in Figure 7.

To sum up, the Green Electricity Law led to an insecure and unstable environment which interferes with long-term planning of industry and interested parties.

| EINSPEISETARIFE FÜR NEUE ÖKOSTROMANLAGEN 2010 *) | | | Tarif in Cent/kWh gemäß BGBl II Nr 42/2010 |
|---|---|---|---|
| **Rohstoffunabhängige Technologien** | | | **Laufzeit 13 Jahre** |
| Windenergie | | | 9,70 |
| Photovoltaik | gebäudeintegriert | bis 5 kWp | über KLI.EN (Investitionszuschuss) |
| | | 5 kWp bis 20 kWp | 38,00 |
| | | über 20 kWp | 33,00 |
| | auf Freiflächen | bis 5 kWp | über KLI.EN (Investitionszuschuss) |
| | | 5 kWp bis 20 kWp | 35,00 |
| | | über 20 kWp | 25,00 |
| Deponie- und Klärgas | | Klärgas | 6,00 |
| | | Deponiegas | 5,00 |
| Geothermie | | | 7,50 |
| **Rohstoffabhängige Technologien** | | | **Laufzeit 15 Jahre** |
| Feste Biomasse (wie Waldhackgut, Stroh) | | bis 500 kW | 14,98 |
| | | 500 kW bis 1 MW | 13,54 |
| | | 1 bis 1,5 MW | 13,10 |
| | | 1,5 bis 2 MW | 12,97 |
| | | 2 bis 5 MW | 12,26 |
| | | 5 bis 10 MW | 12,06 |
| | | über 10 MW | 10,00 |
| Abfall mit hohem biogenen Anteil | | SN 17, Tab. 2, Bsp. Rinde, Sägespäne | minus 25 % |
| | | SN 17, Tab. 1, Bsp. Spanplattenabfälle | minus 40 % |
| | | Andere 5-stellige SN in Tab. 1 und 2 ÖkoStrG | 5,00 |
| Mischfeuerungen | | | anteilig |
| Zufeuerung in kalorischen Kraftwerken | | Feste Biomasse (Waldhackgut, Stroh) | 6,12 |
| | | SN 17, Tab. 2, Bsp. Rinde, Sägespäne | minus 20 % |
| | | Andere 5-stellige SN in Tab. 1 und 2 ÖkoStrG | minus 30 % |
| Mischfeuerungen | | | anteilig |
| Flüssige Biomasse | | Flüssige Biomasse | 5,80 |
| | | Zuschlag für Erzeugung in effizienter KWK | 2,00 |
| Biogas aus landwirtschaftl. Produkten (wie Mais, Gülle) | | bis 250 kW | 18,50 |
| | | 250 bis 500 kW | 16,50 |
| | | über 500 kW | 13,00 |
| | | Biogas bei Kofermentation von Abfallstoffen | minus 20 % |
| | | Zuschlag für Erzeugung in effizienter KWK | 2,00 |
| | | Zuschlag bei Aufbereitung auf Erdgasqualität | 2,00 |
| Mischfeuerungen | | | anteilig |
| **Einspeisetarife für rohstoffabhängige Ökostromanlagen nach Ablauf der Kontrahierungspflicht** | | | |
| Feste Biomasse (wie Waldhackgut, Stroh) | | bis 2 MW | 8,50 |
| | | 2 bis 10 MW | 7,50 |
| | | über 10 MW | 7,00 |
| Biogas aus landwirtschaftl. Produkten (wie Mais, Gülle) | | | |
| | | bis 250 kW | 9,50 |
| | | über 250 kW | 8,00 |
| | | Biogas bei Kofermentation von Abfallstoffen | minus 20 % |
| *) Erstmalige Neuverträge im Rahmen der gesetzlich vorgegebenen Budgetgrenzen | | | |

**Figure 7: Overview about Renewable Energy Feed-In Tariffs in Austria**

**Source: E-CONTROL, 2010**

# 3 REVIEW OF LITERATURE ABOUT IMPACTS AND BARRIERS OF ENERGY AUTONOMY

## 3.1 Introduction

There is a broad range of literature focusing on the impacts and barriers of renewable energy sources (RES) and separately focusing on those of energy efficiency. Given the focus of this paper on energy autonomy and its definition by including both, the supply side (RES) as well as the demand side (energy efficiency), the following chapter aims to combine the existing literature to give an overall picture[5]. The reason for this broad perspective is to use this chapter as basis for the preparation of the following empirical study.

In general, there may be both, internal factors (e.g. local acceptance) as well as external factors (e.g. given macrostructure) that play a significant role in implementing energy autonomy. Chapter 3.2 gives an overview of the impacts of energy autonomy on rural development whereas chapter 3.3 focuses on the barriers impeding further progress. How those may be overcome, as well as recommendations for implementing and supporting the further progress can be found in chapter 4.5.

## 3.2 Impacts of Energy Autonomy

One has to consider, that there are many differences which impact the energy autonomy for rural development in developing countries in contrast to those in developed countries. The quality of life of the people who do not have access to electricity will be strongly influenced, even by small wind turbines or solar panels (PAINULY, 2001). According to KATUWAL AND BOHARA (2009) the main impacts in developing countries can be:

- improved health conditions;
- reduced deforestation;
- improvement in quality of life, especially for women due to reduced workload for collecting firewood;
- increase in agricultural production;
- additional income through Clean Development Mechanism (CDM);

Due to the focus of this paper on impacts in developed countries, the interested reader is referred to KATUWAL AND BOHARA (2009) or PRASERTSAN AND SAJJAKULNUKIT (2006) among others. The following review focuses on developed countries.

[5] One has to consider that the impacts and barriers vary for each project due to technologies used as well as legislation and regional aspects like given resources (e.g. material, capital, skill) (PAINULY, 2001).

Projects in developed countries, focusing on energy autonomy, provide communities and regions with a broad range of possible impacts. Even though the focus is on renewable energies, ADAS (2003) give a good first overview of those impacts and their relationship to rural development. They are divided in positive impacts (no colour), neutral impacts (light grey) or negative impacts (dark grey) as can be seen in Table 3:

**Table 3: Relationship between RE and Rural Development**

| ECONOMIC | ENVIRONMENTAL | COMMUNITY |
|---|---|---|
| Short term *increase in employment opportunities locally during plant construction but often high reliance on overseas and non-local specialist engineers* | *Negligible or no direct impact* on the local environment. Indirect benefits include use of potential pollutant waste materials and maintaining farmers on the land | *Population increase during site / plant construction leads to a temporary increase in local cash flow* |
| Longer term *increased demand opportunities for local service sector development* to meet plant/site servicing needs | *Actual or perceived negative environmental impact of RETs often dissipates* when plant and site up and running | *Increased self respect for individuals through employment and association with green technology* |
| Would reduce local household bills *if energy generated could be procured locally* | *Reduced need for nuclear and conventional energy generation – this benefit is felt at a wider national level, rather than locally* | *Social and community support and development fund* is often provided for use by the local population |
| *Increased skilled and managerial job opportunities* when plant is up and running – benefit not necessarily located in the same locality or region though | *Negative impact during construction phase and potentially beyond (hydro in sensitive catchments)* | *Uneven (positive) impact on rural communities generally*, in terms of geographical location |
| *Increased opportunities* for diversification of the local (largely service) economy where ownership is local | *Stimulates wider public interest in sustainable and community based solutions to energy generation and waste disposal* | Can *help increase informal educational opportunities locally* |

**Source: ADAS, 2003**

In general, these impacts can be divided into direct, indirect, induced and dynamic effects as well as short-term or permanent benefits. Short term-benefits can include such things as jobs which arise due to the planning and construction of RES. In comparison, permanent benefits are for example O&M employment (DEL RIO AND BURGUILLO, 2008). It is mentioned that the degree to which these projects contribute to rural development is mainly dependent on the type of renewable energy used as well as the stage of the project (ADAS, 2003, DEL RIO AND BURGUILLO, 2008). This can typically be seen with the use of wind energy. Equipment and manufacturing usually take place far away from the place where it will be installed (KOMOR AND BAZILIAN, 2005).

The environmental benefits, namely $CO_2$ emissions have been mentioned very often. In comparison, studies about socioeconomic benefits like rural development opportunities, creation of domestic industry, employment opportunities as well as diversification and security of energy supply have been lacking (DEL RIO AND BURGUILLO, 2008). Due to thesis' focus on the socioeconomic impacts (for an overview see Figure 8), the ecological impacts will not be presented in detail.

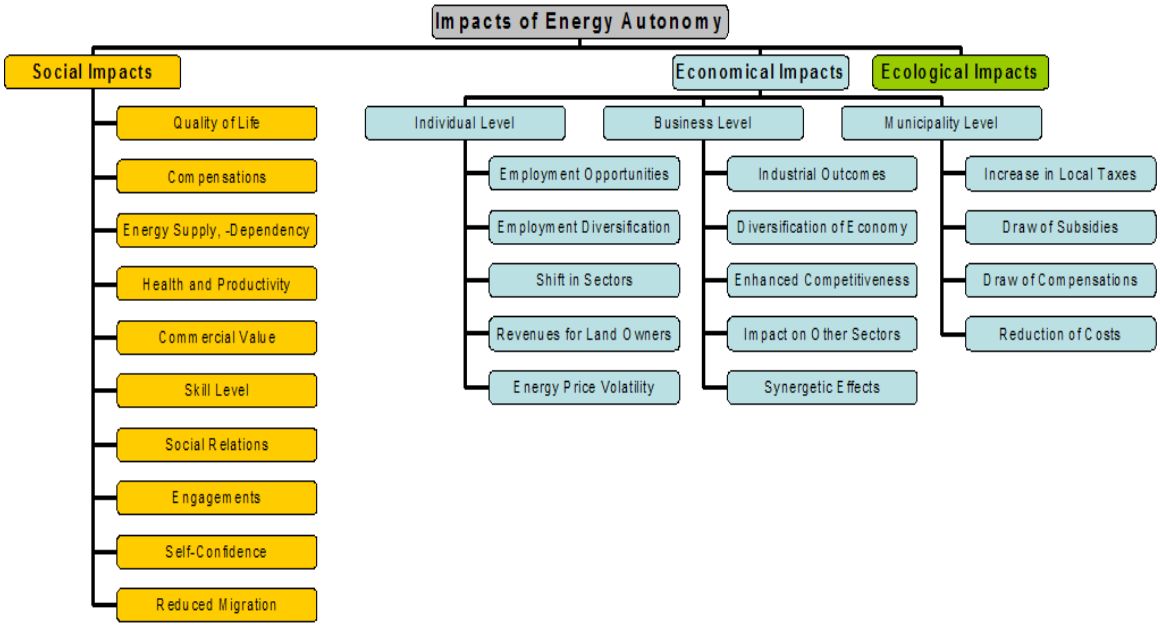


**Figure 8: Impacts of Energy Autonomy on Rural Development**[6]

**Source: Own Illustration compiled from the sources cited in chapters 3.2.1. and 3.2.2., 2010**

## 3.2.1 Economic Impacts

By focusing on the economic impacts of energy autonomy, there is a broad range of studies that have shown that there may be an impact. A study by ADAS (2003) shows that – if UK achieves its target for renewable electricity in 2010 - the impact on rural development will be around £743 million and there will be the creation of 2.465 full-time jobs. Focusing on Austria, a study by KOCH ET AL. (2006) describes the scenario of completely changing energy supply from fossil to renewable energies in the region of Güssing[7] (province of Burgenland). They summarized that due to this project, there is - compared to a loss of regional value of EUR 6.2 Million in 1991 - an expected regional value added of EUR 39 Million in 2005.

[6] One has to consider that the amount of impacts does not reflect its quality; furthermore, due to the focus of this paper on socioeconomic effects, environmental impacts are only illustrated for the sake of completeness.

[7] Municipality of Güssing (province Burgenland) is some kind of poster child concerning becoming energy autonomous. Due to its pioneer character and a lot of projects (including scientific pilot stations) it was possible to reverse the trend from a strongly shrinking municipality without any perspectives to an aspiring municipality with increasing job opportunities and positive, local cash flow (KOCH ET AL., 2006).

#### 3.2.1.1 Economic Impacts at Individual Levels

Focusing on the individual level, most literature states that **employment opportunities** are one of the major economic impacts. The European Commission (EC) announced that one of the most effective ways to encourage competitiveness in industry is due to the increase in energy efficiency (EC, 2006). If energy consumption is reduced by 20% by 2020 (see 2.4.1), it is estimated that 1 million high-quality jobs will be made (EC, 2005). But as could be seen in the past, those generalized statements usually can not be evaluated in detail and thus, it may be better to rely on clearly documented and comprehensible examples.

Regarding the case study of Güssing, it can be reflected that there may be a positive relation between energy autonomy and employment opportunities. Based on the efforts of becoming energy-autonomous 300 jobs were found in energy- and wood processing-sector alone as well as further 700 in downstream sectors were created (KOCH ET AL., 2006). Even if this can be seen as success, one has to keep in mind that Güssing may be unique due to its pioneer character and that it has been one of the first municipalities that focused on this vision. Thus, it may not be possible for other municipalities to get the same results. Another study was made by Akella et al.. They mentioned that "renewable energy systems can create more jobs per Rupee [monetary unit of account in India] invested than conventional energy-supply projects" (AKELLA ET AL., 2009, p. 391). This can be seen by an example of biomass production. For a unit of 1 million kcal there is a demand of direct labour input for wood biomass resources which is 2-3 times higher than that for coal (PIMENTEL ET AL., 1993). This is confirmed by OIKONOMOU ET AL. (2009) who state that there is a demand of 0.5-1 permanent worker/megawatt (MW) for operation and management of a wind park. In contrast there is demand of 0.2 permanent workers/MW for the corresponding tasks in a petrol-operated power station. Even if this sounds pro renewable energy sources, one has to be careful about the given context because it is not mentioned if the process of oil production is included or not.

According to HOPPENBROCK AND ALBRECHT (2010) there are only few confirmed claims regarding the potential of value added work in energy regions. Very often, this information is oversimplified and overstated. This may also be true for any employment opportunity. But, one has to keep in mind that a shift from supply with oil to supply with biomass leads to a shift in the people involved too. Thus, even if jobs can be created in the green energy sector, it means that some will be lost in the fossil fuel sector (e.g. those who produce or maintain heating facilities or who deliver fossil fuels). Thus, there are not only positive economic impacts.

In addition, there may be expansion as well as contraction effects. According to a study done in Germany, the expansion effect appears at the production and construction stage of RES. But due to higher electricity prices of RES which leads to a reduction in demand and thus, reduced production and employment in the electricity sector (contraction effect), those positive expansion effects may be outweighed. This theory is supported by data which shows that there will be – within Germany - 33,000 new jobs in 2004, 14,000 in 2006 and 2,400 in 2008 due to the expansion effect. But the contraction effects would lead to 6,000 jobs lost within 2010 (HILLEBRAND ET AL., 2006).

KOMOR AND BAZILIAN (2005) broaden this aspect of different, time-variant impacts. They suggest that impacts on employment opportunities differ at the different stages of the RES projects (production, construction, maintenance) and can be divided into quantitative and qualitative impacts. The quantitative impacts are the number of jobs, created in a specific area. The qualitative impacts stand for the continuity of created jobs and the level of skills (KOMOR AND BAZILIAN, 2005). Given the example of RES, production and construction may take place at other places than where they are installed and maintenance will be partly done from companies outside the local community (ADAS, 2003). Thus, there is only a marginal quantitative impact due to number of jobs that will be created locally in sales, installation and maintenance of the systems.
As mentioned, qualitative aspects are relevant as well, because there is a shift from jobs in the (decreasing) agricultural sector to other sectors like maintenance which usually requires higher skills and thus, improves people's knowledge (see 3.2.2) (DEL RIO AND BURGUILLO, 2008, ERNST BASLER + PARTNER AG, 2009). To sum up, one may say that **employment diversification** and a **shift from the shrinking agricultural sector** to new sectors may not happen for sure, but may be at least supported (ADAS, 2003).

**Revenues for land owners** are a further economic impact at individual level. Depending on the used renewable source, they can be payments for hiring land (e.g. to install wind turbines) or payments for biomass (ADAS, 2003). Usually the opportunity costs (difference between earnings from agricultural products and earnings from hiring the land) are higher if the land/resource is used for the production of energy (DEL RIO AND BURGUILLO, 2008).

Finally, one has to consider that Austria changed from an energy-exporter to energy-importer over the last few years (see 2.3). Thus, the electricity sector is subject to price fluctuations based on the international energy market. Those fluctuations make it difficult to make forecasts and decisions regarding further investments (KOMOR AND BAZILIAN, 2005). If there is energy self-supply (due to reduced demand and self-supply) **energy price volatility can be negated** or has at least a lower impact and importance.

### 3.2.1.2 Economic Impacts at Business Level

Focusing on the business level, RES may lead to **industrial outcomes**. It is important to consider that there are several exogenous factors, namely timing, geography or size factors that influence if and how many jobs/companies will be created (LUND, 2009). To zoom in on Austria, LUND (2009) states that there has been a contribution especially on the solar thermal and bio-pellets market due to its so-called self-built solar heating movement in the early 1980s. Given the increasing demand, Austrian industry has become one of the largest producers of collectors in the EU. Figure 9 shows the development from 1980 to 2007:

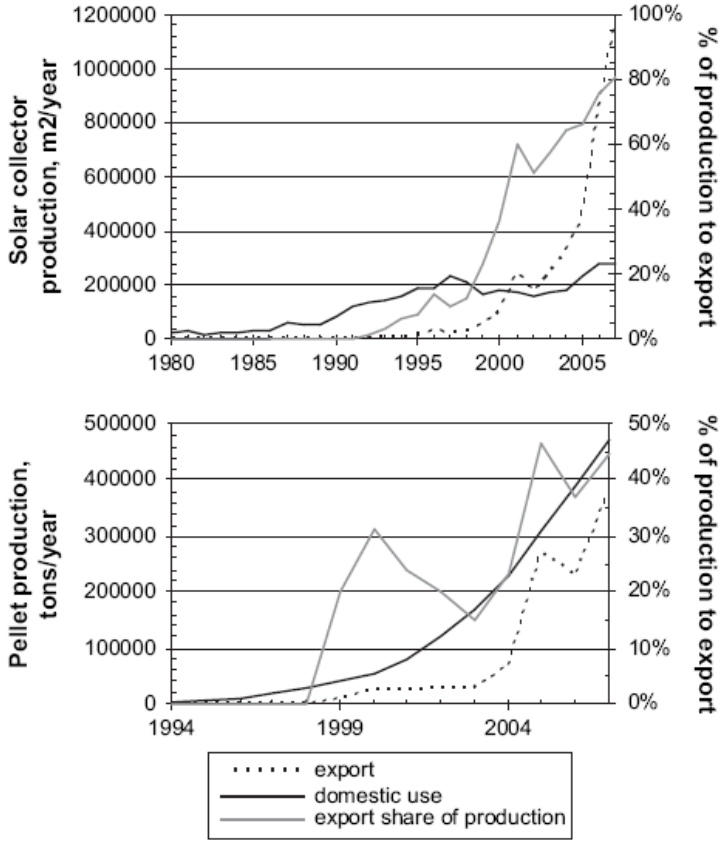


**Figure 9: Market & Export Development of Solar Heating and Bio-Pellets in Austria**
**Source: LUND, 2009**

But there is not only a quantitative increase on a business level, RES may also support the **diversification of the economy** (ADAS, 2003). On the one hand it favours the productive diversification by offering other forms of employment than in agriculture. On the other hand it provides farmers with further sources of income by selling their products not only to the food but also to the energy market (AKELLA ET AL., 2009). This may lead to an **enhanced competitiveness level of rural regions** but may go hand in hand with the area of conflict of "Energy versus Food".

Additionally, to the mentioned impacts on the core businesses (manufacturer of insulation material, energy supplier, farmers, construction companies) there may be **impacts on tourism** in the region due to "demonstration effects" (DEL RIO AND BURGUILLO, 2008) or due to an environmental image of the region (ZOGRAFAKIS ET AL., 2010). For example, Güssing receives an additional 400 visitors per week due to its energy projects (KOCH ET AL., 2006). Even if this successful example may not be transferred to other communities/regions it indicates that there may be correlations between RES and tourism.

Finally, there may be **synergies** which lead to win-win-situations. This may be seen in the case of biomass, used for energy production. There may be synergies between farmers and the operators of a plant. Rapeseed, cultivated by the farmers will be transported to the plant and used for production of biodiesel. Its by-product rapeseed cake will be transported back to the farmer and used as protein feed for livestock (MCCORMICK AND KABERGER, 2007).

#### 3.2.1.3 Economic Impacts at Municipal Level

There may be multiple economic impacts at the local community level. On the one hand, there may be **higher local revenues** due to the increase in economy. On the other hand, there may be **subsidies** granted to the community, the local municipality and the firm for energy projects, i.e. financial support from the European Union as well as the national or regional government (DEL RIO AND BURGUILLO, 2008).

But on the other hand, a change from a decentralized to centralized energy system efforts **investments**. According to KOCH ET AL. (2006) there are conversion costs which may be similar to those of establishing a new energy supply system. Only if there is reduction on the demand side as well, municipalities may have **reduced costs** as well. So as a benefit to the community there will be reduced costs for community energy consumption due to implementation of energy efficiency measures (KOCH ET AL., 2006). However, this may be given if municipal waste will be used for energy production and thus, municipality does not have to pay for disposal (MCCORMICK AND KABERGER, 2007).

Local communities may be influenced by the **compensations** of companies who want to realize a project. Sponsorship of local activities (e.g. the local football union), funds for local projects (e.g. a community library) or equal financial supports are made to improve the acceptance by the local population for the projects (ADAS, 2003). In Greece, the existing legislation stands as a role model for those compensations. Law 3468/2006 bounds investors to pay three percent of their profits that are gained by selling wind electricity. This compensation has to be paid to the community affected by the wind power station (MICHALENA AND ANGEON, 2009).

### 3.2.2 Social Impacts

One has to consider, that all impacts may be distributed in an uneven way between the different stakeholders and participants. Furthermore, they may be perceived differently (DEL RIO AND BURGUILLO, 2008). An important aspect is that there are different incomes within the people of a municipality. Thus, income disparities can cause as social conflicts because several people do not have enough money to adapt their houses or switch to another heating system (see 3.3.4). One aspect that may ease this situation is that, when focusing on new technologies, there is need for new skills and jobs. Even if it is modest, these projects may have a social impact by training local workers. Thus, the **educational/skill level** as well as the income level of the local population could be influenced (MICHALENA AND ANGEON, 2009, DEL RIO AND BURGUILLO, 2008).

Due to the increasing number of jobs in the area, there may be demographic impacts like the **reduction of out-migration**. This means that the actual flow from rural to urban areas may be slowed and under ideal conditions even reversed (REDDY ET AL., 2006, DEL RIO AND BURGUILLO, 2008, KOCH ET AL., 2006).

Based on the mentioned shift away from the agricultural sector, projects focusing on energy autonomy may give (young) people a new view about the opportunities they have in their community/region (DEL RIO AND BURGUILLO, 2008). Furthermore, people may be proud of their ecological image or reputation of their community/region (MICHALENA AND ANGEON, 2009). Thus, **self-confidence** and the **level of engagements** in local associations may improve. This may have an impact on the general quality as well as the quantity of **social relations** (KOCH ET AL., 2006, ERNST BASLER + PARTNER AG, 2009).

Focusing on energy efficiency, the literature mentions that due to "retrofitting of the existing housing stock and/or the construction of new buildings to standards superior than required under current regulations" its **commercial value may increase** (MUNDACA, 2008, p. 3034). Furthermore, due to a higher comfort level in those buildings (given by e.g. higher thermal conditions or a lower noise level) **health and productivity may be influenced** (LEAMAN AND BORDASS, 1999, MUNDACA, 2008). But energy efficiency measures are usually combined with costs (see 3.3.1) and thus, one has to focus on the net benefits.

The energy-twins offer a further social impact, namely the **reduction of energy dependence, diversification** and **security of energy supply** (MICHALENA AND ANGEON, 2009, DEL RIO AND BURGUILLO, 2008, MUNDACA, 2008, ZOGRAFAKIS ET AL., 2010). High-energy dependence and insecure energy supply implies a higher risk of being affected by economic and political changes outside of the country (EVANS ET AL., 2009, KOMOR AND BAZILIAN, 2005).

If one keeps in mind that the EU25 relies on fossil fuel, of which 90% might be imported by 2030 this makes it an important topic area (EC, 2005).

Finally, AKELLA ET AL. (2009) state that, especially in remote areas, RES has an important **impact on the quality of life** because e.g. a plant may provide a part of its electricity to the local people.

## 3.3 Reasons why Energy Autonomy is impeded

If energy autonomy is considered in accompanyment with a big structural change from centralised to decentralised systems, one can imagine that there are obstacles, which have to be overcome. Literature lists different classifications of these barriers, based on different reasons of analysis (see for example McCormick and Kaberger (2007), Rösch and Kaltschmitt (1999), Roos et al. (1999) and EC (2005)). The most comprehensive study regarding barriers can be found in Painuly (2001). Due to its broad perception, the classification of barriers will be used for this paper as well.

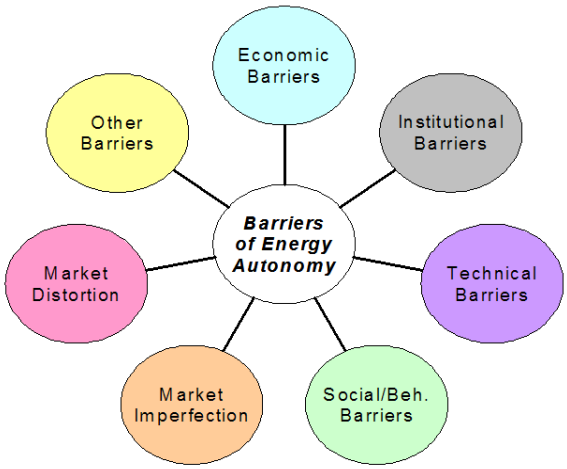


**Figure 10: Barriers impeding Energy Autonomy**

**Source: Own illustration after Painuly, 2001**

As can be seen in Figure 10 barriers can be classified into Economic and Financial Barriers, Institutional Barriers, Technical Barriers, Social/Cultural and Behavioural Barriers, Market Failure/Imperfection, Market Distortions as well as Other Barriers (Painuly, 2001)[8]. One may sum that the key barriers "are non-technical challenges rather than technical issues" (McCormick and Kaberger, 2007, p. 450) as can be seen in the following chapters.

### 3.3.1 Economic and Financial Barriers

Given the current situation, RES as well as projects focusing on energy efficiency are challenging economic and financial barriers. Firstly, RES may be **economically not viable** due to high implementation or adaption costs, high user costs and resource costs (like material, labour or capital) which may be higher than those of fossil energy sources (Painuly, 2001). This can be seen for energy efficiency as well. As reason for the gap

[8] According to Painuly (2001), classification is not very rigid due to:
- Some barriers may belong to more than one class
- Some barriers may be related to each other
- Some barriers may have a cause-effect relationship

between theoretical and the viable potential of efficiency measures (see Figure 11[9]) ERDMANN AND ZWEIFEL (2007) mention engineering and transaction costs (indicated as A) as well as a persistence and rebound effect (indicated as B):

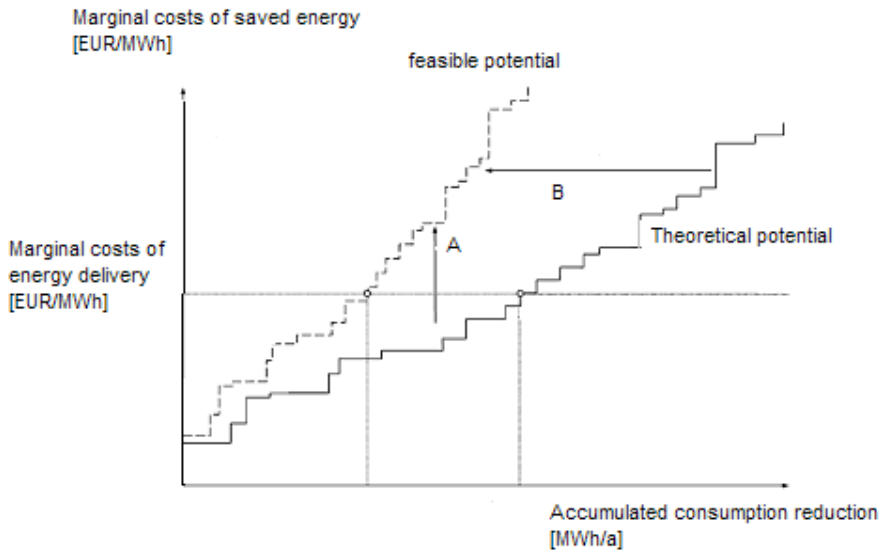


**Figure 11: Barriers of Energy Efficiency**

**Source: modified after ERDMANN AND ZWEIFEL, 2007**

Even if renewable energies (except for biomass) do not need fuel they have higher investment costs which tend to put off new investors (MICHALENA AND ANGEON, 2009). MCCORMICK AND KABERGER (2007) mention that in two out of six case studies they carried out investment grants are a critical point for the establishment of the projects. Furthermore, investors may recognize RES as new technology and thus, have a **high-risk perception** and avoid such investment opportunities (RÖSCH AND KALTSCHMITT, 1999, EC, 2005, MCCORMICK AND KABERGER, 2007). In combination with lack of financing institutions or instruments, one may mention **high up-front capital costs for investors** as second economic barrier (PAINULY, 2001, EC, 2005).

To become competitive against traditional energy sources, energy produced by RES requires investment grants or government subsidies to allow for market penetration (HOHMEYER, 1992, LUND, 2009, MCCORMICK AND KABERGER, 2007). Those subsidies have been paid for many decades for fossil fuels and nuclear power (MCCORMICK AND KABERGER, 2007) and are paid for energy of renewable sources but should reflect the real costs. This is directly linked to the third economic barrier, namely misleading prices due to **exclusion of externalities** (EC, 2005). If external costs were included, prices for energy produced by fossil fuels would increase. Thus, demand would decrease as can be seen in Figure 12. LUND (2009) mentions that either RES prices have to be subsidised (see above) or that energy prices, produced by

[9] persistence and rebound (indicated as B), are described in chapter 3.3.4

fossil fuels have to reflect their external costs (which include the costs of damages to environment and human health).

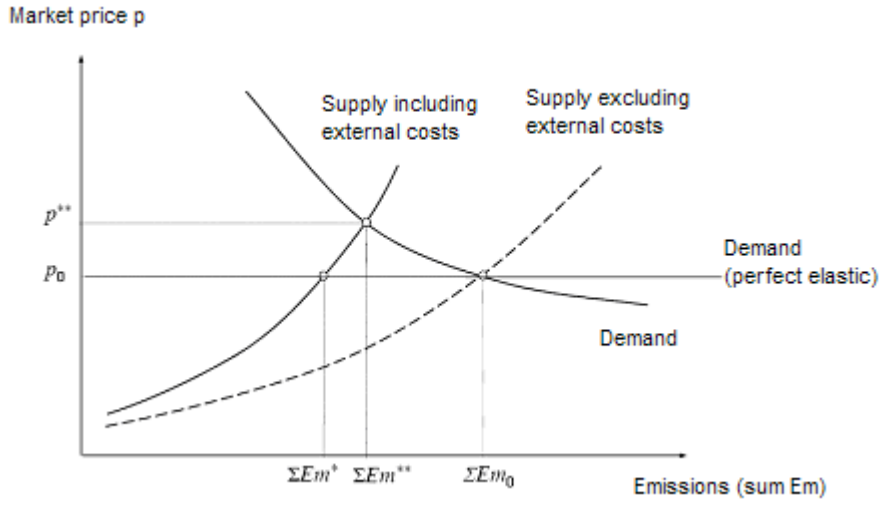


**Figure 12: Correlation of Market Price and Emissions within and without External Costs**
**Source: modified after ERDMANN AND ZWEIFEL, 2007**

This view is broadened by MIRASGEDIS ET AL. (2000) who go on to state that social costs have to be included as well. Additional to costs for environmental and human damages, social costs include macroeconomic impacts (like price stability or job creation) and strategic factors (like resource depletion and security of energy supply). MCCORMICK AND KABERGER (2007) take the same line by summarizing that positive impacts like e.g. energy security or promoting regional development may be given, but they can not be taken into account for evaluations and thus, are **not compensated** by the energy market.
Fifthly, there may be a **changing or inadequate tariff system** (see also chapter 2.4). During the last few decades, energy prices decreased, especially for large industrial users (between 1995 and 2005 in average 10-15% in real terms (EC, 2005)). Decreasing energy prices are not favourable towards projects focusing on energy efficiency and thus, make them less financially viable. Even if there are so called ESCO – companies that supply solutions to become more energy efficient and get paid by the resulted savings – their number is too small to have any real impact (EC, 2005).

Finally, PAINULY (2001) broadens this view about economic and financial barriers by suggesting that there is a lack or **inadequate access to capital** for producers (e.g. poor regulations or governmental policies) as well as a lack of access to credit for consumers (e.g. underdeveloped credit markets or poor credit worthiness), both reducing the overall market size. Focusing on financial aspects **high discount rates** (of manufacturers, producers or consumers, due to high uncertainty of new projects) as well as **high payback**

**periods** such as a low rate of return or high tax on profits act as further barriers (RÖSCH AND KALTSCHMITT, 1999, PAINULY, 2001).

### 3.3.2 Institutional Barriers

Additionally to economic conditions (see 3.3.1) and supply chain issues (see 3.3.6 and 3.3.7), institutional capacity and know-how has been identified as the key barrier to prevent further expansion of bioenergy within the European Union (MCCORMICK AND KABERGER, 2007).

This is reflected in the **missing institutions and mechanisms** as well as in the **missing legal or regulatory frameworks** (PAINULY, 2001). For example, if there is no national strategy and thus, no focused and or joint effort, the aim of promoting the energy twins will not be reached. Furthermore, if there is lack of a national policy (e.g. for implementation of RES installation planning), the procedure of obtaining licenses may take longer and increase bureaucracy (OIKONOMOU ET AL., 2009). This is reflected by a further barrier element, namely problems in **realising financial incentives**, which also includes corruption (PAINULY, 2001).

Furthermore, there may be obstacles in the promotion of renewable energy sources due to **shared administrative authorities**. One has to consider that there are different aspects that need administration permission. This can be seen e.g. for biomass plants. According to RÖSCH AND KALTSCHMITT (1999) permissions have to be obtained for:

- the technical process;
- construction and operation of the plant;
- emissions released into the atmosphere;
- use of different types of biomass for feedstock (e.g. wood, straw or organic waste);
- use of by-products (rapeseed cake) and/or waste (ash);

These permissions have to be made to different authorities, depending on plant size, feedstock and conversion technology. In addition, there may be different national and regional regulations (RÖSCH AND KALTSCHMITT, 1999). This complex structure is also possible for other renewable sources as can be seen in the case of licensing procedure for wind generators in Greece. Due to a complicated procedure it may take three years from application for the license until it is obtained (PAPADOPOULOS ET AL., 2008).

When looking at administrative barriers, one needs to look at the **application process itself**. On the one hand, extensive documentation is required for the environmental and construction permissions (MICHALENA AND ANGEON, 2009). On the other hand due to inferior applications which have to be constantly modified, applicants may send incomplete information and thus, time-consuming modifications are necessary to get the final approval (PAPADOPOULOS ET AL., 2008).

But the domain of the institutional barriers contains more than the above mentioned as can be seen in Figure 13:

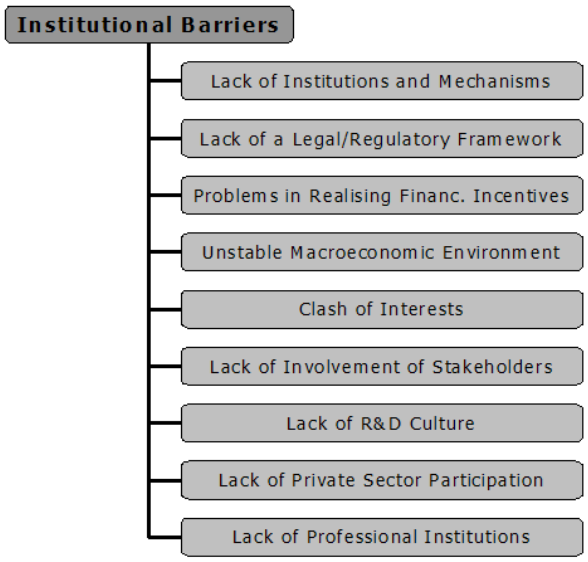


**Figure 13: Barrier Elements of Institutional Barriers**
**Source: Own illustration after PAINULY, 2001**

A lack of promotion in the area of **research and development** further hinders the development and rollout of technology (OIKONOMOU ET AL., 2009). Even if fundamental research demands high financial support by the state, the spillover effect acts as a strong pushing factor and thus, should be promoted (ERDMANN AND ZWEIFEL, 2007).

Furthermore, **different interests**, focusing on the same source, are a further barrier. On the one hand this is reflected by competition for land to produce either energy or food (BERNDES ET AL., 2003). On the other hand there may be competition with other industries that are already very well established in some areas. This can be seen in the example of Umbertide (Italy) where the existing tobacco industry is very strong and thus, able to impede any move towards the cultivation of energy crops (MCCORMICK AND KABERGER, 2007). Regarding efficiency measures, a clash of interests can be seen in the so-called "split-incentive problem" (EC, 2005, p. 11) or "decoupling of investor-consumer interests" (PAINULY, 2001, p. 83). This means that the responsibilities are split for example in the case of rented flats or houses, if the landlord installs/renews the boiler the tenant is expected to pay the heating bill. Or the landlord is responsible for such things as heat insulation whereas the tenant who has no responsibility to invest has to pay the bill (EC, 2005, PAINULY, 2001).

Finally, there may be an **unstable macroeconomic environment** which may be reflected by e.g. high price fluctuations, high inflation rates, unstable currency and uncertain exchange rates in combination with uncertain economic growth (PAINULY, 2001). All of them act as a barrier in promoting energy twins.

### 3.3.3 Technical Barriers

Additional to general barrier of different geographical distribution of renewable energy sources, there are limitations regarding their **availability and technical limitations**, given for certain sources. In the case of solar power there is the problem of energy storage during the night and that there will be a drop in power on cloudy days. This is also the case against wind energy due to the intermittency problems during high or low wind speeds (EVANS ET AL., 2009, MIRASGEDIS ET AL., 2000). This barrier is connected to constraints given by the **existing system**. There may be limitations in the capacity of the existing grid to absorb the additional power and or fluctuations (OIKONOMOU ET AL., 2009). Especially for high-voltage grids, it is very time-consuming and costly to upgrade those (PAPADOPOULOS ET AL., 2008).

A **lack of standardisation of standards, codes or certifications** is the third barrier (PAINULY, 2001). This can be seen especially in the energy-efficiency aspect because energy-using equipment as well as their components may be not standardized. Thus, it is difficult for new technologies which focus on higher efficiency, because they cannot be quickly rolled out within a short time frame (EC, 2005). This barrier goes hand in hand with **products which one cannot rely on** due to their bad quality or improper quality controls (PAINULY, 2001).

Fifthly, one may consider that systems producing bioenergy depend on four aspects: biomass as resource, supply systems, technologies to convert the resource into energy and energy services. All of these steps demand institutional capacity (see 3.3.2) and special **knowledge and skills** (MCCORMICK AND KABERGER, 2007). Due to lack of experts for training, missing facilities or inadequate efforts there may be lack of skilled personnel who have demanded know-how for installation and maintenance (RÖSCH AND KALTSCHMITT, 1999, PAINULY, 2001). Furthermore, if there is a lack of experience and thus, uncertainty, farmers as well as financers may be discouraged to adopt e.g. energy crops respectively grant financial aid (MCCORMICK AND KABERGER, 2007). This is interrelated with a further technical barrier, namely **missing entrepreneurs**. This can be due to the opinion that RES-projects have a relatively low profitability and that there may be restrictive regulations regarding ownership (see 3.3.2) (PAINULY, 2001).

### 3.3.4 Social, Cultural and Behavioural Barriers

In general, one has to consider that the different impacts of projects focusing on renewable energies as well as projects focusing on energy efficiency will be perceived differently by different groups. Furthermore, they will also be perceived differently within those groups. Nevertheless, one previously mentioned social barrier concerning renewable energies is due to the visual impacts of these projects on their surrounding environment. Therefore, **public acceptability** is not given for all projects (JOHANSSON ET AL., 2004). On the one hand, this may be given for wind energy due to aesthetic degradation or noise. On the other hand, this is for large hydropower stations due to displacement of people and disruption to nature or landscape (see 3.3.7) (EVANS ET AL., 2009). But there are other **persistent barriers** as well as is given for biomass resources. Due to legislation, those resources are categorised as waste (as is the case in Italy) and thus, people are conditionally against its use (MCCORMICK AND KABERGER, 2007).

Thirdly, there may be resistance as well as the so-called rebound effect as can be seen in Figure 9 (see 3.3.1). **Resistance** refers to the unwillingness of people to make the step from only talking about the necessity to adapt something to really changing it (ERDMANN AND ZWEIFEL, 2007, PAINULY, 2001) and may be connected to both, renewable energies and energy efficiency. In comparison, **rebound effect** is given for energy efficiency measures. Also called the 'takeback' effect it describes an economic concept that states that "some of the savings from energy efficiency are taken in the form of higher consumption" (HERRING, 1999, p. 213).

MICHALENA AND ANGEON (2009) state that, focusing on innovative technology systems (like RES's are) requires opening the focus. In their opinion the social and institutional context is as important as technological aspects (see 3.3.3) and the interactions at energy market (dynamic of supply and demand) (see 3.3.6). These social and institutional factors, namely "quality of local co-ordination, propensity to collective action and local systems of governance" (MICHALENA AND ANGEON, 2009, p. 2018) may be driving forces to promote common projects. But if there is **missing quality and density of social ties** as well as given **institutional thickness**, these can be seen as barriers which impede further progress. Some authors summarize these social key features as "social capital" (WOOLCOK AND NARAYAN, 2000, COLEMAN, 1990). It includes the given **rules and norms** in a special context, including **trust** as important factor in social relations and focuses on developed **relations and networks of people**. Given the case of Crete, which can be seen as "success story", MICHALENA AND ANGEON (2009) provide a clearly represented summary of above explained factors as can be seen in Figure 14:

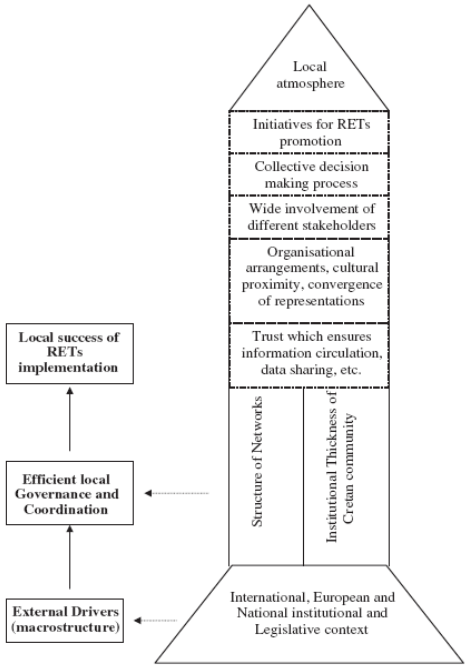


**Figure 14: Efficiency of Local Factors in the RET's Implementation in Crete**

**Source: MICHALENA AND ANGEON, 2009**

This idea of social barriers is also presented in the paper of WÜSTENHAGEN ET AL. (2007) which explains the barrier of "**social acceptance**". Even if this term is often used in literature, there is lack of a clear definition. In case of the mentioned paper it is based on socio-political acceptance, community acceptance and market acceptance as can be seen in Figure 15:


**Figure 15: The Triangle of Social Acceptance of Renewable Energy Innovation**

**Source: WÜSTENHAGEN ET AL., 2007**

This is confirmed by the EC who states that the lack of information and education concerning energy efficiency acts as barrier. If these tools were improved they would be useful to change **perceptions** and encourage actions (EC, 2005).

### 3.3.5 Market Distortions

Market distortions and economic barriers are strongly interrelated to each other. This can be seen by the **exclusion of externalities** (see 3.3.1), which can be put in both categories.

But additionally to these, the market may be disturbed due to **taxes** on renewable energies or **barriers for trade** (PAINULY, 2001). OIKONOMOU ET AL. confirm this citing that "an important obstacle for the infiltration of wind energy is the lack of a tax-free income against the expenditure for purchasing small domestic wind turbines" (OIKONOMOU ET AL., 2009, p. 4881). Furthermore, they broaden this view by mentioning that there may be **unequal distributions of subsidies**. Especially in countries, which are highly depending on specialized industries (e.g. tourism) there is competition about subsidies (OIKONOMOU ET AL., 2009). This is confirmed by the EC which states that even if there is a "plethora of disparate small subsidies", those will have only a "very limited overall impact" (EC, 2005, p. 12). Focusing on the process of subsidies reflect a further barrier. Due to different funding authorities (EU wide as well as at national level) necessity for different applications is given. **Application conditions may change** within the application period and application process itself may need a long time. Thus, projects become less economically viable and more expensive (RÖSCH AND KALTSCHMITT, 1999). Furthermore, the EC states that **taxes as well as state aid** in general often **are misused**. This is due to state aid which may prefer energy efficiency measures or power generation with lower energy yields than could be gained with other technologies. This is valid for taxes too because the actual structure does not reflect the energy consumption. In other words, products with low energy consumption should have lower or no taxes in contrast to those with high power demands (EC, 2005).

Finally, the circumstance that **conventional energy may be preferred** has to be mentioned as well (PAINULY, 2001). As can be seen in chapter 3.3.1 there is a distorted competition due to energy subsidies that have been paid for conventional energy. MCCORMICK AND KABERGER (2007) summarize that, based on the European Environment Agency's assessment of energy subsidies in the EU, conventional energies still profit from those state aids. Due to this favouritism the market is influenced and thus, acts as a barrier.

### 3.3.6 Market Failure/Imperfection

As can be seen in Figure 16, a failing or imperfect market acts as a barrier due to aspects like a **highly controlled energy sector** combined with a **lack of competition**, **restricted access to technology** and **poor market infrastructure**. This includes aspects such as monopoly situations, non freely available technologies, barriers and regulations concerning entry into the market as well as missing or under-developed supply channels (PAINULY, 2001).

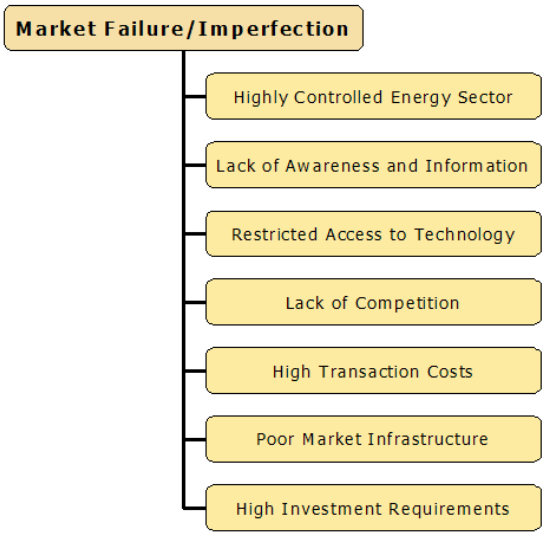


**Figure 16: Barriers of Market Failure / Imperfection**

**Source: Own illustration after PAINULY, 2001**

Furthermore, this barrier class is characterised by a **lack of awareness and information** (e.g. on products, technology, costs, benefits and potentials of RES) as well as **high transaction costs** and **high investment requirements** (see 3.3.1) (PAINULY, 2001). The EC mentions the lack of information as the most important barrier impeding further energy efficiency (see 3.3.4). This is given due to missing information about their own energy consumption (thus, missing overview about the potentials for savings) as well as lack of training on proper maintenance (EC, 2005).

### 3.3.7 Other Barriers

In addition to all these barriers, there may be environmental barriers as well as a lack of infrastructure. **Environmental barriers** can be distinguished into ecological aspects, local pollution as well as competition for resources (see 3.3.2) (PAINULY, 2001) especially ecological aspects differ widely, depending on the used resources (JOHANSSON ET AL., 2004). For example, concerning biomass this may increase water use, use of pesticides or decrease in biodiversity. Focusing on wind, this may be especially based upon aesthetic degradation as well as noise impacts and impacts on birds. In contrast, for hydropower, this may include sedimentation, downstream impacts, changes in fish populations and diversity as well as displacement of local communities for large-scale hydropower projects (see among others EVANS ET AL. 2009, ABBASI AND ABBASI, 2010, ADAS, 2003, JOHANSSON ET AL., 2004).

The basic infrastructure also plays a role, there may be **barriers at transport and installation** of technical equipment. These may be problems that are related to availability of roads or connectivity to grid (see also 3.3.3) (PAINULY, 2001). For example, areas with significant wind potential may be in remote areas such as mountains and thus, lack in infrastructure (PAPADOPOULOS ET AL., 2008).

Finally, these may also include aspects that are connected to the **uncertainty of further development** (PAINULY, 2001). This is due to uncertain government policies (see 3.3.2) as well as the already mentioned high risks that are found in both, projects focusing on renewable energies (see 3.3.1) as well as those focusing on energy efficiency.

# 4 EMPIRICAL STUDY

## 4.1 Introduction

As can be seen by the last chapter, there already was a broad range of impacts and barriers, expressed in literature. But there has been a lack of data at a local/regional level (DEL RIO AND BURGUILLO, 2008). Thus, a comparative case study was chosen for this thesis to evaluate the impacts and the barriers at a municipality's level.

According to a study of AEA, a 2-digit number of municipalities across Austria focused on becoming energy autonomous in 2009 (BÜRBAUMER ET AL., 2010)[10]. First step of data collection was to bring presented data of the study in tabular form and replenish it with further data to find similarities as well as contrariness. Data included aspects like state and district, distance to next town (and thus "rurality"), starting point and ranking according to the study. Thus, a comprehensive overview was possible. Together with Dr. Heimo Bürbaumer of AEA, criteria were found to rank these municipalities. The overall-criterion was that it has to be two municipalities (and not regions) and that the municipalities have to be similar as far as possible. This means that the municipalities have to be in the same province, have to have similar amount of inhabitants and a similar starting point.

Under the mirror of this overall-criterion there were three top- and two sub-criteria, namely:

1. Municipalities have to be in Eastern-/Middle part of Austria due to missing travel funds for the study;
2. At least one municipality has to be very successful (has to have a high ranking according to the study of AEA);
3. Municipalities have to pursue energy autonomy for a longer time (>10 years);

The sub-criteria were that the municipalities shall not focus on hard facts only and thus, shall involve inhabitants and that the municipalities have to be situated in rural areas. After evaluation, 13 municipalities remained which fulfilled these requirements (see Annex 8.2.1). Those were ranked according to the above criteria which led to following result:

1. Steinbach / Windhaag (both Upper Austria)
2. Two municipalities in Styria
3. Two municipalities in Lower Austria

Based on the selection process, carried out in co-operation with AEA, the first steps were further research about local stakeholders to compile an interview list. The mayors of the

[10] Because the study is not published yet, more detailed information (like the names of the other municipalities or an exact ranking) must not be given at this stage. It is planned that the report ("Energieautarkie-Vorreiter Gemeinden und Regionen 2009") will be published in 2011.

municipalities of Steinbach and Windhaag were contacted[11]. They were informed about aims, contents and time-table of the study in advance. Within the first meetings the prepared interview lists were expanded to include people intensively involved in the process of energy autonomy and others not involved (private people). Next step was that chosen interview partners were invited. As already described in 1.3, problem focused semi-structured interviews were the most appropriate method for data acquisition because they could be used for specific questions based on previous analyses of the problem (MAYRING, 2002). The interview partners proposed the location of the interview, which all happened in a relaxed and informal atmosphere and took between 20 minutes and 2.5 hours. Interview partners showed strong interest in the matter. Thus, they were very willing to provide information.

The problem focused interviews consisted of four parts as can be seen in following graph:

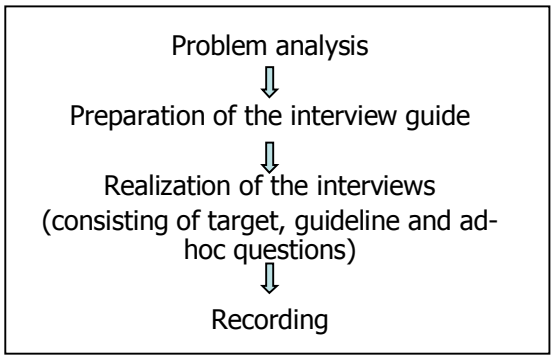


**Figure 17: Model for Problem Focused Interviews**

**Source: modified after MAYRING, 2002**

The interviews based on three types of questions according to Mayring (2002). Those were:

1. target questions: general, open questions to start with the topic;
2. guideline questions: focusing on those topics that are mainly important (based on previous literature review);
3. ad-hoc questions;

There were six questions (three target questions and three guideline questions) which were addressed to every interviewee[12]. Depending on interviewees' position, knowledge and interest, ad-hoc questions were asked as well. The guideline was not sent to the interviewees in advance but the transcribed interviews were sent for review to improve validity (YIN, 2009). In sum, there were 15 interviews at Steinbach and 13 interviews at Windhaag. These were done with different stakeholders according to the abbreviation (see next page). Figure 18 shows how many interviewees were in the diverse interview groups:

[11] If those would not have agreed to cooperate or would not have been interested, the other municipalities would have been chosen.

[12] The interview guideline is available at 8.2.2.

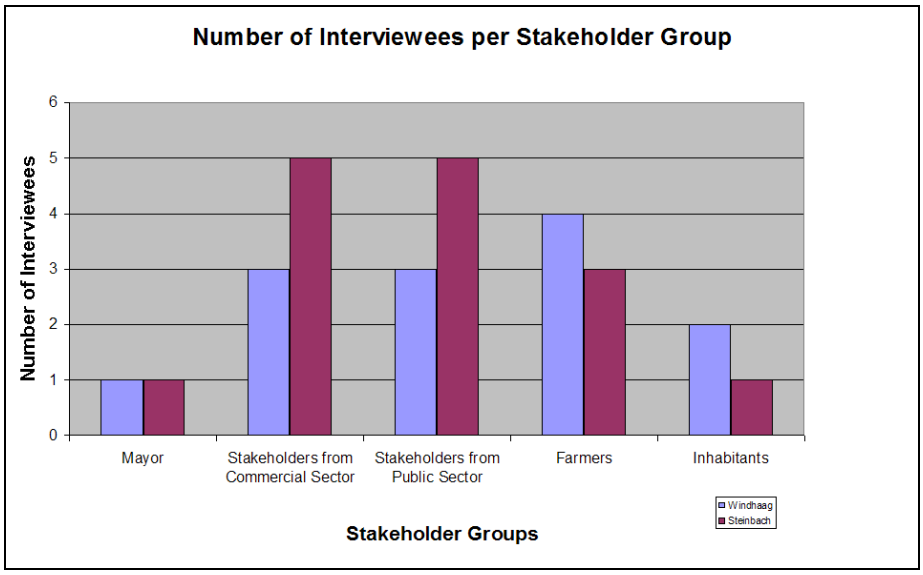


**Figure 18: Number of Interviewees per Stakeholder Group**

**Source: OWN MATERIAL, 2010**

The interviews were recorded on tape and fully transcribed (with free-software f4) to ensure that a detailed evaluation could be done (MAYRING, 2002). Due to the nature of the interviews, the local dialects of the interviewees were transcribed into written German. The 28 interviews resulted in 213 pages (115 Steinbach / 98 Windhaag) of transcribed interviews. Each interviewee received his/her interview for review and additional comments to increase validity. Six interviewees from Steinbach (40%) adapted their interviews whereas eight interviewees from Windhaag (60%) adapted their interviews. A second review process (including a presentation of final results at each municipality, round tables and publishing at the local press) was planned but could not be realized due to time-constraints of mayor's. Instead a brief report was sent to them.

The transcribed and reviewed interviews were analysed in a qualitative content analysis according to MAYRING (2002). To guarantee anonymity abbreviations have been used. Due to the interviews being made in two separate areas, further abbreviations are as follows: S denotes interviews in Steinbach and W for Windhaag. These interviews have been put into groups such as:

M Mayor of the municipality

C Commercial stakeholder (e.g. Electrician, Building Company)

P Stakeholder from the public sector (e.g. Local Government, Regional management)

F Stakeholder from the agrarian sector (e.g. Farmer, Lumberjack)

I Inhabitant

Thus, an interviewee, working as farmer (like two other farmers already interviewed) in Windhaag got assigned the abbreviation WF3.

The information gained from secondary data was used for evaluation as well (the full list can be seen at 8.2.4). Thus, data from different sources was converged to improve validity (YIN, 2009).

The qualitative content analysis was done with support of the software Weft QDA. The categories deduced from literature (and thus deductive categories) were adapted during evaluation of the empirical study. The categories of barriers according to the theory (e.g. technical or economic barriers) were changed to internal and external barriers. Thus, based on new insights there was a modification from deductive to inductive categories. This was done to provide a manageable instrument for municipalities. The differentiations between internal and external barriers offer the opportunity to see necessary adaptions and further steps at a glance. Nevertheless, categorization of socioeconomic impacts remained the same (see 3.2).

To allow a comprehensive summary of the most important information, a summary of the main talking points across the board of interviewees will be given a more in depth analysis than the lesser issues raised. To give the reader a comprehensive overview each sub-chapter offers a table of information, which came from the interviewees (in addition to used secondary data). These tables reflect the number of interviewees who gave feedback about a special topic and look like the following table:

**Table 4: Example of Statistical Information of Mentions of Interviewees**

| Topic | Number | SM | SP | SF | SC | SI |
|---|---|---|---|---|---|---|
| Draw of Compensations | 5 | 1 | 2 | 0 | 2 | 0 |
| Draw of Subsidies | 4 | 1 | 2 | 1 | 0 | 0 |
| **Sum Economic Impacts** | 9 | 2 | 4 | 1 | 2 | 0 |

**Source: Own Material, 2010**

The middle of the table reflects the sum of all mentions for each aspect (see "number") whereas the right side reflects the numbers of mentions per interviewee group. The last row reflects the sum of all mentions as well as per interview group. For example, Table 4 shows that there were two people from the commercial stakeholders group in Steinbach (SC) who gave information regarding levels of compensations. Or, one may see that – overall - mostly stakeholders from the public sector mentioned aspects (four out of nine). Thus, the reader gets an overview on the importance of each topic according to the point of view of the local stakeholders. Furthermore, there is an overview of how the topic is seen among the different interviewee groups.

## 4.2 Definition of Energy Autonomy according to the Interviewees

According to chapter 2.2 there is no generally valid definition of the term Energy Autonomy. This is reflected by the interviewees. At the beginning of each interview, they were asked to give their own definition[13]. At Windhaag, six out of 13 interviewees and at Steinbach ten out of 15 interviewees were able or wanted to define energy autonomy. These definitions were analyzed and classified to three sub-groups (see Table 5).

Several definitions included reasons why there shall be a focus on energy autonomy. Mostly (9 times) a reduction in the dependency from abroad was mentioned. Eight definitions included the use of local resources and two definitions included an increase in local value added.

**Table 5: Definition of Energy Autonomy according to Interviewees**

| | Topic . | Total | Number of Mentions | Interviewees of Windhaag | | | | Number of Mentions | Interviewees of Steinbach | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| The Reasons to become energy autonomous are to..... | ... reduce dependency from abroad | 9 | 3 | WM | WF1 | WF2 | | 6 | SM | SC2 | SC3 | SC4 | SF1 | SF2 | | |
| | ... increase local value added | 2 | 1 | WF2 | | | | 1 | SM | | | | | | | |
| | ... use the local resources | 8 | 4 | WC2 | WC3 | WF2 | WI1 | 4 | SC3 | SP1 | SP4 | SI1 | | | | |
| | **Sum of Mentions** | **19** | **8** | | | | | **11** | | | | | | | | |
| Energy Autonomy means to focus on..... | ... energy supply | 12 | 4 | WC2 | WF1 | WF2 | WI1 | 8 | SM | SC2 | SC3 | SC4 | SP4 | SF1 | SF2 | SI1 |
| | ... energy demand | 0 | 0 | | | | | 0 | | | | | | | | |
| | ... a supply by renewable energies and a reduction in energy demand | 4 | 2 | WM | WC3 | | | 2 | SP1 | SP2 | | | | | | |
| | **Sum of Mentions** | **16** | **6** | | | | | **10** | | | | | | | | |
| To me, Energy includes ... | Power | 2 | 1 | WC2 | | | | 1 | SP2 | | | | | | | |
| | Heat | 1 | 0 | | | | | 1 | SF1 | | | | | | | |
| | Mobility | 0 | 0 | | | | | 0 | | | | | | | | |
| | Power and Heat | 6 | 3 | WC3 | WF2 | WI1 | | 3 | SP4 | SF2 | SI1 | | | | | |
| | Power, Heat and Mobility | 5 | 1 | WM | | | | 4 | SC2 | SC3 | SC4 | SP1 | | | | |
| | All Products made of Oil (including e.g. Plastic, ...) | 3 | 1 | WF1 | | | | 2 | SC2 | SP1 | | | | | | |
| | **Sum of Mentions** | **17** | **6** | | | | | **11** | | | | | | | | |
| | **Overall Sum** | **52** | 20 | | | | | 32 | | | | | | | | |

**Source: INTERVIEWEES OF STEINBACH (SM, SC2-4, SF1+2, SP1+4, SI1) AND WINDHAAG (WM, WF1+2, WC2+3, WI1), 2010**

Noticeable is that 12 out of 16 interviewees focused on energy supply only and four interviewees mentioned that there has to be both, an energy supply from renewable energies and a reduction in demand. Furthermore it is interesting to highlight, that in Steinbach, most interviewees mentioned that energy includes three aspects – power, heat and mobility whereas most interviewees from Windhaag said that energy is about power and heat.

[13] For detailed information the interested reader is referred to chapter 8.3

## 4.3 Steinbach an der Steyr

### 4.3.1 Characterization of the Municipality

Steinbach an der Steyr is part of Upper Austria, which is one of the nine federal states of Austria. It belongs to the district of Kirchdorf an der Krems and is situated at 381 to 1.273m above sea level (MUNICIPAL OFFICE STEINBACH/STEYR, 2010). There are 570 houses, containing 740 households and giving the municipality its character of a village based mainly upon single-family houses and only a few multi-level houses (AEA, 2009b, STATISTIK AUSTRIA, 2001d). There is little industry, mainly small trade such as electricians or plumbers, and several service enterprises like a small supermarket, a doctors, a Kindergarden and a school and so on. 36% of the overall area of 28.23 km² is used for forestry (AEA, 2009b). More detailed statistical information can be seen in Table 6. The nearest town is called Steyr and is about 20 km away (MUNICIPAL OFFICE STEINBACH/STEYR, 2010).

**Table 6: Statistical Information about Steinbach**

| | Sub-Topic | Unit | | % | Year of Evaluation | Source |
|---|---|---|---|---|---|---|
| **Basic Information** | Area | km² | 28.23 | 100.00 | 2001 | 1 |
| | Area used for Agriculture and Forestry | km² | 20.60 | 72.97 | 1999 | 2 |
| | Inhabitants | Number | 1984 | | 2009 | 3 |
| | Density of Population | Inhabitants/km² | 72 | | 2001 | 1 |
| | Amount of Flats | Number | 740 | | 2001 | 4 |
| **Statistics about Employment** | Employed People | Number | 1036 | 52.01 | 2008 | 5 |
| | Unemployed People | Number | 25 | 1.26 | 2008 | 5 |
| | Other People (like Pupils, Students, Retiree) | Number | 931 | 46.74 | 2008 | 5 |
| **Statistics about Employment Opportunities** | Business and Service Enterprises | Number | 56 | | 2001 | 6 |
| | Agricultural and Forestry Businesses | Number | 110 | | 1999 | 2 |
| | Working Places within the Municipality | Number | 251 | | 2001 | 6 |
| **Statistics about Migration** | Distance to Next Central Place (Steyr) | km | 19.42 | | 2011 | 8 |
| | Out-Commuter | Number | 675 | | 2001 | 7 |
| | In-Commuter | Number | 123 | | 2001 | 7 |
| | Employees who do not Commute or Commute within the municipality | Number | 232 | | 2001 | 7 |

**Source: STATISTIK AUSTRIA (Source 1: 2009d, 2: 2001c, 3: 2010c, 4: 2001d, 5: 2010d, 6: 2009e, 7: 2009f) and MAP24, 2011 (Source 8)**

The municipality has an overall concept including qualified and quantified aims concerning its energy and climate policy. Within this concept the vision of becoming energy autonomous is fixed, even if there is no clear declaration in which year it shall be reached (AEA, 2009b). Steinbach is part of several networks like the "Climate Alliance (Austria)" (which is the biggest network focusing on the protection of climate within Europe) or "E-GEM" (which stands for "Energy-Municipality" and is an initiative of the federal state of Upper Austria to support municipalities on their way towards supply with renewable energies and a reduced demand for energy). Furthermore, the municipality has a climate- and energy representative and project groups focusing on aspects of energy (AEA, 2009b, REGIONALMANAGEMENT OÖ GMBH, 2010).

The previous mayor Karl Sieghartsleitner, was the person who pioneered this move towards energy autonomy (SPES, 1994). The reason was a strong economic slowdown after the closing of the biggest local employer in 1967 (company "Franz Pils & Sons" which produced mainly knifes). Till that time, the industry of Steinbach was dominated of the production of cutlery which came under pressure due to high competition from cheaper production in Asia (SPES, 1994, OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006). In 1986 a project, called "Der Steinbacher Weg" (which means "The way of Steinbach") was initiated to stop the shrinking process by promoting a sustainable development within the municipality[14]. One of the projects aims was to use biomass to allow for an energy-self-supply system to provide heating within the municipality (OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006).

During the time of Mr. Sieghartsleitners mandate (the exact inception date could not be found), an analysis of the demand for energy was made. This was done for the whole of municipalities administration and several private houses within municipalities centre. Unfortunately, this analysis is no longer available (SM, SP4). But since the spring 2010 municipalities administration started a second analysis based on the "E-GEM" network (see above) and thus, by the end of 2011 new data about the actual demand of energy, potentials due to given resources and opportunities for further development shall be available (SM, REGIONALMANAGEMENT OÖ GMBH, 2010).

Following data concerning energy supply and demand could be evaluated during the study:

- **Power**: There are two hydro power stations of Energie AG in Steinbach. They already exist for longer than 1986 and produce as much power as is needed by 1.500 households per year (SC1+2, AEA, 2009b). Thus, the municipality (which has about 700 household) is already energy-autonomous regarding power – at least for the balance sheet because the inhabitants and local industry are not only provided for by the owner of these power stations (SM). Even if both hydro power stations were renovated in 2005, an increase in energy production was not possible (SC1+2, SM). Additional (small) hydro power stations existed till 50 years ago but are not used now (SM). Focusing on other energy sources, six solar power stations were installed by the inhabitants to supply themselves with power from the sun. Other energy forms to produce power like geothermal energy, wind energy or energy from biogas are not used as yet (SM, AEA, 2009b).

[14] Due to "Der Steinbacher Weg" the amount of small businesses and service enterprises doubled (from 27 companies in 1986 to 55 companies in 2001), 147 new jobs were created from 1986-2001, rate of unemployment was reduced from 9% in 1986 to 2.8% in 2001 and 70 permanently unemployed persons found a job (OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006).

- **Heat**: All public buildings of which municipality is the owner (which are the municipal office, two Kindergardens, the school, the music school and the church) as well as 200 households are supplied by heat made from biomass (SP4, SM). There is a farmer cooperative, named "Nahwärme Steinbach" which built 5 decentralised heating plants starting in 1986 and supply above described buildings/households (NAHWÄRME STEINBACH, n.d.). Furthermore, there are single heating systems, solar panels, and heat pumps which are used for private households (SM, AEA, 2009b). According to the mayor, about 80% of private households are supplied with heat made from renewable energies (SM). Focusing on the demand side, there is data about the situation of buildings of which municipality is owner. 50% of these buildings have the standard of demanding very little, but there is no building which was built as passive house (AEA, 2009b).
- **Mobility**: Even if a concept about mobility of the municipality is missing, it was possible to enable a re-connection to the public transport system (bus station was re-opened) (SM, SP4, SI1, AEA, 2009b) and to start a car-sharing project (SP4, SI1). A service station for electrical vehicles is planned, but up to now has not been built due to a lack of funds (SM).

### 4.3.2 Impacts of Energy Autonomy at Steinbach

As described, there were different efforts by local people to become energy autonomous (see 4.3.1). The evaluation of interviews showed that there were 86 mentions of interviewees who perceived different impacts of these efforts. 47 mentions regarded economic impacts whereas 39 mentions covered the social impacts. Quality of life and self-confidence was the most frequently mentioned (from 11 interviewees from all groups). It was followed by employment opportunities and diversification as well as energy supply and decrease in dependency (both mentioned ten times from almost all groups). In combination with secondary data, the following picture can be drawn regarding the impacts of the municipality's aims to become energy-autonomous.

#### 4.3.2.1 Economic Impacts

Focusing on the economic impacts, employment opportunities and diversification as well as impact on other sectors, draw of subsidies and compensations[15] as well as revenues for land owners were most frequently mentioned.

[15] As already described in 3.2.1.3 subsidies are financial support from the European Union or national/regional government granted to e.g. the local municipality or a firm for energy projects (DEL RIO AND BURGUILLO, 2008). These are paid to support motivated people to realize projects. In contrast, compensations are made to improve the acceptance by the local population for the projects (ADAS, 2003). These may be done by monetary support (like sponsorship or funds) but also by non-monetary support (like provision of room to a lower price than usual).

As can be seen in Table 7, 72% of mentions (34 out of 47) covered these aspects.

**Table 7: Mentions of Interviewees of Steinbach concerning Economic Impacts**

| Topic | Number | SM | SP | SF | SC | SI |
|---|---|---|---|---|---|---|
| Employment Opportunities and Diversification | 10 | 1 | 4 | 3 | 2 | 0 |
| Impact on other Sectors | 6 | 1 | 4 | 0 | 1 | 0 |
| Draw of Compensations | 6 | 1 | 2 | 0 | 3 | 0 |
| Draw of Subsidies | 6 | 1 | 4 | 1 | 0 | 0 |
| Revenues for Land Owners | 6 | 1 | 2 | 3 | 0 | 0 |
| Commercial Value | 5 | 1 | 0 | 1 | 2 | 1 |
| Impact on Local Taxes | 3 | 1 | 1 | 1 | 0 | 0 |
| Energy Price Volatility | 3 | 1 | 1 | 0 | 1 | 0 |
| Reduction of Costs | 2 | 1 | 1 | 0 | 0 | 0 |
| Synergetic Effects | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sum Economic Impacts** | **47** | **9** | **19** | **9** | **9** | **1** |

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SC3+SC4), 2010**

It must be also noted that employment opportunities and diversification was mentioned across almost all groups and not only by the farmers who had the most to gain from this development. Furthermore, it can be seen that almost all of these economic impacts were not mentioned by the inhabitants, except for the commercial value of existing housing stock. The following passages will highlight these impacts in detail.

Since 1986 it was possible to create 4.475 full-time **working places** within the four **founded companies/cooperatives** (SM, SP1-4, SF1+2). According to Table 8 all of these are part time-jobs and thus, 25 people gained from additional income. Most of them (20 people) are working for the farm cooperative called „Nahwärme Steinbach". All 20 are producing biomass materials, three of them are additionally working as the cooperative's management (SF1).

**Table 8: Created Jobs within Energy Sector at Steinbach since 1986**

| Name of Company | Field of Activity | Number of Working People | Full-time Working Places |
|---|---|---|---|
| Farmer Cooperative "Nahwärme Steinbach" | Provision of biomass;<br>Construction and maintenance of decentralized biomass heating system at Steinbach | 20 | 2.4 |
| Firma HMH ("Heizen mit Holz") | Energy Contracting;<br>Construction and maintenance of decentralized biomass heating systems outside of Steinbach | 2 | 0.2 |
| Firma Kals | Production and distribution of wood chips | 2 | 1 |
| Regional- and Leadermanagement Steinbach an der Steyr | Energy Manager (Coordinator about topic of energy within the region) | 1 | 0.875 |
| | **Sum** | **25** | **4.475** |

**Source: INTERVIEWEES (SM, SP1-4, SF1+2), 2010 AND NAHWÄRME STEINBACH, N.D.**

In addition Energie AG (power supplier) employed up to 50 people (an average of 10 people at anyone time), but only for nine months in 2002. This was due to the necessary rehabilitation of the two existed local hydro power stations (SC1+2).

Additionally to those who found jobs, there were **local investments** to construct the necessary infrastructure for partly heated self-supply systems within the municipality. The farmer cooperative has constructed five decentralized heat plants since 1991 (see Table 9). Thus, EUR 1,200.000,-- (including tax) were invested (NAHWÄRME STEINBACH, N.D., SPES, 1994).

**Table 9: Constructed and Maintained Heat Plants at Steinbach**

| Heat Plant | Name | Year of Construction | # of houses, supplied with heat | Supply of.... | Supply Line [m] | Boiler Capacity [kW] | Fuel | Fuel Demand [Srm] | Operation |
|---|---|---|---|---|---|---|---|---|---|
| #1 | Alter Pfarrhof | 1991 | 7 | 4 flats, Drying plant, Office of Regional- and Leadermanagement | 160 | 140 | Wood Chips | 240 | 15.09-15.05 |
| #2 | Eckergründe | 1996 | 14 | 10 flats | 320 | 120 | Wood Chips | 500 | whole year |
| #3 | Schulstraße | 1997 | 2 | Rental appartements from flat association, Elementary School, Kindergarden, private houses | 50 | 200 | Chips of Wood, Saw Dust | 500 | whole year |
| #4 | Volksschule | 1997 | 35 | Rental appartements from flat association, Elementary School, Kindergarden, private houses | 1.200 | 500 | Wood Chips | 1.200 | whole year |
| #5 | Ortszentrum | 1999 | 24 | Raiffeisenbank, Sparkasse, Rectorate, Supermarket, Steinbacher Insurance company, Rented flats within city center | 400 | 400 | Wood Chips | 700 | whole year |
| | | **Sum** | **82** | | **2.130** | **1.360** | | **3.140** | |

**Source: INTERVIEWEES (SP4, SF1), 2010, MUNICIPAL OFFICE STEINBACH AND „NAHWÄRME STEINBACH" ,2000, SPES, 1994**

Even if the technical installations came from outside the municipality, there were direct **impacts on further, local companies**. About 50% of the investments (about EUR 600.000,--) went to companies of Steinbach (local electricians, builders, plumbers etc.). According to the interviewees (SM, SP1,2+4, SF1+3, SC1+2) these were spent on:

- Construction of all heating plants (Company Rimpler - builders);
- Plumbing activities and purchase of all heat transfer stations (Company Augustin - plumber);
- Maintenance of all heating plants (Company Halbartschlager – chimney sweeper);
- Construction of chimneys in public and private houses (Company Winter – roofer);
- Electrical support and maintenance;

Apart of these direct local investments, there were **additional indirect payments**. These came from so-called "energy tourists" (SM, SP1-4, SC1). According to the mayor of Steinbach, there are 2.300-2.500 visitors to the heating plants per year (SM). Plus there are people visiting the hydro power station as well, but only "very very few" (SC1). Even if these tourists do not stay overnight, they spent money in the local restaurants and shops (SM). Steinbach has four restaurants which can – according to mayor's view - "not be taken for granted in a municipality with 2.000 inhabitants" (SM). He also is of the opinion that the

Regional- and Leadermanagement settled at Steinbach 15 years ago, due to the described successful "Steinbacher Weg". But this view is not confirmed by the representatives of the Regional- and Leadermanagement (SP1).

There were six interviewees who mentioned **subsidies** and six interviewees who mentioned **the incentive of synergies** as an economic impact. These were the mayor and commercial stakeholders as well as stakeholders from the public sector. Only one farmer mentioned these as aspects. According to interviewees and secondary data

- most of the biomass heat plants (independent if it was private or from the farm cooperative) gained subsidies for its installation. In the beginning (after 1986) 50% of the investment costs were subsidised by European Union as well as from national and state administration (NAHWÄRME STEINBACH, n.d.). Nowadays, a maximum of 30% will be subsidised (SP2, SP4, SF2 and NAHWÄRME STEINBACH, n.d.).
- Furthermore, there were subsidies for modernising the insulation of buildings. How much was subsidised depended on the achieved energy reductions (SM). An exact value could be evaluated for the flat associations – they gained subsidies by a program called "Promotion of house building". Of up to 80% of total costs were admitted and subsidised as annuity government grant (SC5, SM);
- Finally, there were subsidies from the federal state of Upper Austria. EUR 19.000,-- were paid to support the municipality in the recently started E-GEM-process (SM). E-GEM stands for "Energie-Gemeinde" (energy municipality). This process was started to gain an overview of the status quo and resources of the energy situation in involved municipalities in Upper Austria (SM, SP1-3 and REGIONALMANAGEMENT OÖ GMBH, 2010).

Incentives of compensations were mentioned due to

- Unused heat of one of the heating plants is used for the local drying plant (SM, SP4) and thus, reduces costs;
- The farm cooperative provided a room at one of the decentralized heat plants to the local crib association. Thus, the cooperative gained higher subsidies and the association has to pay a very low rent (SM, SP4+5);
- A project from local school pupils was sponsored by Energie AG (SC1, SC2, SP5);

Another aspect, namely **revenues for land owners**, was also mentioned. The members of the farm cooperative had to pay a membership fee – depending on how much biomass they wanted to deliver per year. Thus, they were guaranteed a fixed price for the biomass they delivered (as long as the quality of biomass fulfilled the special requirements, such as a moisture of about 20%). Thus, members of the farm cooperative knew how much they would earn each period (SM, SP1+4, SF1-3).

Finally, five interviewees mentioned an economic impact due to an **increase in the commercial value of buildings**. In their opinion this is given due to

- Insulation and building using the latest equipment (SI1, SM, SC5);
- Refitting of the two local hydro power stations (and thus, higher protection against flooding) (SC1);
- Making Steinbach more attractive to flat associations (due to improved infrastructure in heat supply (SF1, SM);

In addition to these economic impacts, three or fewer interview partner mentioned:

- An **impact on local taxes** (which is only paid by company Kals (MUNICIPAL OFFICE STEINBACH, 2010) because - up to now - it has not been possible to attract further companies from outside the municipality to establish a branch/company in Steinbach) (SM, SF1, SP4);
- An **energy price** which is not as volatile as that of oil (SM, SP4, SC5);
- **Reduced costs** for the municipality and the flat association due to combination of sewer repairs and construction of heat conduction (SM, SP4);

#### 4.3.2.2 Social Impacts

Highlighting social impacts provides an interesting view because the different impacts were mentioned across almost all of the interview groups (see Table 10). The quality of life and self-confidence were especially mentioned (11 times). There is no impact which is mentioned lower than four times. Looking at it via the different interview groups it can be seen that the group of stakeholders from the public sector mentioned social impacts very often.

**Table 10: Mentions of Interviewees of Steinbach concerning Social Impacts**

| Topic | Number | SM | SP | SF | SC | SI |
|---|---|---|---|---|---|---|
| Quality of Life and Self-Confidence | 11 | 1 | 3 | 3 | 3 | 1 |
| Energy Supply, -Dependency | 10 | 1 | 2 | 3 | 4 | 0 |
| Social Relations and Engagements | 7 | 1 | 4 | 1 | 0 | 1 |
| Skill Level | 7 | 1 | 4 | 1 | 1 | 0 |
| Migration | 4 | 1 | 2 | 0 | 1 | 0 |
| **Sum Social Impacts** | **39** | **5** | **15** | **8** | **9** | **2** |

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SP5+SC4), 2010**

As diverse as the term '**quality of life**' is seen, as diverse were the mentions about this aspect. Concretely, interviewees mentioned that they perceived a change of their quality of life as positive (right side of Table 11) or as negative (left side) due to:

**Table 11: As Positive and Negative Perceived Changes in Quality of Life at Steinbach**

| As negativ perceived changes | As positive perceived changes | |
|---|---|---|
| There were no further compensations by restauration of the two hydro power stations (except of the try to integrate it into the given townscape) (SM, SC1, SC2) | Improve in air quality due to a change from old, out-of-date furnaces to new furnaces which are state-of-the-art (SP4, SF1+2) | Ecology and fishery gain due to the new ecological regulations (like e.g. minimum of instream flow) (SC1, SC2) |
| People have the feeling that they are put under pressure to allow the farm cooperative to install the necessary lines across their property (SM, SF1-3, SI1) | Focusing on energy offers the opportunity for a re-positioning of regional development (SP1, SP2, SP4) | Higher mobility due to re-implementation of the local bus stop (SP4, SI1) |
| | Insulation means a reduction in energy costs and thus, is some kind of private provision for one's old age (SP4, SI1, SC5) | Reduction in $CO_2$-Emissions (SF2) |

**Source: INTERVIEWEES (SM, SC1+2, SC5, SF1-3, SP1+2, SP4, SI1), 2010**

If we single out the self-confidence aspect alone we can see that out of the 15 interviews at Steinbach, only one interviewee mentioned that „due to the farmers new challenge [of being responsible for the heating plants] and the reason that the municipality is a cutting-edge one compared to other municipalities, appreciation and praise are predominant" (SP4).

One social impact which was mentioned ten times by interviewees was concerning **energy supply and dependency**. Interviewees felt that the energy supply and dependency changes were mainly positive due to:

- Autonomy at power – even if this is only given on the balance sheet (SM, SP2, SC1+2, SF1, SC3+5);
- There is a supply of wood chips which comes from a radius of 20 km and the farmer cooperative produces biomass in a sustainable way (SP4, SF1-3,);
- Energy Provider lives within the municipality and thus, is close at hand; furthermore, there is a 24-hour-troubleshooting-service (SF1, SF2);
- Contracts for energy supply are fixed for 15 years (private citizens) or five years (companies) but can be cancelled every year. Thus, there is security for the energy supply for consumers (SC5);
- Contracts for energy supply focuses on a special amount of heat. Thus, the quality of used wood chips is not relevant for the consumer (SF1+2);
- Energy prices are „more stable" due to a installation fee (only has to be paid once), an index-linked price, savings in time and money because there is no further need for the chimney sweeper for consumers (SF3, SC5, SP4, SM);
- Optimization of the existed heat distribution (SP4);

An important aspect mentioned was, that there is a preferred orientation of the flat associations to use the existing grid. This means, that there is no preference for renewable energies. They just use the existing grid - independent of it being gas or district heat (SC3, SC5);

Due to the municipality's focus on energy autonomy several **co-operations and associations were founded**. On the one hand there are energy groups and a so called "Energy regulars' table" (SM, SP4). On the other, there is an E-GEM project group (see 4.3.1) and a project focusing on mobility (four households share a car) (REGIONALMANAGEMENT OÖ GMBH, 2010, SP4, SI1). The biggest group concerning social relations is the founded farmer cooperative "Nahwärme Steinbach". Farmers meet regularly to coordinate the necessary supply of the heat plants (NAHWÄRME STEINBACH, N.D., SP1-4, SF1, SM).

Seven interviewees mentioned an **impact on skill levels**. These were mainly stakeholders from the public sector (four mentions). According to the interviewees the impact was due to:

- External trainings (outside of the municipality): One to two trainings from the Austrian Biomass Association and the Chamber for Agriculture for the members of the farmers cooperative (SF2, SM), special trainings for the workers of the company Augustin (plumber) (SM) and trainings for the electricians of the company Zemsauer about solar and wind power (SC3);
- Internal trainings (done within the municipality): continuous lectures and energy consulting by the farmers cooperative for inhabitants (SP1-4, SC3);

According to interviewees, the municipality evolved **from a municipality with net-immigration to a municipality with net-emigration** (in detail see chapter 8.2.3) (SM, SP2+4, SC3). This was confirmed by statistical data from the municipal office (MUNICIPAL OFFICE STEINBACH, 2010). The possible causes for this included a lack of childcare (SM) and missing job opportunities (SM, SP4) were mentioned. Nevertheless, three interviewees argued, that – due to the "Steinbacher Weg" – fewer people migrate than the data implied (SM, SP4).

### 4.3.2.3 Summary

To sum it up, the three socio-economic impacts mentioned most by the interviewees of Steinbach (see Figure 19) were:

- Quality of Life and Self Confidence (social impact, mentioned 11 times)
- Employment Opportunities and Diversification (economic impact, mentioned 10 times)
- Energy Supply and decrease in Energy Dependency (social impact, mentioned 10 times)

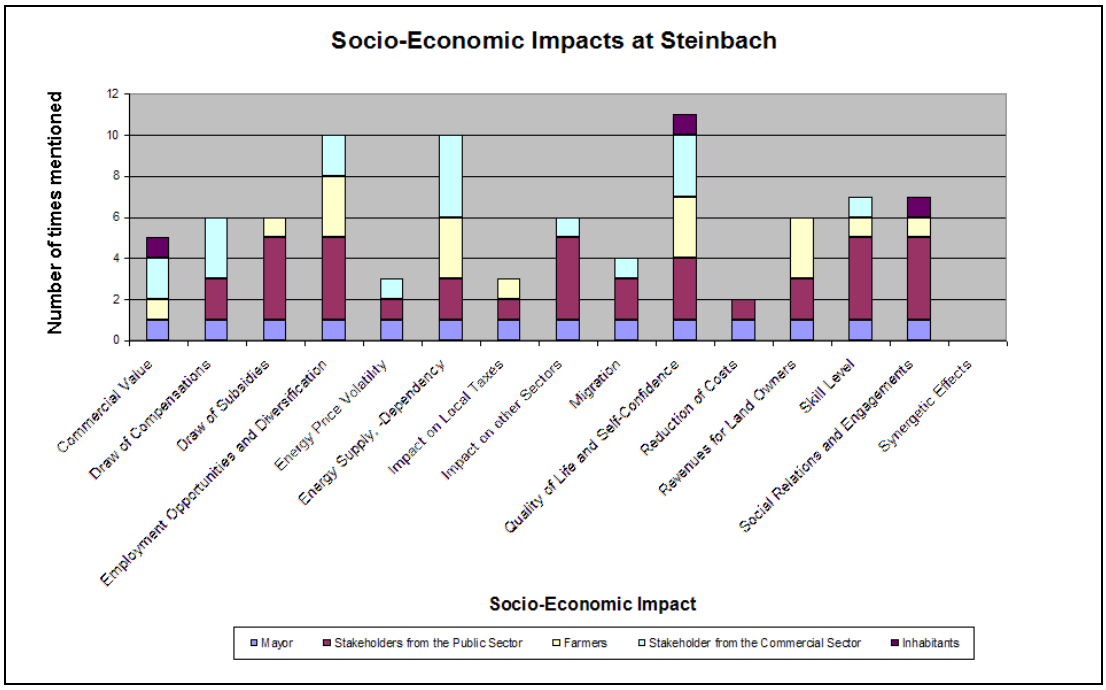


**Figure 19: Socio-Economic Impacts at Steinbach**

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SC4), 2010**

In contrast, those with three or fewer than three mentions were impact on local taxes (three times), energy price volatility (three times), reduction of costs (two times) and synergetic effects (not mentioned).

### 4.3.3 Barriers of Energy Autonomy at Steinbach

In addition to the already mentioned impacts, the author's focus was to get information about the barriers as well. The categories of barriers according to the theory (e.g. technical or economic barriers, see 3.3) were changed to internal and external barriers and thus, there was a modification from deductive to inductive categories.

The evaluation of interviews reflects that there were 42 mentions regarding internal barriers (which are 40% of all mentions about barriers) and 62 mentions of external barriers (60%). Noticeably is, that the interviewees from the commercial sector and the mayor gave most information about external barriers (27 of 62 mentions). In contrast, interviewees from the public sector, the farmers and the mayor gave most information about internal barriers (29 of 42). Which barriers were seen by the interviewees will be content of the following chapters, starting with the internal barriers.

#### 4.3.3.1 Internal Barriers

Internal barriers are those which are mainly "created" within the municipality and thus, can be influenced by local people. Some of these can be solved within a short time, for some, it may need medium- and long term planning and adaption. Highlighting them in more detail gives the following picture:

**Table 12: Mentions of Interviewees of Steinbach concerning Internal Barriers**

| Topic | Number | SM | SP | SF | SC | SI |
|---|---|---|---|---|---|---|
| Missing Conviction and Stimulation for Conversion | 9 | 1 | 3 | 2 | 2 | 1 |
| Status, Envy, Greed and Missing Trust | 8 | 1 | 3 | 2 | 1 | 1 |
| Partisanship and Decision Makers Attitude | 6 | 1 | 1 | 3 | 1 | 0 |
| Retain in Given Situation | 6 | 1 | 2 | 2 | 0 | 1 |
| Uncertainty | 5 | 1 | 0 | 2 | 1 | 1 |
| Unequal Perception and Distribution of Impacts | 4 | 0 | 3 | 0 | 0 | 1 |
| Time-Line till Submission of Project | 3 | 0 | 0 | 0 | 3 | 0 |
| Missing Overview about Energy Costs | 1 | 1 | 0 | 0 | 0 | 0 |
| **Sum Internal Barriers** | 42 | 6 | 12 | 11 | 8 | 5 |

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SP5 AND SC5), 2010**

As to the reasons why not everyone living in Steinbach focuses on lower energy demands or uses renewable energies, interviewees mentioned a **lack of conviction and stimulation for conversion** (SM, SC2+4, SF1+3, SP1, 3+4, SI1). Two interviewees mentioned that it is not enough if there are only financial incentives. It is also necessary to raise people's awareness of these topics (SP4, SI1).

Further aspects, such as **status, envy and greed** as well as **missing cooperation** were mentioned as internal barriers for renewable energies and mobility. Interviewees – mainly from the public sector (three out of eight mentions) – said that it is a question of

significance (SM, SP1,2+4, SF1+2, SC3, SI1). Up to now, there is a significant difference in an investment in the energy sector (e.g. solar power which has a payback period of 12-15 years) in comparison to an investment in another sector (e.g. a car). This is reflected by an interviewee who said: "if somebody wants to buy a big BMW, he does not ask when the payback period is over. It is a question of status. To change status is a lot of hard work" (SP2).

There were six mentions about **partisanship and the attitude of decision makers**, mainly from the farmers. In contrast to private sector, in municipal sector more people have to be involved to find decisions. Thus, different points of view and attitudes have to be taken into account which may act as a barrier. The political responsibilities mentioned that there were agreements between the political parties to find the best decisions according to the topic and political attitude was set aside (SM). Furthermore this was confirmed by other interviewees (SP1, SF1+3). But there were municipalities around Steinbach who boycotted certain energy projects for political reasons which led to time delay's of up to two years and additional costs of EUR 100.000,-- (SF1+2). Independent of political orientation, interviewees mentioned the attitude of decision makers as a barrier (SC4, SF2). Even if they argued that this may not be a barrier in Steinbach (SF1, SP1), it is seen as barrier for a further development on regional level. This is reflected by a statement of a stakeholder from the public sector: "Deadlocked attitudes are a barrier – I mean if someone is strongly convinced about something. For example, I know two mayors who are involved in the fossil fuel sector and of course, this is reflected in the municipality as well" (SP1). One interviewee mentioned that it is a problem that politicians want to be re-elected and thus, may promote other topics (SC4).

People may talk about necessary changes, but do not necessarily change anything and thus, **retain in given situation**. This situation was voiced by six of the interviewees (SM, SP1+4, SF1+2, SI1). Interviewees mentioned that new technologies or new construction methods (e.g. passive houses) were not used because of the reaction of neighbours, friends and family (SP4, SI1). For example, if one builds a new house without any heating system and without a chimney "people are whispering because they believe that we do not want to pay money to the chimney sweeper. Well, everything is interconnected and a reduced energy demand is correlated with economy and jobs" (SI1).

When questioned about any structural changes (e.g. change from singular heat sources in each household to a common, decentralised heating plant) there was **uncertainty** – especially within the first few years (SM, SF1+2, SI1, SC3). Those, who feared to lose out due to this structural change, stoked fears and negative mood in others.

But due to the successful implementation of energy projects this barrier blow over (SM, SF1). Nevertheless, interviewees suggested that keeping that barrier in mind for further development (new projects) was possible and may need to be addressed.

During the interviews the belief that there may be an **unequal perception and distribution of impacts** between those involved and local people intensified. According to the interviewees from the public sector and the inhabitant, people with higher income (SP1, SI1) or people with higher education (SI1) or economically involved people (like farmers, builders or plumbers) (SP1, SP2, SI1) or people over 30 (SP2) and men (SP1-3, SI1) are more strongly involved and have more to gain than those not listed here. There was one exception from two interviewees – at cooperative meetings and road shows there is no difference between groups of people (SP1+2).

Only three interviewees from the commercial sector mentioned that the **time-line before a project can be submitted is too long** (SC1,2+4). Finally, the mayor mentioned that – due to the structure in the municipalities accounting – it is **not possible to get an overview of energy costs** (these costs are split between the different categories like energy costs for school/for Kindergarden/… and thus, energy savings can not be seen at a glance) (SM).

#### 4.3.3.2 External Barriers

In contrast to internal barriers, the external barriers give a clearer overview of these determining factors of energy autonomy, which are usually established and resolved outside of municipality's decision framework. Thus, the local people can only marginally influence their outcome (e.g. by broaching the issues with the responsible administrations). Highlighting them in more detail gives the following picture:

**Table 13: Mentions of Interviewees of Steinbach concerning External Barriers**

| Topic | Number | SM | SP | SF | SC | SI |
|---|---|---|---|---|---|---|
| Costs (Conversion-, Investment-, Running-) | 12 | 1 | 2 | 3 | 5 | 1 |
| Given or Missing Legislation | 10 | 1 | 3 | 1 | 4 | 1 |
| Allocation of Subsidies | 10 | 1 | 4 | 3 | 2 | 0 |
| Technical Aspects | 9 | 1 | 3 | 0 | 4 | 1 |
| Exclusion of Externalities | 6 | 1 | 1 | 3 | 1 | 0 |
| Highly Controlled Energy Sector | 5 | 0 | 1 | 2 | 2 | 0 |
| Financial Situation of the Municipality | 3 | 1 | 1 | 1 | 0 | 0 |
| Responsibility and Land Tenure | 3 | 0 | 1 | 1 | 1 | 0 |
| Lack of Knowledge and Skills | 2 | 1 | 1 | 0 | 0 | 0 |
| Lack of Regional Strategy | 1 | 0 | 1 | 0 | 0 | 0 |
| Dynamic of Energy Market | 1 | 0 | 0 | 0 | 1 | 0 |
| **Sum External Barriers** | 62 | 7 | 18 | 14 | 20 | 3 |

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SP5), 2010**

It is interesting to look at the different interview groups. In general, one may see that costs, legislation, allocation of subsidies and technical aspects were often mentioned. Costs and Legislation were mentioned across all groups and stakeholders from the commercial sector tended to emphasis this issue the most. But there are several other aspects, which were also mentioned. But about 50% of the different topics were mentioned fewer than three times and thus, will be described very briefly in the following chapters.

The adaptation from a centralized to a decentralized system for energy supply as well as a reduction in energy demand (e.g. insulation or energy-saving appliances) goes hand in hand with **costs**. Due to the broad range of given resources and possibilities to use them as well as possibilities to reduce energy demand, various costs may arise. According to the interviewees, the following costs act as barrier against implementing energy autonomy and thus, impede further progress:

- Investment-Costs:
  - for insulation (SP4, SC5, SM);
  - for the necessary equipment and connections of heating plants (SM, SP1, SF1-3), hydro power stations (SM, SC1+2) and solar power (SM, SC3+4, SI1, SF2);
- Adaption-Costs: for the necessary equipment to use solar panels in older houses (because usually there is no central supply for the whole house but a single boiler in each flat) (SM, SC5);
- Additional Costs: for ecological reasons such as a fish climb or a minimum of instream flow in the hydropower stations which leads to a "loss" for the energy producer (SC1+2);
- Purchase Price: for electric vehicles due to their low market penetration (SM, SP1, SP4, SC2-5, SI1);

Furthermore, one has to consider, that the following also act as a barrier;

- age of the existing energy supply system (if it is only a few years old, people will not switch to another system) (SC5, SP4, SI1) and
- low energy demand of so called "low energy houses" (makes a connection uneconomical) (SF1-3, SI1);

Ten interviewees across all interview groups mentioned that the **given legislation** was barrier due to the following reasons:

**Table 14: Barriers of Energy Autonomy due to Legislation at Steinbach**

| Aspect | Reason |
|---|---|
| Old and Inadequate Regulations | Which are in conflict with new construction mechanisms (e.g. passive houses do not need a chimney but according to existing regulations it has to be build) (SF1, SI1) |
| Obstructive Regulations | Town plans, land use regulations and regulations about local taxes support decisions contra renewable energies and energy efficiency measures (e.g. favoritism of individual traffic due to construction of shopping malls at municipality's boarder) (SP1-3) |
| Missing Legal Regulations Wind Energy | There are no legal regulations for small wind power plants ("… in Upper Austria there is no policy for those. There is no law and no specification. How shall I install something if there is no legal basis?" (SC3)) |
| Strong Regulations Wind Energy | Due to regulations of 10m-height and a distance of 800m to the next houses the amount of potential sites strongly decreases (SC3) |
| Strong Regulations Hydro Power Energy | Due to ecological regulations (e.g. necessary fish climb) re-activation of small, downclosed hydro power stations is hindered (SM, SC1, SC2, SC4) |

**Source: INTERVIEWEES (SF1, SI1, SP1-3, SM, SC1-4), 2010**

The development of Steinbach showed that – due to its focus on energy autonomy at an early stage – the responsible administrations have not had adequate **subsidy systems**. Thus, during the whole process of the examination of the proposal, municipalities did not know how much subsidies would be paid. Several times, this led to further needs for re-financing (SM, SP4). According to interviewees this still exists, but only partly (e.g. for solar power (SC3)). Nevertheless, there are several other aspects concerning the actual system for subsidies which were mentioned by the interviewees as barrier:

- Continuously changing (SP2) as well as unclear and complex regulations (SP1, SC3) like is reflected by the following: "Now we have a new call for big solar power but nobody knows how to handle it. And if one call KPC [Kommunalkredit Public Consulting which is one of the responsible administrations] they are overstrained. And if they do not know what to do, how shall we manage that?" (SC3)
- Necessary documents and supporting documents increased (SF1-3, SP3, SC3, SC5);
- Subsidies for solar power are too low and do not reflect the real costs (SM, SC3, SF1+2);
- Responsible administrations focus on standardized proposals: thus, new and innovative projects which demand a comprehensive overview do not have the possibility to be subsidised (SP1+4);
- Several times, it was only possible to make an application via internet which excludes people (like older or poor people who do not have internet) (SM, SP4);

Nine out of 15 interview partners at Steinbach mentioned barriers due to the **technical aspects**. Noticeable is however, that no farmer mentioned this as a barrier. This may be due to the early-stage development of farmers cooperative as was stated by two interviewees. They argued that there were technical problems in the beginning of the heating plants. Furthermore, people were concerned about the reliability of the heating plants because they would not be able to repair something on their own (which is the case if it is a singular heating system in the basement of one's own house). But both apprehensions could be solved (SM, SP4). Actually the following aspects also acted as a barrier:

- given the infrastructure of some buildings, they are handicapped if they should be adapted to a renewable energy supply (SC5);
- due to the given infrastructure of power grid it is not possible to extend the amount of energy produced by solar power, hydro power and wind energy above a certain number. The reason for this is that the grid is not able to take and further increases via irregularly produced energy (which is a problem for these three forms of energy) (SC3+4);
- There is an insufficient network of service stations for electrical vehicles (SI1, SM, SP1+2, SC3);
- Nominal reach of electrical vehicles is very low (SM, SP1, SI1, SC3);
- Charging time of electrical vehicles is too long (SM, SP1, SI1, SC2+3);
- Low efficiency of small wind power plants (SC3);

According to the interviewees, due to the **exclusion of externalities and high subsidies of fossil fuels**, the price for energy does not reflect its real costs (SM, SP2, SF1-3, SC4). This was mentioned for two prices – the price for energy produced from oil and that produced from nuclear power. Additional, according to SF1+2, SP1, SC3+4 the **highly controlled energy sector** acts as a barrier because "energy is – at least in parts and within Upper Austria – an absolute monopoly" (SF1). Thus, further development – especially of new projects which demand a shift from the monopolists to other sectors – is strongly impeded.

As can be seen in Table 13 there are five aspects which are listed by the interviewees, but with three or lower than three mentions:

- **The financial situation of the municipality**

  According to the mayor of Steinbach, the municipality struggles with a lack of capital to make further investments in the energy sector (SM). This view was shared with two further interviewees (SP4, SF2). That aspect was confirmed by the actual outlook of "Gemeindebund" (an association which keeps track of the development of all municipalities within Austria) which states that more than 50% of the 2.357 Austrian municipalities and towns will have a budget deficit in 2010 (KOMMUNALKREDIT, 2009).

- **Responsibility and land tenure**

  From the point of view of SC2, SF2 and SP1 responsibilities and land tenure act as a barrier. They argued that the energy topic is shared among different authorities within the municipality and thus, there are overlaps which impede further development (SP1). Furthermore, some property owners do not want that the heat supply line is crossing their property (SF2) and due to the make-up of the land tenure being small, inactive hydro power stations may not be used (SC2).
- **Missing knowledge and skills**

  In contrast to Windhaag, there may be enough specialist counselling of highly qualified people at Steinbach because only two interviewees mentioned a lack of knowledge and skills as barrier (SM, SP1).
- A **missing regional strategy** (SP1) and the **dynamic of the energy market** (SC4) were mentioned only once.

### 4.3.3.3 Summary

Highlighting internal and external barriers shows, that the interviewees of Steinbach perceive more external (62 mentions) than internal (42 mentions) barriers. Costs (12 mentions), given legislation (10 mentions) and aspects about technique (10 mentions) were mentioned mostly – all three are external barriers as can be seen in Figure 20.

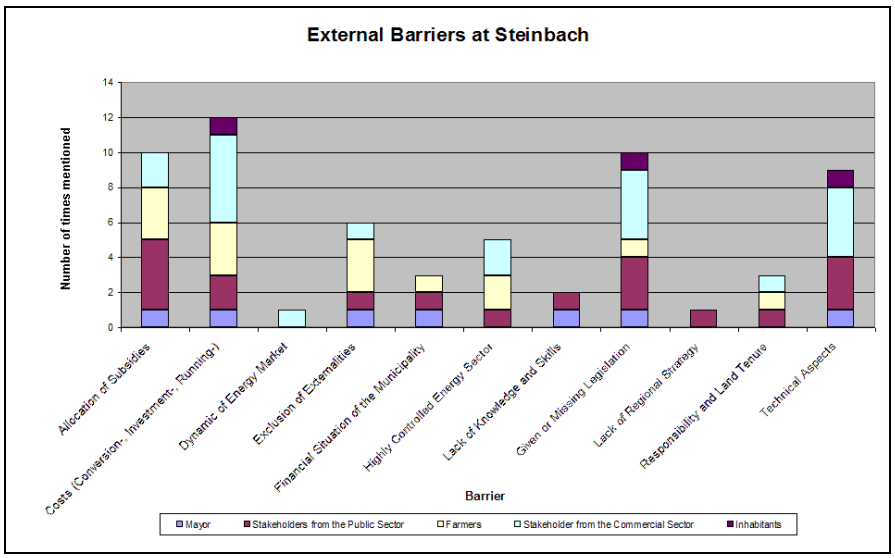


**Figure 20: External Barriers at Steinbach**

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SP5), 2010**

The internal barriers mentioned most often include (see also Figure 21)

- Missing conviction and stimulation for conversion (nine mentions);
- Status, envy, greed and missing trust (eight mentions);
- Partisanship and decision makers attitude as well as to retain in given situation (six mentions);

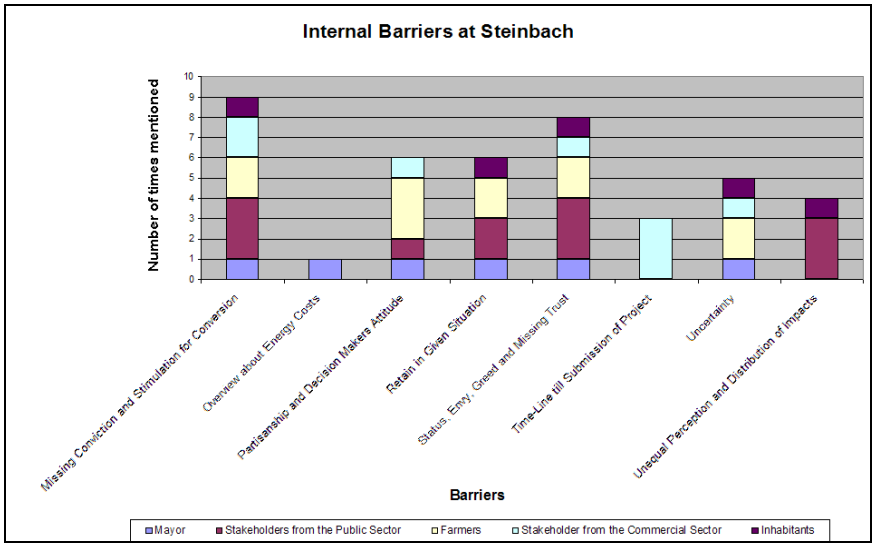


**Figure 21: Internal Barriers at Steinbach**

**Source: INTERVIEWEES OF STEINBACH (EXCEPT FOR SC5 AND SP5), 2010**

## 4.4 Windhaag bei Freistadt

### 4.4.1 Characterization of the Municipality

Windhaag is – as Steinbach - part of Upper Austria. But in contrast to Steinbach it is in the northern part of the federal state, not far away from the boarder to Czech Republic. It belongs to the district of Perg and is situated at 723m above sea level (STATISTIK AUSTRIA, 2009a) (more detailed statistical information can be seen in Table 15). There are mainly single-family houses and only a few multi-level houses. As in Steinbach, there is little industry, mainly small trade like electricians or plumbers, and several service enterprises like a small supermarket, a Kindergarden and a school. 43% of the overall area of 42.86 km² is used for forestry (WF3, STATISTIK AUSTRIA, 2001a). The nearest town is Freistadt, which is about 13 km away (WM).

**Table 15: Statistical Information about Windhaag**

| | Sub-Topic | Unit | | % | Year of Evaluation | Source |
|---|---|---|---|---|---|---|
| **Basic Information** | Area | km² | 42.86 | 100.00 | 2001 | 1 |
| | Area used for Agriculture and Forestry | km² | 38.41 | 89.62 | 1999 | 2 |
| | Inhabitants | Number | 1634 | | 2010 | 3 |
| | Density of Population | Inhabitants/km² | 40 | | 2001 | 1 |
| | Amount of Flats | Number | 620 | | 2001 | 4 |
| **Statistics about Employment** | Employed People | Number | 858 | 54.09 | 2008 | 5 |
| | Unemployed People | Number | 28 | 1.71 | 2008 | 5 |
| | Other People (like Pupils, Students, Retiree) | Number | 752 | 45.91 | 2008 | 5 |
| **Statistics about Employment Opportunities** | Business and Service Enterprises | Number | 41 | | 2001 | 6 |
| | Agricultural and Forestry Businesses | Number | 177 | | 1999 | 2 |
| | Working Places within the Municipality | Number | 259 | | 2001 | 6 |
| **Statistics about Migration** | Distance to Next Central Place (Freistadt) | km | 12.86 | | 2011 | 8 |
| | Out-Commuter | Number | 494 | | 2001 | 7 |
| | In-Commuter | Number | 101 | | 2001 | 7 |
| | Employees who do not Commute or Commute within the municipality | Number | 329 | | 2001 | 7 |

**Source: STATISTIK AUSTRIA (Source 1: 2009a, 2: 2001a, 3: 2010a, 4: 2001b, 5: 2010b, 6: 2009b, 7: 2009c) AND MAP24, 2011 (Source 8)**

There is no official overall concept regarding energy which is implemented by the municipal council (AEA, 2009a). But there is an unofficial one as was confirmed by several interviewees (WM, WF1-3, WI2). In 2006, the permanent exhibition "Unser Weg nach morgen in die Energieunabhängigkeit" [which means "Our way towards an energy-autonomous tomorrow"] was established. It describes the given situation of Windhaag up to 2005, its given resources and potentials as well as different opportunities to become energy autonomous. An extensive as-is analyses of all public and private buildings was done showing that 77% of all the inhabitants participated (ENERGIEAUSSTELLUNG WINDHAAG, 2007, WF1). The results of the exhibition are seen as the overall concept concerning energy within the municipality (WM, WF1-3, WI2). As in Steinbach, Windhaag is part of a network. It is a member of the "Climate Alliance (Austria)" and – at the beginning of 2011 – became a

member of Agenda 21. Furthermore, the municipality has a climate- and energy representative and a project group focusing on aspects of energy (WM, WP1, WI2, AEA, 2009a).

The first steps toward energy autonomy were done by the previous mayor Dr. Roiss who managed to install one of the first wood chip heating plants, which has been built and maintained by a municipality within Upper Austria (WM, WF1). Up to now, further heating plants have been installed as can be seen at 4.4.2.1. (BIOENERGIE WINDHAAG REG.GEN.MBH, 2010) One of the first decisions regarding how the municipality shall promote the topic of energy autonomy was that there shall be no financial support (WM, WF1). Rather, there was a clear decision to focus on consultancy and information based on:

- Exhibition "Our way towards an energy-autonomous tomorrow" (ENERGIEAUSSTELLUNG WINDHAAG, 2007, WM, WF1);
- Independent consultancy offered by the founded association "Energiebezirk Freistadt" (EBF) (which means "Energy district Freistadt") (EBF, N.D., WM, WC1, WF1, 3+4, WP1+2, WI2);
- One hour at an architect will be paid from the municipality (WM, WF1);
- Zukunftsforum Windhaag (see 4.4.2.2) (VEREIN ENERGIEBEZIRK FREISTADT, N.D., WM, WF1, WP1+2);
- Initiative "Do not drive away – buy within the municipality" (WM);

Based on the discussions about the nuclear power station Temelin[16] (WM, WF1, WC2) and due to "pressure from within the municipality" to use the local resources (WF1), a broad range of projects and initiatives where established to promote and use renewable energies and reduce the overall energy demand. In 2002 this was acknowledged by two awards – the Austrian Solar Award and the European Solar Award (ENERGIEAUSSTELLUNG WINDHAAG, 2007, WM, WF1).

Following data concerning energy supply and demand could be evaluated:

- **Power**: In 2006, the demand for energy for power was 4.05 GWh (which corresponds to 9% of the overall energy demand of Windhaag [which is 45 GWh]. Of this, 1.69 GWh (42%) were produced locally by
  - Several small hydro power stations (0.1 GWh);
  - 2 Wind Turbines á 660 kW (1.5 GWh);
  - 2.055 m² of solar power (0.09 GWh);

  Furthermore, street lighting in the market square is now operated by solar panels (WM, ENERGIEAUSSTELLUNG WINDHAAG, 2007, AEA, 2009a).

[16] There was a worst case scenario of a super gau in the nuclear power station of Temelin which is only few km away, in the neighbouring Czech Republic.

- **Heat**: Focusing on the energy demand for heat, in 2006 there was a demand for 26.55 GWh within the municipality (which corresponds to 59% of the overall energy demand of Windhaag). Out of this, 14.66 GWh (55%) are produced by local biomass and 5.56 GWh (21%) are imported. Focusing on the demand side, there is data about the situation of buildings of which municipality is owner. 20% of these buildings had the standard of demanding very little, but there is no building which was built as a passive house (ENERGIEAUSSTELLUNG WINDHAAG, 2007, AEA, 2009a, WM).
- **Mobility**: Regarding local transportation, 14.85 GWh (which corresponds to 33% of the overall energy demand) was needed to enable mobility in 2006. There was no local production of biofuels, but there were several bus connections to cities around Windhaag and thus, a connection to public transport was provided. Furthermore, there are two electrical bicycles which can be used by inhabitants or tourists. In 2011, a service station for electrical vehicles – powered by solar panels – will be installed (ENERGIEAUSSTELLUNG WINDHAAG, 2007, AEA, 2009a, WM).

## 4.4.2 Impacts of Energy Autonomy at Windhaag

Due to the municipality's focus on energy autonomy, there were various efforts made by Windhaag (see 4.4.1) to reach this goal. The evaluation of the interviews showed that there were 88 mentions by interviewees, who perceived different impacts of these efforts. 50 mentions refer to economic impacts, 38 mentions to social impacts. Social relations and engagements (from ten out of 13 interviewees) as well as employment opportunities and -diversification (11 times) were mentioned most frequently. Both were mentioned among all interview groups. In combination with secondary data, the following picture can be seen highlighting the impacts of the municipality's aim to become energy-autonomous.

### 4.4.2.1 Economic Impacts

According to Table 16 employment opportunities and diversification, the incentive of subsidies and impact on other sectors were those three economic impacts mostly mentioned. Noticeable however, is that all of these aspects where mentioned by almost all interview groups. This differs from all the other aspects which were mentioned by a maximum of three out of five interview groups.

**Table 16: Mentions of Interviewees of Windhaag concerning Economic Impacts**

| Topic | Number | WM | WP | WF | WC | WI |
|---|---|---|---|---|---|---|
| Employment Opportunities and Diversification | 11 | 1 | 2 | 4 | 2 | 2 |
| Draw of Subsidies | 9 | 1 | 0 | 4 | 3 | 1 |
| Impact on other Sectors | 8 | 1 | 2 | 3 | 2 | 0 |
| Revenues for Land Owners | 5 | 0 | 0 | 3 | 2 | 0 |
| Energy Price Volatility | 5 | 1 | 0 | 3 | 0 | 1 |
| Impact on Local Taxes | 4 | 1 | 0 | 2 | 1 | 0 |
| Draw of Compensations | 3 | 1 | 2 | 0 | 0 | 0 |
| Synergetic Effects | 2 | 1 | 0 | 1 | 0 | 0 |
| Reduction of Costs | 2 | 1 | 0 | 1 | 0 | 0 |
| Commercial Value of Real Estate | 1 | 0 | 0 | 1 | 0 | 0 |
| **Sum Economic Impacts** | 50 | 8 | 6 | 22 | 10 | 4 |

**Source: Interviewees of Windhaag (except for WP3), 2010**

Since 1986, 5.525 full-time **working places** within four **founded companies/associations** were created at Windhaag (WM, WF1-4, WC1+3, WP1+2, WI2). According to Table 17 all of these are part time-jobs and thus, 63 people gain from an additional income. The majority (57 people) are working for the farm cooperative called „Bioenergie Windhaag reg.GenmbH". Out of these 57 people, four are working as heating attendants, one produces wood chips and one is responsible for finance and controlling. The other members provide biomass (WF1-4).

**Table 17: Created Jobs within Energy Sector at Windhaag since 1986**

| Name of Company | Field of Activity | Numbert of Working People | Full-time Working Places |
|---|---|---|---|
| Bioenergie Windhaag reg.GenmbH | Provision of biomass;<br>Construction and maintenance of decentralized biomass heating system at Windhaag | 57 | 2.175 |
| Windpark Spörbichl | Production of Wind Power; | 1 | 0.150 |
| Zacharias Franz | Electrician - specialised on photovoltaics; | 1 | 0.200 |
| Verein Energiebezirk Freistadt (EBF) | Association to promote renewable energies and energy efficiency measurements; | 4 | 3.000 |
| | **Sum** | **63** | **5.525** |

**Source: INTERVIEWEES (WM, WF1-4, WC1+3, WP1+2), 2010 AND ENERGIEAUSSTELLUNG WINDHAAG, 2007 AND BIOENERGIE WINDHAAG REG.GEN.MBH, N.D.**

In addition to the created jobs, economic impacts were due to **local investments**. Those were necessary to construct the infrastructure for energy produced by wind, water, sun and biomass as can be seen in the next table. A total of EUR 1,290.683,-- (including tax) were invested to install 523 m² of solar panels (WM), re-open two small hydro power stations (WF3+4) and build three heating plants with its necessary supply lines (WM, WF1, WF2).

**Table 18: Installations for Energy Self-Supply at Windhaag**

| Year of Construction | Source of Energy | Name | Operator | Costs [EUR] | Area [m²] | Power [kW] | Produced Energy [kW/year] | Produced Energy [kWh/year] | Supply Line [m] | # of Houses supplied with heat |
|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | Biomass | Heizwerk 1 - Gemeindeheizung | Bioenergie Windhaag | 181.683 | | 550 | | | | 5 |
| 1988 | Hydro Power | No name | Puchmayr Gottfried | 20.000 | | | 50.000 | | | |
| 1999 | Wind | Windpark Spörbichl | Windpark Spörbichl | n.s. | | 1.320 | | | | |
| 2002 | Hydro Power | No name | Jachs Michael | 20.000 | | | 45.000 | | | |
| 2003 | Biomass | Heizwerk 2 - Pfarrhof | Bioenergie Windhaag | 107.000 | | 150 | | | 220 | 5 |
| 2005 | Solar Power | PV Anlage - Schuldach | Bioenergie Windhaag | 58.000 | 100 | | | | | |
| 2008 | Solar Power | PV Anlagen - Schule, Kläranlage | Markt-gemeinde | 160.000 | 179 | | | 26.000 | | |
| 2008 | Biomass | Netzerweiterung Schmollfeld | Bioenergie Windhaag | 154.000 | | 280 | | | 250 | 9 |
| 2009 | Biomass | Heizwerk 3 - Siedlung | Bioenergie Windhaag | 430.000 | | 300 | | | 760 | 19 |
| 2010 | Solar Power | PV Anlagen - Feuerwehrhaus, Kindergarten | Markt-gemeinde | 160.000 | 244 | | | 36.000 | | |
| | | | **Sum** | **1,290.683** | **523** | **2.600** | **95.000** | **62.000** | **1.230** | **38** |

**Source: INTERVIEWEES (WM, WF1-4, WC3), 2010 AND ENERGIEAUSSTELLUNG WINDHAAG, 2007**

In addition to these initiatives which were done by cooperatives, associations or the municipality, there were several **private investments** as well:

- Construction of four biomass-micro-nets;
- 215 single heating systems (80 powered by wood chips, 70 powered by split logs, 30 powered by pellets and 35 powered by wood gasification furnace);
- 1.300 m² solar panels to produce hot water;

(INTERVIEWEES (WI1, WF1, WP1), 2010 AND ENERGIEAUSSTELLUNG WINDHAAG, 2007)

There is need to mention, that most of the technical equipment came from outside the municipality. But nevertheless, there were direct impacts on further, local companies as well. According to the interviewees about 25% of the investments of decentralised heat plants powered by biomass (about EUR 218.171,--) were local investments in companies within Windhaag. According to the interviewees (WM, WF1-4, WC3, WI1, WP2) these were spent on:

- construction of all heating plants;
- construction of chimneys at public and private houses;
- purchase of all heating transfer stations (which are necessary at each house);
- electrical and plumbing activities;
- continuous maintenance of all heating plants (by the chimney sweeper);

The highest investment was done in 2009. EUR 430.000,-- was invested to build the third heating plant and "as long as it was possible and arguable, we bought locally. And thus, we may not save a company from insolvency because 2009 was the year of economic crises everywhere. But we may have saved one or two working places because we were the only company which invested in Windhaag – long after e.g. federal state said that they do not have money anymore" (WF2).

Independent of the above described direct local investment, there were **indirect payments** through "Energy Tourism" and "Zukunftsforum Windhaag" as well. This was mentioned by eight out of 13 interviewees among all groups, except for inhabitants (WM, WP1+2, WF1, 2+4, WC2+3). According to WM, there are about 1.300 visitors of the permanent exhibition "Our way towards an energy-autonomous tomorrow" per year which was confirmed by data from the municipality:

**Table 19: Tourists visiting the Energy Exhibition at Windhaag**

| Year | Number of Busses | Number of Visitors |
|---|---|---|
| 2007 | 19 | 515 |
| 2008 | 43 | 1.442 |
| 2009 | 37 | 1.177 |
| **Sum** | **99** | **3.134** |

**Source: MUNICIPALITY OFFICE WINDHAAG, 2010**b

In addition, each year, the so called "Zukunftsforum Windhaag" takes place. During three days, up to 800 pupils and students are at Windhaag. They discuss with politicians from federal state and federal ministers about aspects concerning the future (VEREIN ENERGIEBEZIRK FREISTADT, N.D., WF1, WC3, WP1+2). According to WF1, this event was initiated because there was a need to involve young people and to make them aware of the actual development in the energy sector and Austria's high dependency.

Except for the interview group of interviewees from the public sector, **incentives for subsidies** was mentioned from nine out of 13 mentions. According to interviewees and secondary data most of the biomass heating plants (either independent, private or from the farm cooperative) gained subsidies for their installation. Noticeable however, is that, among the interviewees it was noted that the first heating plant could only have been built due to its high subsidies (WM, WF1, WI1, WC2). In the beginning (after 1986) 50% of the investment costs of the following heating plants were subsidised by European Union as well as from national and state administration. Nowadays, a maximum of 30% will be subsidised (WM, WF1-3, BIOENERGIE WINDHAAG REG.GEN.MBH, N.D.).

But there were further subsidies as can be seen in following table:

**Table 20: Subsidies, Paid for Diverse Energy Projects at Windhaag since 1986**

| Subsidies paid by... | Subsidies | | Appropriation |
|---|---|---|---|
| | % | Amount [EUR] | |
| Federal State Upper Austria | depending on the achieved reduction of energy demand | n.s. | Modernising insulation of buildings |
| European Union, Austrian Federation, Federal State | in the beginning 100%, over time a continuous decrease to 65% --> 50% --> 40% --> actually 30% | n.s. | Biomass heat plants |
| Federal State Upper Austria | n.s. | 14.700 | Adaption of Sewage System to integrate solar power |
| Climate- and Energy Fund of Austria | n.s. | 100.000 | Subsidising EBF to enable a cooperation as climate- and energy model region |
| Austria Federation, Federal State Upper Austria | n.s. | n.s. | Subsidising kick-off of EBF |
| Austrian Federation and National Energy Provider | 25% each | n.s. | Subsidising wind park Spörbichl |
| Austrian Federation | 49% | n.s. | Solar power at public buildings |

**Source: INTERVIEWEES (WM, WF1-4, WC1-3, WI1), 2010 AND MUNICIPAL OFFICE WINDHAAG, 2010a**

Five interviewees mentioned the additional **income for local people** who invested in renewable energy (WC2+3, WF2-4). For example there were 250 shares for the wind park which could be bought for a price of Austrian Shilling 30.000,-- [EUR 2.180,--] by 100 people. According to an interviewee, "During the selling process of these shares people from Windhaag were preferred. […] and now, people from Windhaag are the second largest group of investors" (WC3). There are yearly refunds with an interest rate of 3-5% and up to now, half of capital has already been paid back to the investors (WC3). Furthermore, the members of the farm cooperative get revenues for their biomass. In the beginning, they had

to pay a membership fee – depending on how much biomass they wanted to deliver per year. Thus, the price was set at a fixed price (as far as the quality of biomass fulfills special requirements like a degree of moisture of about 20%) (WF2-4). Last year, EUR 60.000,-- was paid to the members of the cooperative (WF2+3).

Looking at the **volatility of the energy prices** reflected that – as in Steinbach – the price of energy, produced by biomass is volatile like the price of standard energy produced using oil because both are interconnected. But the volatility of price of energy produced by biomass is not as strong as that of oil because it depends on five indicators of which only two are depending on the oil price (WF1, 2+4, WM, WI1). In the beginning (after 1986) the price for energy produced by biomass was higher than that of oil and thus, there was criticism about the switch from oil to that of biomass (WM, WF1). Nowadays it is the other way round.

As further economic impacts, interviewees mentioned:

- **Impact on Local Taxes**

  Four out of 13 interviewees mentioned that there was no increase in local taxes. As reasons, all the interviewees mentioned that Windhaag is located off the main roads. Even if there were several initiatives, it has not been possible yet to attract companies from outside the municipality to establish a branch/company at Windhaag (WM, WF1, WF3, WC2).

- **Draw of Compensations**

  According to WM and WP1+2, there were compensations, but only marginal. These were for example the provision of room for the permanent exhibition about energy (WM, WP1+2), support of a local artist to create a sun clock (WP1+2) or selling of confection of pastry by the local farmer cooperative who donated sales revenue to public library (WP1+2).

- **Reductions of Costs**

  There are only marginal reductions of costs, due to lower demand of personal resources for the municipality. This is because the farmer cooperative is now responsible for maintenance of heating plants (WM, WF1). But the reduction in costs for the municipality may be bigger in future due to self-supply of power from solar power (WM).

- **Synergetic Effects**

  According to WM and WF1, ash from the heating plants is used as fertilizer.

- **Increase in the commercial value of buildings**

  Was only mentioned by WF1 and thus, will be neglected.

### 4.4.2.2 Social Impacts

The evaluation of social impacts showed that they were noted by almost all of the interview groups. The social relations and engagements came first (ten out of 13 interviewees), followed by skill level (nine out of 13) and quality of life and self-confidence (eight out of 13). Noticeable however, is that these three impacts were noted by all the farmers. As in Steinbach there is no aspect which was mentioned fewer than four times.

**Table 21: Mentions of Interviewees of Windhaag concerning Social Impacts**

| Topic | Number | WM | WP | WF | WC | WI |
|---|---|---|---|---|---|---|
| Social Relations and Engagements | 10 | 1 | 2 | 4 | 1 | 2 |
| Skill Level | 9 | 1 | 2 | 4 | 2 | 0 |
| Quality of Life and Self-Confidence | 8 | 1 | 1 | 4 | 1 | 1 |
| Energy Supply, -Dependency | 7 | 1 | 0 | 3 | 2 | 1 |
| Migration | 4 | 1 | 1 | 2 | 0 | 0 |
| **Sum Social Impacts** | 38 | 5 | 6 | 17 | 6 | 4 |

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WP3), 2010**

According to the interviewees, several **cooperatives, associations and project groups were founded** due to municipalities aim to become energy autonomous. These are:

- Farmers Cooperative "Bioenergie Windhaag reg.GenmbH" (57 members) (WM, WF1-4, WI1+2, WP1);
- Zukunftsforum Windhaag (up to 800 student and peoples per year) (VEREIN ENERGIEBEZIRK FREISTADT, N.D. AND INTERVIEWEES (WM, WF1, WP1+2), 2010);
- Energy Project Group (about 50 people) (WM, WF1, WP1, WI2);
- Agenda 21 Group (nascent) (WM, WP1);
- "Energy district Freistadt" an association which provides independent consultancy and trainings on renewable energies and reduction in energy demand (EBF, N.D. AND INTERVIEWEES (WM, WC1, WF1, WF3+4, WP1+2, WI2), 2010);
- Working group for the establishment of "Mühlviertler Ressourcenplan" (which is a plan that will give an overview about the given resources within the northern part of Upper Austria) (WC1, WP1+2);
- Wind Cooperative (WP1, WF2);

Because of the farmer cooperative, social relations within the municipality increased (WP2, WM) as described by an interviewee: "If a farmer wants to sell heating produced from his wood chips, he had to get in contact with all those that are interested in being connected to the heating plant. Thus, there is an interconnection between farmer and other inhabitants. Otherwise there was no reason for a farmer and an inhabitant from municipalities centre get into contact" (WM). But it was argued that the tightest social relations were established during the building of the heating plants (due to necessary basic information about how heating plants work, to make the necessary contracts and so on). Nowadays, contacts are

reduced between farmer and private people. There only is a contact if there is a problem with the heating supply (farmers offer a 24-hour-hotline) or when the annual account matures (WI1). Farmers themselves still have a strong interrelation because of the production and supply of wood chips, which has to be organised among the different heating plants (WI1-2, WF1-4).

Highlighting the **impacts on skill level** shows that there were quantitative (amount of trainings) as well as qualitative impacts (duration and consistency of trainings). This was mentioned among all interview groups except for inhabitants:

- "Zukunftsforum Windhaag"
  a symposium at which 800 pupils and students discuss with local, regional and nation politicians (in the beginning only pupils and students from Windhaag attended, in the meantime young people also come from outside Windhaag) (VEREIN ENERGIEBEZIRK FREISTADT, N.D. AND INTERVIEWEES (WM, WP1+2, WF1, WC3), 2010);
- Apprenticeship as skilled worker in the energy sector
  Triggered from the results of "Zukunftsforum Windhaag" and the initiatives at Windhaag an apprenticeship as a skilled worker in the energy sector was established at the agricultural school at Freistadt in winter 2010 (250 hours have to be attended within one semester) (WM, WF1-4, WP1);
- Association named "Energy District Freistadt"
  Offers a broad range of trainings (like qualification as Energy Consultant) and lectures (about 250 per year) on energy issues for all groups of stakeholders (mayor, companies, private people) (EBF, N.D. AND INTERVIEWEES (WP1+2, WF1+4, WC1), 2010);
- Trainings from Energie AG and at St. Magdalena for the heating attendants of the farmers cooperative (both, once a year for one day) (WF2);

Out of those "Zukunftsforum Windhaag", trainings for the farmer's cooperative and several trainings by EBF also take place in Windhaag itself. The other trainings take place in Freistadt (about 20km away). This was criticized by several interviewees because they trainings are not under the responsibility of Windhaag anymore and thus, the municipality does not gain from the trainings as would have been the case if they were located in Windhaag (WP2, WF1, WC1).

Eight out of 13 interviewees mentioned aspects about **quality of life and self-confidence**. One of the farmers summarized: "To me the situation of Windhaag appears if I look at the facts: we are a municipality where people have an average income that is lower than in other municipalities and there are no subsidies from the municipal authorities. But nevertheless there is a large number of different energy projects – at biomass, solar power. People do not do that because it is so funny. People do that because they are proud. That is an awareness of life, that is quality of life. That is social as well – like I am happier and so

on" (WF1). Highlighting the mentions in detail reflect that there is a range of impacts. Several perceived changes in quality of life as positive (right side of Table 22) and several perceived it as negative (left side).

**Table 22: As Positive and Negative Perceived Changes in Quality of Life at Windhaag**

| As negative perceived changes | As positive perceived changes | |
|---|---|---|
| The feeling to be forced to be connected to the local heat or to insulate like all the others around (WI1) | Travel time to working place is shorter because it is within the municipality --> thus, there is more leisure time (WM, WF3+4) | A positive feeling because I am doing something which is good for the enviroment/the future of children (WM, WF1, WI1) |
| The task to be continuously available for the 24-hour-hotline (WF1, WF2) | Well-tended landscape due to higher thinning (WF3+4) | Higher comfort due to insulation and building equipment which is state-of-the-art (WF1, WM) |
| Higher responsibility (WF1, WF2) | Efforts are acknowledged (WM, WF1+2, WI1) | Reduction of $CO_2$-Emissions and less environmental pollution due to reduced transport of resources (like e.g. coal/oil) (WF1,2+4, WM, WI1) |

**Source: INTERVIEWEES (WM, WF1-4, WI1, WC3), 2010**

Focusing on self-confidence alone shows that there is a difference to Steinbach (where only one interviewee mentioned this aspect). Seven out of 13 interviewees mentioned that they have the feeling that people from Windhaag have a higher self-confidence than in 1986. As reasons for this development, interviewees mentioned the two awards (see 4.4.1) (WM, WP2, WF1+4), the permanent energy-exhibition, which has become famous within Upper Austria and beyond (WM, WP2, WF1+4, WC3, WI1), the multitude of projects at the energy sector (WM, WF1+4, WP2, WC3) and the increase in tourism due to energy-tourism (WM, WF1, 2+4, WC3, WP2).

One social impact which was mentioned seven times by interviewees concerned the **energy supply and dependency**. Interviewees mentioned mainly positive changes concerning energy supply and dependency due to:

- Due to insulation, energy demand is lower and thus, people are less dependent (WI1);
- There is a supply of wood chips which comes from a radius of 20 km and the farmer cooperative produces biomass in a sustainable way (WI1, WF1+2);
- Contracts for energy supply run for 10 years (private citizens) or five years (companies) but can be cancelled every year. Thus, there is security for the energy supply to consumers (WC2, WF2+3);
- Contracts for energy supply focus on a special amount of heat. Thus, the quality of wood chips used is not relevant for the consumer (WF1+2, WM);

According to interviewees, the municipality evolved from a **municipality with net-immigration to a municipality with net-emigration** (for detailed information see chapter 8.2.3) (WM, WP2, WF1+2). This was confirmed by statistical data from the

municipal office (MUNICIPAL OFFICE WINDHAAG, 2010b). The municipality's remoteness was given as major reason (WM, WP2).

### 4.4.2.3 Summary

To sum it up, the three socio-economic impacts mentioned most by the interviewees of Windhaag (see Figure 22) were:

- Employment Opportunities (economic impact, mentioned 11 times);
- Social Relations and Engagements (social impact, mentioned ten times);
- Skill Level (social impact) and Draw of Subsidies (economic impact) (both mentioned nine times);

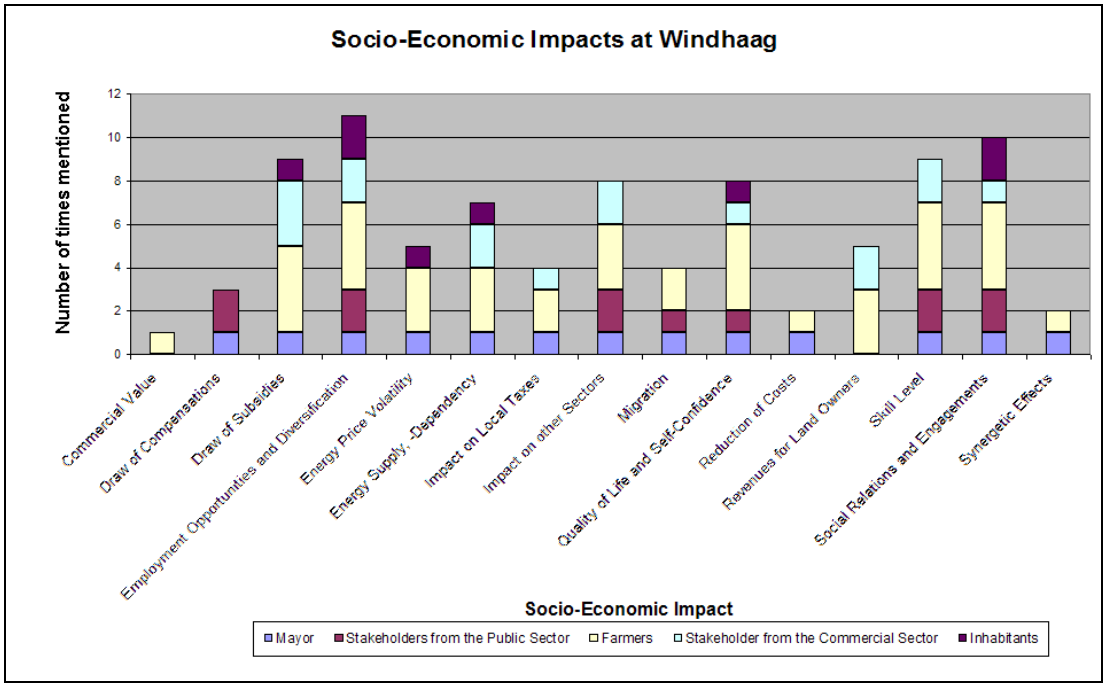


**Figure 22: Socio-Economic Impacts at Windhaag**

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WP3), 2010**

In contrast, those with three or fewer than three mentions were draw of compensations (mentioned three times), synergetic effects (two times), reduction of costs (two times) and commercial value (mentioned once).

### 4.4.3 Barriers of Energy Autonomy at Windhaag

As already described in the methodology (see 1.3) there was a modification from deductive to inductive categories due to a change from barriers according to the theory to internal and external barriers which helped to analyse the transcribed interview material. In total there were 85 mentions by the interviewees regarding barriers. Out of these there were 32 mentions of internal barriers (which are a little bit more than 1/3 of all mentions of barriers) and 53 mentions of external barriers (a little bit less than 2/3). Noticeable however, is that especially interviewees from the farmers and the mayor gave information regarding barriers (45 of 85 mentions). Which barriers were seen by the interviewees will be content of the following chapters, starting with the internal barriers.

#### 4.4.3.1 Internal Barriers

Highlighting internal barriers and thus, these which are mainly "created" within the municipality, gives the following picture:

**Table 23: Mentions of Interviewees of Windhaag concerning Internal Barriers**

| Topic | Number | WM | WP | WF | WC | WI |
|---|---|---|---|---|---|---|
| Status, Envy, Greed and Missing Trust | 7 | 1 | 2 | 2 | 1 | 1 |
| Retain in Given Situation | 7 | 1 | 2 | 2 | 2 | 0 |
| Partisanship and Decision Makers Attitude | 6 | 1 | 2 | 1 | 1 | 1 |
| Uncertainty due to Ignorance | 7 | 1 | 2 | 3 | 0 | 1 |
| Unequal Perception and Distribution of Impacts | 5 | 1 | 2 | 2 | 0 | 0 |
| Missing Conviction and Stimulation for Conversion | 0 | 0 | 0 | 0 | 0 | 0 |
| Time-Line till Submission of Project | 0 | 0 | 0 | 0 | 0 | 0 |
| Missing Overview about Energy Costs | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sum Internal Barriers** | 32 | 5 | 10 | 10 | 4 | 3 |

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WP3, WC3 AND WI2), 2010**

To give a comparison of the two municipalities (see chapter 5), the categorisation of barriers during evaluation of empirical study remained the same for Windhaag as for Steinbach. Table 23 reflects that there are differences to Steinbach because the last three internal barriers were not mentioned by the interviewees of Windhaag.

Among all the groups interviewed, **status, envy and greed** as well as **missing trust** were mentioned equally as internal barriers for further progress towards energy autonomy. This was mentioned especially for the use of renewable energies.

Especially in the beginning, there were criticism and envy "because there were thoughts like 'the farmers gain and we do not have a profit'" (WM). But due to the successful supply of heating over several years, a high level of service and the offered 24-hour-hotline, these critics fell silent (WM, WF1+3). Furthermore, it was mentioned that due to differences in income and thus, available budget, not everybody has the same possibilities to switch the energy system or invest in insulation. Within a municipality, where a lot of such projects are

done (e.g. from the neighbouring towns and villages), people may feel under pressure to do it the same way (WM, WF1). Another aspect concerned subsidies. Interviewees argued that people were envious if "the neighbour received subsidies" (WC2, WP1+2), without realising that only a part of the costs were covered. Finally, greed and missing trust were mentioned. **Trust** is necessary to change to local heating at a micro level (like 4-6 households that are connected) – if there was no trust, it would not have been possible to build and operate such a local heating systems at a micro level (WF1, WI1). Greed acts as a barrier because it impedes further development of a sustainable supply of energy (WP1+2).

That people may talk about necessary changes, but do not change anything and thus, **remain in the existing situations** was mentioned by seven interviewees (WM, WP1+2, WF1+2, WC1+2). The main argument was that people from Windhaag do not want to change – especially if they have the feeling that they are loosing something due to these changes. This was shown in statements like "…fear against the new" (WC1), "narrow (sectoral) view, reservation against changes and idleness of inhabitants" (WP1) or "people think only locally" (WP1). According to the mayor, this barrier is especially valid when looking at a change in mobility. He mentioned that "… mobility, there are a lot of different factors relevant, like for example the standard of living. It does not help if we become energy autonomous if the standard of living decreases. People will not support a decrease" (WM).

Six interviewees of all interview groups (WM, WP1+2, WF1, WC2, WI1) mentioned that there were barriers due to the **attitude of the decisions makers** because "In one municipal sector, there are political orientations – that means that the political party has a higher importance than the topic and thus, they do not decide about the topic but align to their political orientation" (WP2). This fact and several problems in the surrounding municipalities around Windhaag - due to political orientation - were the reason why the responsible stakeholders recommended a professional planning of the diverse projects and focused on an agreement between the political parties to find the best decisions according to the topic and not according to political attitude (WM, WF1). This was more prevolent in the beginning, there were problems within the municipality authorities because "It was difficult to convince the decision board because they said: "Why do we need this?" [a shift to a heat-self-supply based on biomass instead of oil] The decision board and local supply were the main barriers in the beginning. That changed completely over time. Now everybody knows how it works and there are no problems. Nowadays, the problems mainly are about financing" (WM).

The interview group of farmers mentioned that - based on a structural change of heating and power supply - there was **uncertainty**, especially within the first years (WF1,3+4, WI1,

WP1+2). Even if there were experiences about external supply of energy produced by biomass (several farmers already delivered wood chips to Freistadt to supply the hospital), there was uncertainty about the technical aspects (WM, WF1,3+4). These were e.g. thoughts about an equal distribution within the supply of heat (WI1) or wind turbines (WC2). But there also was uncertainty because people had the feeling, that there was missing adequate (independent) consultancy (WP1+2, WI1). Furthermore, those who feared they would be the loser of a structural change, stoked fears and negative moods (WI1). But due to the successful implementation of energy projects this barrier has not occoured yet (WF1, WF3+4). Nevertheless, interviewees suggested keeping that barrier in mind for further development (like new projects) (WP1, WF1,3+4).

As in Steinbach, interviewees from Windhaag mentioned that the **impacts** of becoming energy autonomous **may be perceived and distributed in an unequal way**.

- the group of involved people adapted over time to a small group of specialists (WP1, WF1);
- farmers are strongly involved, workers or commuters are less so (WP1, WF3);
- mainly man are involved; women, the youth and elder people may be involved as well but to a lesser extent (WM, WP1);
- it is mainly a topic for those with a higher income (WP2, WF1);

### 4.4.3.2 External Barriers

Highlighting external barriers in more detail reflects that three out of 11 aspects (costs, allocation of subsidies and knowledge and skill – see Table 24) were mentioned among all interview groups whereas several aspects (see last three rows) where not raised by the interviewees at Windhaag. Mostly, costs, allocation of subsidies as well as technical aspects were mentioned as barriers impeding further progress of energy autonomy. In contrast, the financial situation of the municipality was only mentioned twice and thus, will be described very briefly.

**Table 24: Mentions of Interviewees of Windhaag concerning External Barriers**

| Topic | Number | WM | WP | WF | WC | WI |
|---|---|---|---|---|---|---|
| Costs (Conversion-, Investment-, Running Costs) | 10 | 1 | 1 | 4 | 2 | 2 |
| Allocation of Subsidies | 9 | 1 | 1 | 4 | 2 | 1 |
| Technical Aspects | 9 | 1 | 0 | 4 | 2 | 2 |
| Given or Missing Legislation | 7 | 1 | 1 | 3 | 2 | 0 |
| Lack of Knowledge and Skills | 7 | 1 | 2 | 1 | 1 | 2 |
| Exclusion of Externalities | 4 | 1 | 0 | 2 | 1 | 0 |
| Highly Controlled Energy Sector | 5 | 0 | 0 | 4 | 1 | 0 |
| Financial Situation of the Municipality | 2 | 1 | 0 | 1 | 0 | 0 |
| Responsibility and Land Tenure | 0 | 0 | 0 | 0 | 0 | 0 |
| Lack of Regional Strategy | 0 | 0 | 0 | 0 | 0 | 0 |
| Dynamic of Energy Market | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sum External Barriers** | 53 | 7 | 5 | 23 | 11 | 7 |

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WC1 AND WP3), 2010**

It is interesting to note how the different interest groups emphasised certain areas. For example several aspects (costs, allocation of subsidies, technical aspects as well as a highly controlled energy sector) were mentioned of all the farmers.

Due to the broad range of given resources and possibilities to use them as well as possibilities to reduce energy demand, various **costs** may arise. According to the interviewees, the following costs act as a barrier against energy autonomy and thus, impede further progress:

- Investment-Costs: for the necessary equipment and connections of heating plants (WP2, WF1+2, WI1+2), wind parks (WC2+3) and solar power (WM, WF4, WC3);
- Adaption-Costs: for the refurbishment and thus, necessary adaption of small hydro power stations (WF3+4) as well as for the necessary equipment to use solar panels in older houses (WP2);
- Additional Costs: for ecological requirements like fish climb or a minimum of in-stream flow which leads to a "loss" for the energy producer in the hydro electrical stations (WF3+4);
- Purchase Price: for electronic vehicles due to their low market penetration (WM, WI2);

Furthermore, one has to consider that the age of the existing energy supply system (if it is only a few years old, people will not switch to another system) (WP2, WI1) and a low energy demand of so called "low energy houses" (makes a connection uneconomical) (WI1+2) can act as a barrier.

**Subsidies** and **the way they are shared** as well as the way how the **system of subsidies** works were criticised by the interviewees nine times and thus, as often as technical aspects. The main criticisms were about:

- Continuously changing guidelines, especially the regulations about "Green power" (WF1+4, WC2+3, WM, WP1);
- Inadequate subsidies for hydro power, solar power and wind power (WP1, WF1-4, WC2+3, WI1, WM);
- Missing subsidies for local heating on micro level in the past (such a "micro local heating" was only subsidies if it was built and maintained by a farmer, but not if this was done by several private people together) (WM, WF1, WP1);
- Necessary documents and supporting documents increased massively (WC3, WF1-4);
- Strong restrictions:
  - In the case of local heating on micro level: proposals are only possible from a commercial stakeholder, not a private person, it is compulsory that one apply for a loan to receive the subsidy and there has to be a positive return (WF1, WI1);
  - In the case of heating plants: 0.5 kW delivery rate per running meter has to be reached (WF2+3);

- Rising costs for application itself because there are planning costs (which are necessary to get the necessary data for application) and costs for contracts (which have to be enclosed in the application) (WM, WF2, WI1);

Similarly mentioned nine times were barriers due to **technical aspects** like problems with the machines or inadequate infrastructure. Especially in the beginning, wind turbines or decentralised heating plants had technical problems. Furthermore, people were afraid about the reliability of the heating plants because they would not be able to repair something on their own (which is the case if it is a singular heating system in the basement of one's own house). Actually there are following aspects which act as a barrier:

- Due to the given infrastructure it is not possible to extend the amount of energy produced by solar power, hydro power and wind energy. The reason is that the grid is not able to take further, irregularly produced energy (WF3+4, WC2+3);
- There is la ck of adequate small wind turbines which suit the Austrian landscape (WC2+3);
- The low energy demand of new passive houses makes it uneconomical to connect to the existing heating grid or extend it (WM, WF2, WI1+2);
- The infrastructure of buildings is a handicap if they should be adapted to renewable energy supplies (WM, WF1);
- There is an insufficient network of service stations for electrical vehicles (WM, WI2);
- Nominal reach of electrical vehicles is very low (WM, WI2);
- Charging time of electrical vehicles is too long (WM, WI2);

Seven interviewees among all the interviewed groups mentioned **legislation** as barrier due old and inadequate regulations, obstructive regulations or strong restrictions as can be seen in following table:

**Table 25: Barriers of Energy Autonomy due to Legislation at Windhaag**

| Aspect | Reason |
|---|---|
| Old and Inadequate Regulations Wind Energy | Responsible authority of nature conservation assesses wind parks only on their influence on landscape. Thus, a positive assessment in only a few cases is possible. But influence on landscape is given due to e.g. roads as well where there is an agreement of nature conservation (WC2+3) |
| Old and Inadequate Regulations Solar Power | It is only allowed to construct a solar power panel at the roof if one is registered at that house - thus, rent of roofs for contruction of solar power panels is impeded (WC3, WF1, WM) |
| Obstructive Regulations | Town plans, land use regulations and regulations about local taxes support decisions contra renewable energies and energy efficiency measures (e.g. favoritism of individual traffic due to construction of shopping malls at municipality's boarder) (WM, WP1, WF1) |
| Strong Regulations Wind Energy | Due to regulations of 10m-height and a regulation of 800m to the next houses the number of potential sites strongly decreases (WC2+3) |
| Strong Regulations Hydro Power Energy | Due to ecological regulations (e.g. necessary fish climb) re-activation of small, downclosed hydro power stations is hindered (WF3+4) |

**Source: INTERVIEWEES (WM, WP1, WF1,3+4, WC2+3), 2010**

Equally seven out of the 13 interviewees (out of all interview groups) pointed to barriers due to **missing know-how** or **inadequate consultancy.** Highlighting that in detail reflects that this was a barrier in the past. Due to Windhaags pioneering character, there was lack of knowledge and skills. The years after 1986 were characterized by associations which could only give consultancy for big projects (like wind parks containing more than five wind turbines or centralized heating plants for a whole municipality). But it was very hard to find qualified people who could give consultancy for small, decentralised solutions. Furthermore, it was not possible to find independent consultancy and it was hard to find experienced people who made adequate evaluations of economic efficiency (WM, WP1+2, WF2, WC3, WI1+2). Due to these reasons EBF was founded.

According to four interviewees (WM, WF1+4, WC2), due to the **exclusion of externalities** and **high subsidies of fossil fuels**, the price for energy does not reflect its real costs. This was mentioned for two prices – the price for energy produced from oil and that produced from nuclear power.

The interviewees of Windhaag argued that a **highly controlled energy sector** acts as a barrier towards energy autonomy. A switch from a centralised to a decentralised system goes hand in hand with a shift in power. Interviewees argued that the suppliers of power and heat try to avoid this switch by dumping prices for e.g. the construction of a gas network (WF1-4, WC2).

According to WM and WF1, the municipality struggles with **missing capital** to make further investments in the energy sector. But in contrast to Steinbach, this was not seen as problem, rather it was seen as a "delay in time-line" (WM).

#### 4.4.3.3 Summary

Highlighting internal and external barriers shows, that the interviewees of Windhaag perceive more external (53 mentions) than internal (32 mentions) barriers.

Costs (ten mentions), allocation of subsidies and technical aspects (both mentioned nine times) were mentioned mostly – all three are external barriers as can be seen in Figure 23.

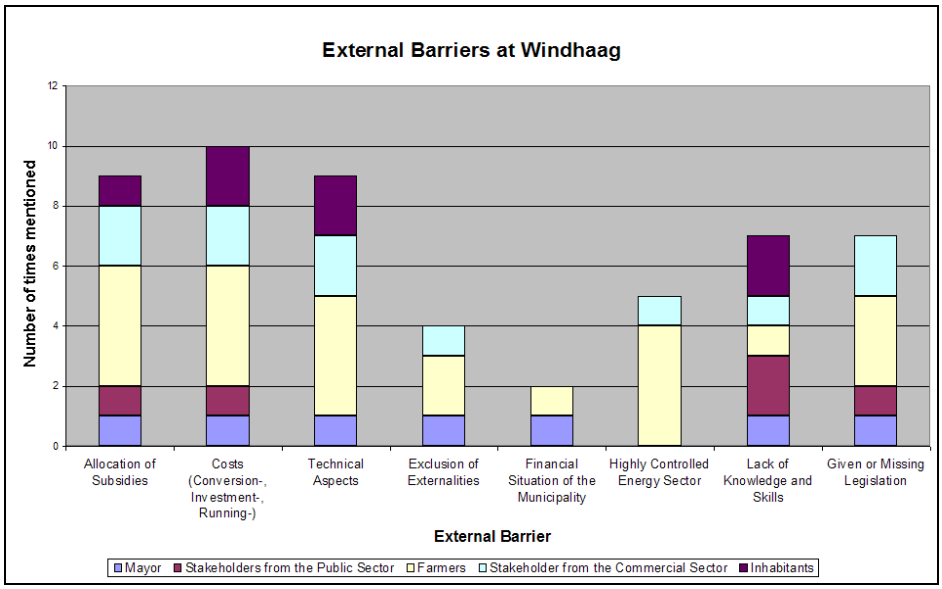


**Figure 23: External Barriers at Windhaag**

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WP3 AND WC1), 2010**

As internal barriers status, envy, greed and missing trust, to retain in given situation and uncertainty (all mentioned seven times) and partisanship and decision makers attitude (mentioned six times) were mentioned mostly as can be seen in Figure 24.

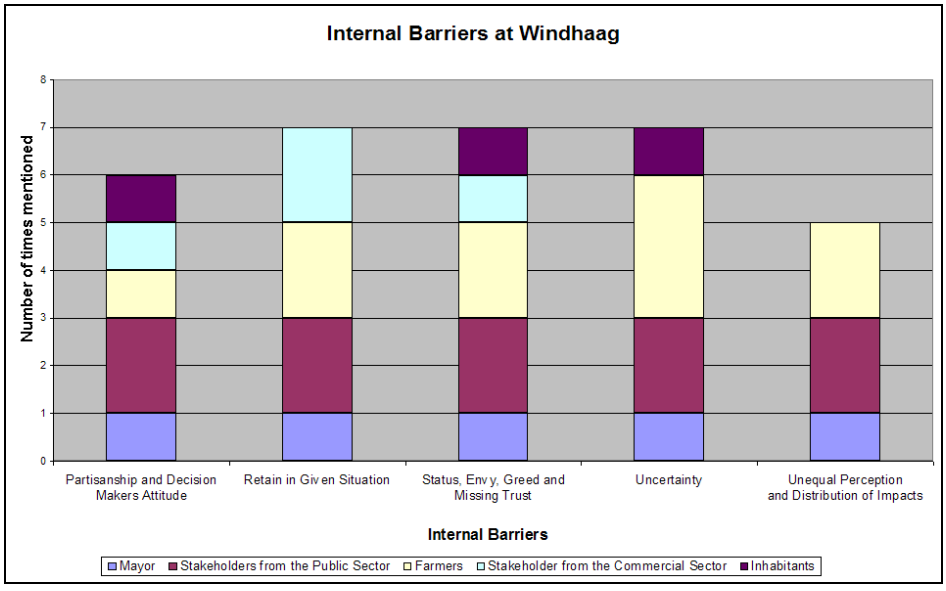


**Figure 24: Internal Barriers at Windhaag**

**Source: INTERVIEWEES OF WINDHAAG (EXCEPT FOR WP3, WC3 AND WI2), 2010**

## 4.5 Recommendations from the Interviewees

During the empirical study, there were continuous recommendations from the interviewees regarding the necessary changes needed to achieve energy autonomy. It is important to mention, that this list of suggestions is not supposed to be or can be a list of all necessary aspects that have to be realized. As already described due to different facts (e.g. diverse status quo or given resources) there is no universal way towards energy autonomy for each municipality. This list of recommendations rather should be seen as "Wallet of Ideas" to enable further progress or enable municipalities to start a process.

There were 98 recommendations of which 72 came from interviewees of Steinbach and 26 from interviewees of Windhaag (see Table 26). These were singular aspects as well as generalities of how to break new ground. The recommendations comprise aspects which have to be realized within the municipalities (and thus, overcome internal barriers; in sum 61 mentions) as well as aspects of a broader view (and thus, overcome external barriers; in sum 37 mentions). Thus, recommendations about how to overcome internal barriers were mentioned most. To allow a comprehensive overview, recommendations were categorized into three groups. The first group, called "Overall" includes recommendations which did not focus on either, the reduction in energy demand nor an energy supply based on renewable energy. The other two groups include recommendations focus on one of these two groups solely. Within the following passages, the recommendations about internal aspects mentioned by more than three interviewees will be highlighted in more detail[17].

**Table 26: Number of Mentioned Recommendations from the Interviewees**

| Topic | | Steinbach | | Windhaag | |
|---|---|---|---|---|---|
| | | Internal | External | Internal | External |
| Overall | Involvement | 18 | 0 | 3 | 0 |
| | Politics | 8 | 3 | 0 | 1 |
| | Projects | 7 | 0 | 3 | 0 |
| | Knowledge/Skills | 1 | 0 | 0 | 0 |
| | Subsidies | 0 | 1 | 0 | 1 |
| | **Sum** | **34** | **4** | **6** | **2** |
| Reduction in Energy Demand | Concept | 8 | 0 | 1 | 0 |
| | Costs | 3 | 2 | 2 | 2 |
| | **Sum** | **11** | **2** | **3** | **2** |
| Switch to Energy Supply based on Renewable Energy | Biomass | 5 | 0 | 0 | 0 |
| | Law | 1 | 0 | 0 | 0 |
| | Solar Power | 1 | 3 | 0 | 2 |
| | Subsidies | 0 | 3 | 0 | 2 |
| | Mobility | 0 | 2 | 0 | 6 |
| | Solar | 0 | 2 | 0 | 0 |
| | Water | 0 | 3 | 0 | 0 |
| | Wind | 0 | 1 | 0 | 3 |
| | **Sum** | **7** | **14** | **0** | **13** |
| **Total Sum Int./Ext. per Municipality** | | **52** | **20** | **9** | **17** |
| **Total Sum of Mentions** | | **72** | | **26** | |

**Source: INTERVIEWEES (SM, SC1-5, SP1-4, SF1-3, SI1 AND WM, WC1-2, WF1-3, WI1), 2010**

[17] The interested reader is referred to 8.4 where the whole list of recommendations can be found.

Focusing on the recommendations about internal barriers, most mentioned was **involvement** (21 times). Interviewees gave the following recommendations:

- Balance the involvement of stakeholders and thus, try to involve young/old, men/women, poorer/richer people equally (SP4, SF2, SF3, SI1) but also try to involve all stakeholders and thus, private person, commercial stakeholder and politicians (WC1);
- Focus on a higher involvement of women and youth (SP1, SP3, SF1, SI1);
- Support an adaption in status – away from "its cool if it is big, much, expensive" to "that gives me the quality I need" (SP1, SP4, SF2);
- Continuously give information, present highly motivated people (SP1+3, SF2) and examples of best-practice (at e.g. the local newspaper) (SP1, SF2, WC2, WF1);
- Be a role model (SM) and give hope for new projects (SC4);

Highlighting recommendations about **political aspects** showed that there – in contrast to involvement – are external as well as internal aspects. Internal aspects were about:

- Focus on a common principle about energy autonomy which is agreed among all political parties (SM, SP1, SP3, SF2);
- Define which significance energy autonomy shall have within the municipality (SC1, SP1);
- Try to establish a system which works independent of the term of office of the mayor (SC4, SP3);

There were ten interviewees who recommended **projects** which already were done (two projects) or shall be done in future (four) as well as from other municipalities. Five of those projects where mentioned from one interviewee only but five interviewees mentioned the need for a network focusing on energy (SP1-3, SF1, WC1). This shall be done on regional level to allow exchange of experiences.

Nine interviewees said that it is very important to **work conceptual** and thus, realize the following:

- Carry out an analysis of the current situation (of energy demand and supply within the municipality) and the given potentials (SM, WF1);
- Establish an independent manager for the improvement of accommodations (SP1, WC2);
- Establish a concept for working groups which focus on aspects like centralised buying of inhabitants within the municipality to reduce costs (SP2, WF2);
- Work on concepts for sustainable development within the municipality and thus, adapt the believes of inhabitants that energy saving does mean to be restricted – instead it should be seen as an improvement in quality of life (SP1, WF1);
- Only work on concepts which can be realised because there is financial fund – otherwise people may be interested but there is no way for realisation (SF2, WM);

To overcome the given situation of high costs but missing funds on municipal level, three interviewees recommended the establishment of a **local or regional fund**. This may be realised with the aid of public participation like it already was done for several wind projects (SM, SP4, SF2, WF1);

Finally, there were five interviewees who recommended aspects especially about **biomass**. These were:

- Avoid compulsory connections to the heating grid (SM, SI1);
- Inform property developer about given decentralised heating plants as well as further plans for their extension (SC5, SF1);
- Focus on a decentralised system and an extension step by step instead of a centralised system which provides the whole municipality (SP4);

# 5 DISCUSSION

## 5.1 Introduction

Steinbach and Windhaag were chosen because of their marked similarities in e.g. area, number of inhabitants or economic situation (see chapter 4.1). Even if their primary reason to become energy autonomous was different[18], the starting point to focus on a self-supply in energy was for both municipalities in 1986.

Although there are basic similarities at Steinbach and Windhaag, already the term energy autonomy is seen differently among the different stakeholders (see chapter 4.2). This confirms BMLFUW (2011), SERI (2007) AND CIPRA (2010) among others who stated that each region, municipality or state which aims to become energy autonomous has its own definition. The empirical study showed that Steinbach and Windhaag chose different ways in how population has been involved. In combination with different given, natural resources and a broad range of possibilities to reduce the demand in energy, it may not be astonishing that impacts and barriers are distributed and perceived in an uneven way between the different stakeholders and those parties with a vested interest This will be shown within the following chapter.

First of all, the interviewees and their diverse mentions shall be analyzed in more detail. In sum, there were 28 interviewees at Steinbach and Windhaag together. These were

- two mayors;
- eight stakeholders from the public sector (S:5, W:3);
- seven farmers (S:3, W:4);
- eight stakeholders from the commercial sector (S:5, W:3) and
- three inhabitants (S:1, W:2);

Thus, interviewees from public and commercial sector as well as farmers were represented in a similar amount. But if one highlights the numbers of statements of groups a different picture is drawn. Farmers mentioned most aspects along almost all issues, either been it impacts or barriers as can be seen in Figure 25:

[18] Steinbach: strong economic slowdown (SPES, 1994), Windhaag: nuclear power plant of Temelin (WM, WF1+3, WC2, WI2) and "pressure from within the municipality" (WF1)

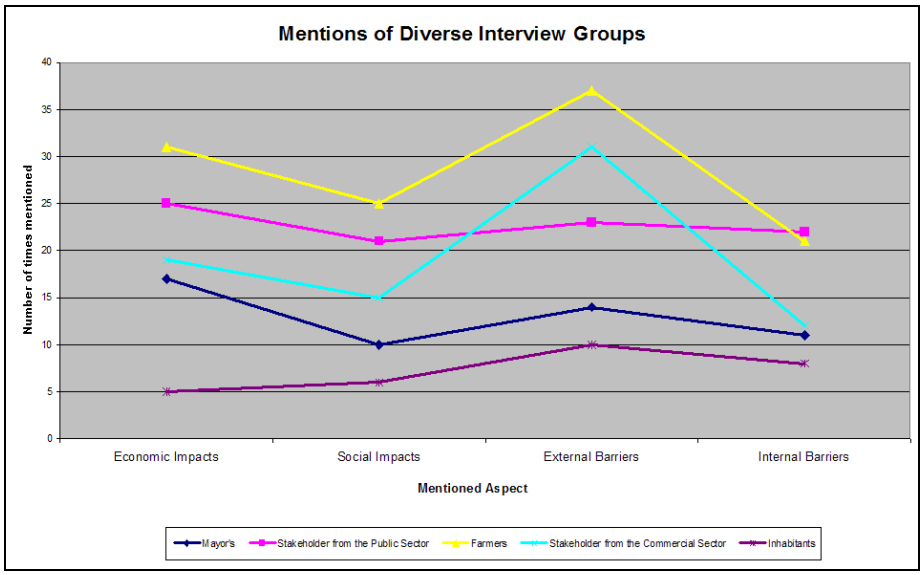


**Figure 25: Mentions per Interview Group**

**Source: All Interviewees, 2010**

By comparing the literature and results of the empirical study it can be shown that there are similarities as well as distinctions. There are several aspects that are similar whereas several aspects are not mentioned by the interview partners or are new in comparison to literature. Thus, literature is reflected partly in this research.

Those impacts and barriers which were mentioned both, in literature and empirical study will be described in chapter 5.2 and chapter 5.3. Focus will be given how those impacts and barriers differ at the two municipalities. New – in comparison to literature - is an additional income for local people at Windhaag. In literature, only the income for land owners could be found (ADAS, 2003), but due to the public participation at the wind park, inhabitants gain too.

But even if social impacts according to literature were almost mentioned from interviewees at both municipalities (except for an impact on health and productivity which was only mentioned at Steinbach), there were several aspects which were not mentioned by the interviewees too. These were economic impacts but especially barriers according to literature. Not mentioned from the interviewees of Steinbach/Windhaag were the following:

**Table 27: Impacts and Barriers according to Literature but not reflected in Study[19]**

| Main Topic | Sub-Aspect | Main Topic | Sub-Aspect |
|---|---|---|---|
| **Economic Barriers** | High-risk Perception | **Technical Barriers** | Missing Entrepreneurs |
| | Inadequate Access to Capital | **Social/Behavioural Barriers** | Persistent Barriers |
| | High Discount Rates | **Market Distortion** | Taxes and State Aid |
| | High Payback Periods | | Barriers for Trade |
| | Realising Financial Incentives | | Conventional Energy may be Preferred |
| **Institutional Barriers** | Shared Administrative Authorities | **Other Barriers** | Environmental Barriers |
| | Research and Development | | Barriers at Transport and Installation |
| | Different Interests | **Economic Impacts** | Enhanced Competitiveness |
| | Problems in Realising Financial Incentives | | |
| | Unstable Macroeconomic Environment | | |

**Source: Own Material, 2010**

There may be several reasons, why these impacts and barriers were not mentioned from the interviewees. According to RÖSCH AND KALTSCHMITT (1999), EC (2005) and MCCORMICK AND KABERGER (2007) **high-risk perception** may be given because investors may recognize RES as a new technology. Most of the farmers at Steinbach/Windhaag already used wood chips for their private households and several farmers already were experienced in supplying somebody else with heat (e.g. farmers of Windhaag already supplied the hospital at Freistadt before starting projects in their own municipality). This may be a reason why nobody mentioned this topic. **Institutional barriers** and **market distortion** may not be mentioned because a "broader view about the topic" is necessary to recognize these as a barrier. This may not be given due to the interviewer's and interviewee's focus on local level. **Missing entrepreneurs** (see PAINULY, 2001) may not be mentioned because both municipalities were pioneers and thus, highly motivated people who try to find solutions were involved and started the diverse, new projects. According to MCCORMICK AND KABERGER (2007) there may be **persistent barriers** because several resources may be categorised as waste and thus, people are conditionally against its use. Farmers of Steinbach and Windhaag only use wood chips or saw dust which is not seen as waste in Austria and thus, this aspect may not be mentioned. Finally, environmental barriers and barriers at transport and installation were not mentioned. PAINULY (2001) stated that environmental barriers can be distinguished into ecological aspects, local pollution and competition for resources. Due to the use of wood from the forests at Windhaag and Steinbach, there was no increase in water use, use of pesticides or decrease in biodiversity. Installations for the use of hydropower already existed at both municipalities. This may be the reasons, why **environmental barriers** were not mentioned. Due to the fact that Windhaag and Steinbach are not located within the mountains and thus are reachable by street, no **barriers due to transport and installation** of technical equipment arose and thus, may not have been mentioned.

[19] In addition, barriers due to a lack of standardisation, codes or certificates (SC3) and the rebound effect (SC4) were only mentioned from interviewees at Steinbach.

## 5.2 Socio-Economic Impacts of Energy Autonomy on Rural Development

According to the interviewees, a broad range of socio-economic impacts were perceived:

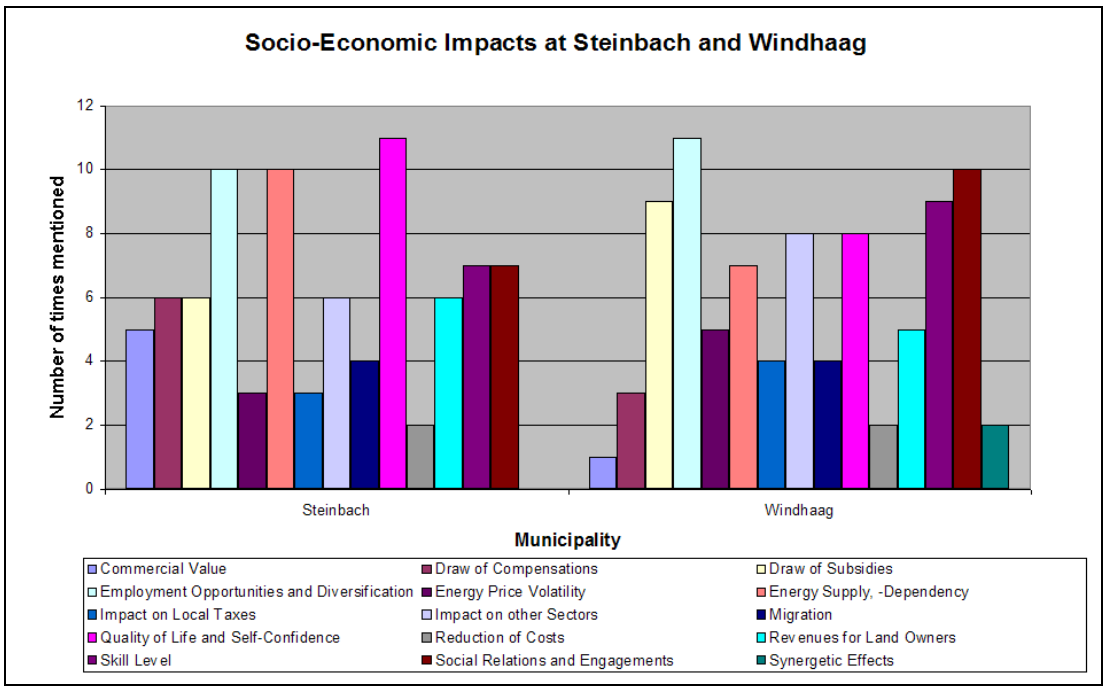


**Figure 26: Socio-Economic Impacts at Steinbach and Windhaag**

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SC4 AND WP3), 2010**

Evaluation of the impacts showed that the results differ (see Figure 26). This is especially valid for the social impacts. But if one highlights these socio-economic impacts in detail, it can be seen that – even if they were perceived in both municipalities – their dimension is different at Windhaag and Steinbach.

### 5.2.1 Distinctions between Steinbach and Windhaag

There are six socio-economic impacts that differ between Steinbach and Windhaag. Noticeable is, that these impacts are the ones which are mentioned most from the interviewees (except for the impact on employment opportunities and diversification which is similar in both municipalities). Distinctions between the two municipalities are given at:

1. Social Relations and Engagements;
2. Impact on Self-Confidence;
3. Educational and Skill Level;
4. Energy Supply and Decrease in Energy Dependency;
5. Revenues for Land Owners and Interested People;
6. Draw of Compensations;

Even if interviewees of both municipalities stated that there was an increase in **social relations** and **level of engagements** there is a difference in the number of established initiatives and their diversification. As described at ADAS (2003) and KOCH ET AL. (2006), based on the farmers cooperatives, there evolved relations between people who did not have much contact prior to the setup of the projects (SP1-4, SF1, SM, WM, WF1-4, WI1+2, WP1). Furthermore, both municipalities implemented local project groups concerning energy (SM, SP4, WM, WF1, WP1+2). But in contrast to Steinbach, which has only one further project (focusing on mobility (SP4, SI1)), there is a broad range of additional initiatives in Windhaag. These initiatives do not only involve different age groups, they also involve different interests such as technical aspects (training as energy consultant), topics to address the future (Zukunftsforum Windhaag, Agenda 21) as well as sustainable development initiatives (Mühlviertler Ressourcenplan) (WM, WC1, WF1, 3+4, WP1+2, WI1+2). Additionally, different levels of stakeholders are involved such as people from the economic sector, public authorities as well as private people (WM, WC1, WF1). Thus, a seminal basis has been built which allows for more initiatives and broader involvement of the local population than in Steinbach. This goes hand in hand with another aspect, namely **self-confidence** as mentioned by MICHALENA AND ANGEON (2009) or ADAS (2003). Even if both municipalities gained national and international tribute, in Steinbach only one interview partner mentioned a change in self-confidence (SP4). In contrast, in Windhaag nearly half of the interview partners (seven out of 13) mentioned increase of self-confidence and proud about the two awards (WM, WP2, WF1+4), the permanent energy exhibition (WM, WP2, WF1+4, WC3, WI1), the local energy-initiatives (WM, WF1+4, WP2, WC3) and the increase in energy-tourism (WM, WF1,2+4, WC3, WP2).

This crucial difference continues, if one focuses on the **educational and skill level**. ADAS (2003) argued that a focus on renewable energies can help to increase the educational opportunities locally as was confirmed by this empirical study. Whereas in Steinbach only the members of the cooperatives receive internal and external training (SM, SF2, SP1-4, SC3), a completely new training scheme was established in Windhaag[20]. There are trainings for the farmers cooperative as well (WF2) but in addition, the so called "Apprenticeship as skilled worker in the energy sector" was set up as a 250 hour course at the "Landwirtschaftliche Fachschule" and had to be passed within a year (WM, WF1-4, WP1). Furthermore, there is the "Zukunftsforum Windhaag", which is attended by about 800 pupils and students. Even though the student catchment area has been widened, the majority of Windhaager pupils have attended this course of further education (WM, WP1+2, WF1, WC3). Last but not least, due to "Verein Energiebezirk Freistadt" more than 250 evening events, combined with a lot

[20] Out of all mentioned trainings at Windhaag, "Zukunftsforum Windhaag", trainings for the farmer's cooperative and several trainings by EBF also take place in Windhaag itself. The other trainings of EBF take place in Freistadt (about 20 km away) (EBF, N.D.).

of daily trainings and some over a number of days are offered for all levels of society (citizens, mayors, freelancers as well as business people) (WP1+2, WF1+4, WC1). Furthermore, it has been possible to launch the so called "Energieberater - Kurs A" which offers (in combination with course F) the opportunity to go into business for oneself. These courses are very rarely offered elsewhere across Austria and thus are fully booked with waiting lists of at least a year (EBF, N.D.).

A further difference can be seen at the **reduction of energy dependence and security of energy supply.** This aspects, highlighted by EVANS ET AL. (2009) OR KOMOR AND BAZILIAN (2005) is important if one think about Austria's change from an energy exporter to energy importer (see chapter 2.3). The reduction of energy dependency and thus, higher security was mentioned very often (ten times at Steinbach, seven times at Windhaag). As described in 4.3.2.2 and 4.4.2.2) this is due to several factors like sustainable supply (SP4, SF1-3, WI1, WF1+2), long-term contracts (SC5, WC2, WF2+3) and the provided 24-hour-service (SF1+2) to mention only several. In both municipalities the combination of reduced demand due to energy efficiency measurements as well as the supply by renewable energies has been acknowledged as an important factor to increase this security. But the difference appears if one focus on the different forms of renewable sources that are used for reduction of energy. At Steinbach, there are five decentralized heat plants (using biomass). In addition, there are two hydro power stations (using water) which already existed before 1986 (they were constructed and are in ownership of a provincial energy supplier). Furthermore, there are only few initiatives from inhabitants using single heating systems, solar panels and heat pumps (NAHWÄRME STEINBACH, N.D., AEA, 2009B, SM, SC1+2). In contrast, Windhaag uses wind (two wind turbines), biomass (three decentralized heat plants, four micro-nets and 215 single heating systems), water (two small hydro power stations) and sun (523m² panels for solar power and 1.300 m² panels for solar heat) (AEA, 2009b, BIOENERGIE WINDHAAG REG.GEN.MBH, N.D., ENERGIEAUSSTELLUNG WINDHAAG, 2007 AND INTERVIEWEES (WM, WF3, WI1, WF1, WP1), 2010).
But one has to keep in mind that this security of energy supply is only given for the heating sector and partly for the power sector. The sector of mobility of both municipalities fully depends upon fossil fuels and thus, is still dependent on the oil industries from foreign countries.

**Revenues and thus, income for land owners,** as described by ADAS (2003) could be found in both municipalities. There are payments for biomass and thus, additional income of the farmer's cooperative members (SM, SP4, SF1-3, SP1, WF2-4). But in contrast to Steinbach, there is an **income for interested people** in the municipality of Windhaag. These have had the opportunity to share in the profits of the Windpark in Spörbichl (WC2+3).

Finally, there are two aspects that could only be found in Steinbach. These are the fact that **health and productivity may be improved** and **compensations**. Changes in the health situation are due to the topography of Steinbach which is not found in Windhaag. In former times, old heaters produced emissions which were observed within the municipality. Due to the change to decentralized systems with new technology, there has been an improvement of local air quality (SP4, SF1+2). Furthermore, it was possible to gain compensations for the "Museum of nativity sets" in Steinbach. One boiler house was rebuilt to provide more space for the local museum. Thus, a win-win-situation was established because the museum had the possibility to have more space at a lower price than before and the cooperative received higher subsidies (SP4+5, SM).

## 5.2.2 Similarities of Steinbach and Windhaag

Common for both municipalities are the following socio-economic impacts:

1. Employment Opportunities and Diversification in Economy;
2. Draw of Subsidies;
3. Reduction of Costs;
4. Impact on Other Sectors;
5. Impact on the Quality of Life;
6. Impact on the Commercial Value of Real Estate;
7. Impact on Migration;
8. Energy Price Volatility;
9. Impact on Local Taxes;

If one looks at the economic impacts, there are similarities. Most mentioned by interviewees where **employment opportunities and a diversification in economy** in both municipalities (ten times at Steinbach and 11 times at Windhaag). As described in diverse studies (see KOCH ET AL., 2006, EC, 2006) it has been possible to create jobs. At Windhaag and Steinbach, these are ten full-time jobs for 88 people so far as can be seen in Table 28:

**Table 28: New Jobs at Steinbach and Windhaag due to Focus on Energy Autonomy**

| | Name of Company | Field of Activity | Amount of Working People | Full-time Working Places |
|---|---|---|---|---|
| Steinbach an der Steyr | Farmer Cooperative "Nahwärme Steinbach" | Provision of biomass; Construction and maintenance of de-centralized biomass heating system at Steinbach | 20 | 2,400 |
| | Firma HMH ("Heizen mit Holz") | Energy Contracting; Construction and maintenance of decentralized biomass heating systems outside of Steinbach | 2 | 0,200 |
| | Firma Kals | Production and distribution of wood chips | 2 | 1,000 |
| | Regional- and Leadermanagement Steinbach an der Steyr | Energy Manager (Coordinator about topic of energy within the region) | 1 | 0,875 |
| | | **Sum** | **25** | **4,475** |
| Windhaag bei Freistadt | Bioenergie Windhaag reg.Gen | Provision of biomass; Construction and maintenance of decentralized biomass heating system at Windhaag | 57 | 2,175 |
| | Windpark Spörbichl | Production of Wind Power; | 1 | 0,150 |
| | Zacharias Franz | Electrician - specialised on photovoltaics; | 1 | 0,200 |
| | Verein Energiebezirk Freistadt | Association to promote renewable energies and energy efficiency measurements; | 4 | 3,000 |
| | | **Sum** | **63** | **5,525** |
| | | **Total Sum** | **88** | **10** |

**Source: ENERGIEAUSSTELLUNG WINDHAAG, 2007 AND INTERVIEWEES (SP1-4, SF1, SM, WM, WF1-4, WC1+3, WP1+2), 2010**

But as mentioned by HOPPENBROCK AND ALBRECHT (2010) one has to be careful not to oversimplify and overstate these employment opportunities. One has to bear in mind that most of these jobs (expect of those at company Kals, Regional- and Leadermanagement as well as EBF) offer only additional earnings (SF1, SP2+3, WC1, WF1). Especially most of the farmers see their work for the biomass cooperative as an additional income or to cover the costs of producing wood chips for use on their own land (SF1, WF1-4). In contrast, the loss of jobs within the municipalities has not been mentioned and thus, the substitutions effect could not be found within the municipality. This may be different if there would have been a regional or national focus. An important partial aspect is that almost all the jobs have a high qualitative impact (as described by DEL RIO AND BURGUILLO, 2008, ERNST BASLER + PARTNER AG, 2009). Only the 50 jobs for refurbishment of the two hydro power plants in Steinbach were short term (SC1+2), all the others have been created for long term and employees received new, additional skills.

This aspect goes hand in hand with the economic impact at a business level as mentioned by LUND (2009). It has been possible to have an industrial outcome in both municipalities due to the establishment of eight companies and associations. These companies invested EUR 2.490.683,-- [21] to establish eight decentralised heat plants (five at Steinbach and three at Windhaag) as well as 523 m² panels for solar power and the renovation of the two small hydro power stations at Windhaag (NAHWÄRME STEINBACH, N.D., BIOENERGIE WINDHAAG REG.GEN.MBH., N.D., MUNICIPAL OFFICE WINDHAAG, 2010b).

**Table 29: Constructions and Investments at Steinbach and Windhaag**

| Municipality | Source of Energy Supply | Costs [EUR] | Produced Energy | Operator | Further Information |
|---|---|---|---|---|---|
| Steinbach | 5 decentralized heat plants | 1.200.000 | Heat | Farmer Cooperative "Nahwärme Steinbach" | 2.130 m supply line, 1.360 kW boiler capacity, 3.140 Srm fuel demand, supplying 82 houses (and thus, about 200 households) almost the whole year |
| | 2 hydro power stations | n.s. | Power | Energie AG | producing as much power as is needed from 1.500 households per year; renovated by Energie AG |
| | unknown amount of single heating systems, solar panels and heat pumps | n.s. | Heat | Inhabitants | |
| | **Sum of Investments Steinbach** | **1.200.000** | | | |
| Windhaag | 3 decentralized heat plants | 872.683 | Heat | Bioenergie Windhaag | 1.230 m supply line, 1.280 kW, supplying 38 houses |
| | 2 wind turbines | n.s. | Power | Windpark Spörbichl | á 660 kW, producing 1.5 GWh |
| | 523 m² of solar power | 378.000 | Power | Municipality of Windhaag | |
| | 2 small hydro power stations | 40.000 | Power | Inhabitants | |
| | 4 biomass micro-nets | n.s. | Heat | Inhabitants | |
| | 215 single heating systems | n.s. | Heat | Inhabitants | 80 powered by wood chips, 70 powered by split logs, 30 powered by pellets, 35 powered by wood gasification furnace |
| | 1.300 m² solar panels to produce hot water | n.s. | Heat | Inhabitants | |
| | **Sum of Investments Windhaag** | **1.290.683** | | | |
| | **Sum of Investments** | **2.490.683** | | | |

**Source: NAHWÄRME STEINBACH, N.D., AEA, 2009b, BIOENERGIE WINDHAAG REG.GEN.MBH, N.D., ENERGIEAUSSTELLUNG WINDHAAG, 2007, MUNICIPAL OFFICE WINDHAAG, 2010a AND INTERVIEWEES (SM, WM, WI1, WF1,3+4 WP1), 2010**

[21] This figure may be higher, but it was not possible to evaluate all investment costs, especially all the private investments.

Even if the whole local investment could not be evaluated, data could be found for the highest group of costs, those of the biomass projects. EUR 2.072.683,-- was invested in a decentralized energy supply system of which EUR 818.171,-- (39,47 %) where spent at local companies (Steinbach: EUR 600.000,--/ 50% of costs (SF1) and Windhaag: EUR 218.171,--/25% of costs (WF2)). Due to building measures, heat-transfer stations and necessary treatments the investments lead to orders for sales, installation and maintenance. These have not created any additional jobs but may have safeguarded employment, especially during the last economic crises (SM, SP1,2+4, SF1-3, SC1+2, WM, WF1-4, WC3, WI1, WP2).

The created businesses are cooperatives, associations or working in the exiting field of their agricultural business. Thus, one may argue that the initiatives supported farmers to remain in their business and avoided the need to search for another job outside of their municipality. Furthermore, several companies have been established with the focus to continuously expanding their business. According to SF1, WC1+3 these are:

- Company HMH – energy contracting;
- Company Kals – production and distribution of wood chips;
- Zacharias Franz – electrician, specialised in solar power;
- Verein Energiebezirk Freistadt (EBF) – an institution of education;

To sum up, a diversification in the rural economy (see ADAS, 2003 and AKELLA ET AL., 2009), particularly a diversification of agricultural activities could be realized. Even if there has been an adaption - to up to now within the municipality unknown activities (like energy contracting) - most of the people remained in their original business and thus within their sector. Thus, an enhanced competitiveness level could only be marginally found too. This is because the companies created lead to only a marginal diversification in the economy and act within the boundaries of the municipality.

**Impacts on subsidies** (see among others DEL RIO AND BURGUILLO, 2008) and **reduced costs** (see KOCH ET AL., 2006) could be evaluated in both municipalities too (mentioned six times at Steinbach and nine times at Windhaag). These aspects are very interesting because they reflect the big changes since 1986. Within the first years, both municipalities gained because they could install the first biomass plants and adapt their buildings to lower costs due to very high subsidies (NAHWÄRME STEINBACH, N.D., BIOENERGIE WINDHAAG REG.GEN.MBH, N.D., AND INTERVIEWEES (SP2+4, SF2, WM, WF1-3, WI1), 2010).

Since 1986 both municipalities – as well as inhabitants – gained subsidies from European Union, Austrian Federation and Federal State. Several projects gained special subsidies. E.g. EBF gained subsidies for its kick-off from the Climate and Energy Fund of Austria (WF1, WC1), municipality of Steinbach gained subsidies for the recently started E-GEM-process (SM). Nowadays a maximum of 30% of the costs for biomass projects will be subsidised (NAHWÄRME STEINBACH, N.D. AND INTERVIEWEES (SP2+4, SF2, WM, WF1-3), 2010). Subsidies for

modernising the insulation of buildings depend on the achieved energy reductions (SM, SC5).

Common for both municipalities is that there was an **impact on other sectors**, namely tourism. DEL RIO AND BURGUILLO (2008), and KOCH ET AL. (2006) described that there may be an increase in tourism due to "demonstration effects". Each year there are about 1.300 "energy-tourists" (WM, MUNICIPALITY OFFICE WINDHAAG, 2010b) and 800 pupils and students visiting "Zukunftsforum Windhaag" (WM, WP1+2) at Windhaag. At Steinbach there are about 2.400 "energy-tourists" per year (SM, SP4). Even if it has not been possible to create new jobs in the tourism sector, there is the additional income for the local shops, bars and restaurants (WM, WF1, SM, SP4).

As already described in the empirical study, the aspect of **quality of life** is reflected most obviously and the impacts are often perceived differently. It is not always possible to make a distinction between the positive or negative impacts because the number of mentioned impacts does not reflect their relevance. According to AKELLA ET AL. (2009) there may be an impact due to e.g. a plant that may provide a part of its electricity to the local people. Neither the wind park at Windhaag nor the hydro power stations at Steinbach provide power to the local people directly. But nevertheless, 11 interviewees at Steinbach mentioned a change in quality of life whereas eight interviewees mentioned this topic at Windhaag. If one compares the two municipalities, it can be seen that there is a broad range of impacts on quality of life.

**Table 30: As Positive and Negative Perceived Changes in Quality of Life**

| Municipality | As negative perceived changes | As positive perceived changes | |
|---|---|---|---|
| Steinbach | Only few compensations (SM, SC1, SC2) | Improvement in Quality of Air (SP4, SF1+2) | Improvement for Ecology (SC1, SC2) |
| | People have the feeling that they are put under pressure (SM, SF1-3, SI1) | Posibility of Positioning of the Region (SP1, SP2, SP4) | Higher mobility (SP4, SI1) |
| | | Provision for One's Old Age (SP4, SI1, SC5) | Lower Environmental Pollutions (SF2) |
| Windhaag | People have the feeling that they are put under pressure (WI1, WP1+2) | More leisure time (WM, WF3+4) | Positive Attitude to Life (WM, WF1, WI1) |
| | Additional tasks (24-hour-service) (WF1, WF2) | Well-tended landscape (WF3+4) | Automated Building Equipment (WF1, WM) |
| | Higher responsibility (WF1, WF2) | Gained Recognition (WM, WF1+2, WI1) | Lower Environmental Pollutions (WF1,2+4, WM, WI1) |

**Source: INTERVIEWEES (SM, SC1,2+5, SF1-3, SI1, SP1,2+4 AND WM, WI1, WP1+2, WF1-4), 2010**

Focusing on the changes interviewees perceived as negative shows that:

- due to the broad range of initiatives, several people have had the feeling they are being put on the spot i.e. pressed for additional activity (SM, SF1-3, SI1, WI1, WF1+2). Due to income disparities it is not possible for everyone to either renovate their house or build it using the latest – low energy - standards. Furthermore, people may not have the possibility to change to local energy (e.g. because their heating system is only a few years old) even if all their neighbours want to do this (WP1+2). This may lead to social segregation.
- Additionally, several farmers interviewed mentioned that they feel a higher responsibility because of the obligations of delivering heat and or a 24-hour-service (WF1+2).

To conclude with the impacts, there are several impacts which were mentioned not that often and thus, will be described very briefly:

- **Commercial value of real estate**

Five interviewees at Steinbach and only one interviewee at Windhaag mentioned this aspect. Due to insulation and use of the latest equipment (SP1, SM, SC5), refitting of the two hydro power stations (SC1) and a higher attraction to flat associations due to the given infrastructure in heat supply (SF1, SM) interviewees mentioned that real estate can be sold at a higher price (WF1). Thus, MUNDACA (2008) was confirmed.

- **Migration**

Common for both municipalities is the aspect about migratory flows. Contrary to literature (REDDY ET AL., 2006, DEL RIO AND BURGUILLO, 2008, KOCH ET AL., 2006), the actual flow from rural to urban areas could not be stopped or even be reversed as mentioned by eight interview partners (SM, SP2+4, SC3, WM, WP2, WF1+2). Both municipalities are still net-out-migration municipalities and thus, are confronted with decreasing populations and consequently decreasing revenues (MUNICIPAL OFFICE STEINBACH, 2010, MUNICIPAL OFFICE WINDHAAG, 2010b).

- **Energy Price Volatility**

As mentioned from eight interviewees, due to the energy self-supply the volatile energy price has had a lower importance to those using solar panels or connected to the new local heating system. However, one can not fully neglect the price of oil due to it being partly linked to green-energy price (SM, SP4, SC5, WF1,2+4, WM, WI1).

- **Impact on Local Tax**

It must be noted that all of the companies have been created by the people within the municipality, who – except for one – do not provide additional local tax. Thus, it has not yet been possible to attract external companies to relocate their companies to Windhaag/Steinbach or establish a branch office in these municipalities (SM, SF1, SP4, WM, WF1+3, WC2).

## 5.3 Barriers impeding Energy Autonomy

The overall picture shows, that there are internal and external barriers, people at Steinbach and Windhaag struggle with (see Figure 27). Yellow ellipses show the internal barriers whereas red ellipses show the external barriers. There is a broad range of barriers that are common for both municipalities (shown in the big red and big yellow ellipses), but there are barriers which only were mentioned at Steinbach (shown in the additional small red and small yellow ellipses).

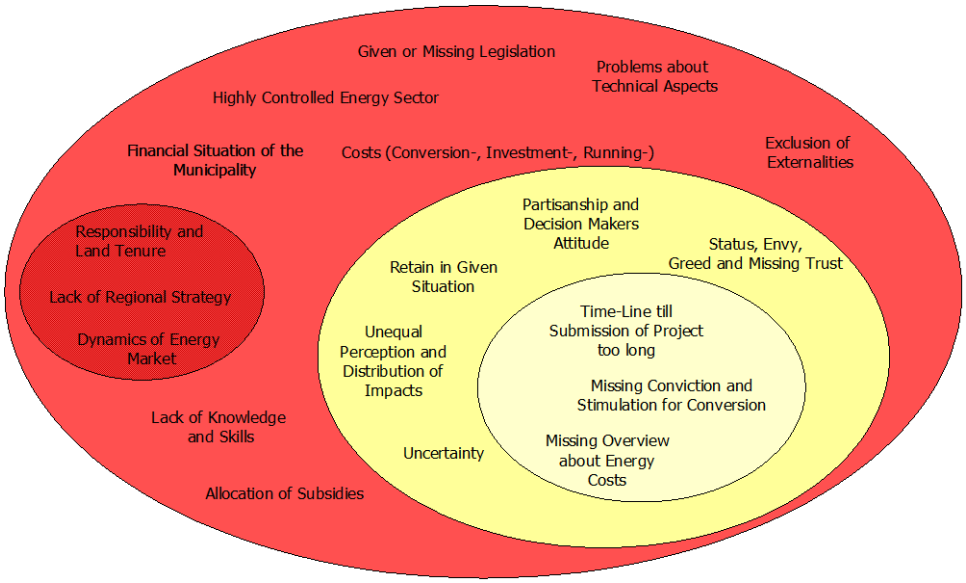


**Figure 27: Barriers at Steinbach and Windhaag**

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SP5 AND WP3), 2010**

If one combines the topics and the number of times they were mentioned, the similarities and distinctions between the two municipalities become clearer as can be seen in Figure 28:

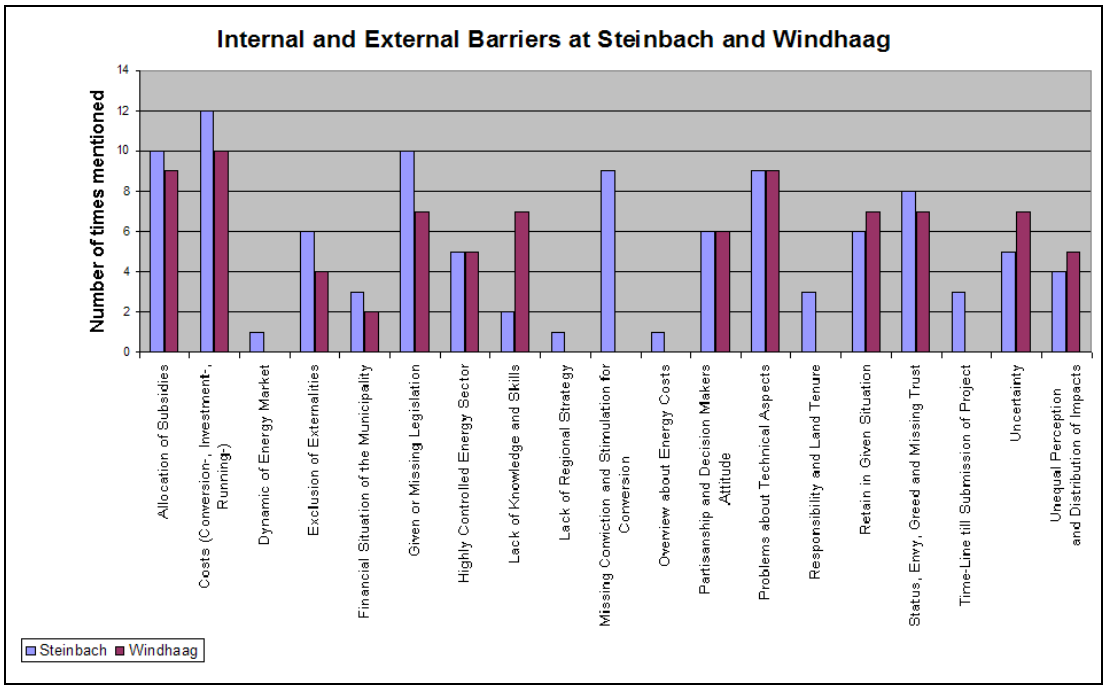


**Figure 28: Barriers at Steinbach and Windhaag by Relevance**

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SP5 AND WP3), 2010**

The following chapters highlight these internal and external barriers that are mentioned more than three times, at least at one municipality.

### 5.3.1 Internal Barriers

According to the interviewees, there were five internal barriers which arise in both municipalities. In addition, missing conviction and stimulation for conversion was mentioned as barrier in Steinbach. These six barriers were mentioned diversely among the different interview groups.

There were mentions of all interview groups for each topic, but in an unequal number. There is one exception: there was no stakeholder from the commercial sector who mentioned an unequal perception and distribution of impacts as a barrier as can be seen in the following figure:

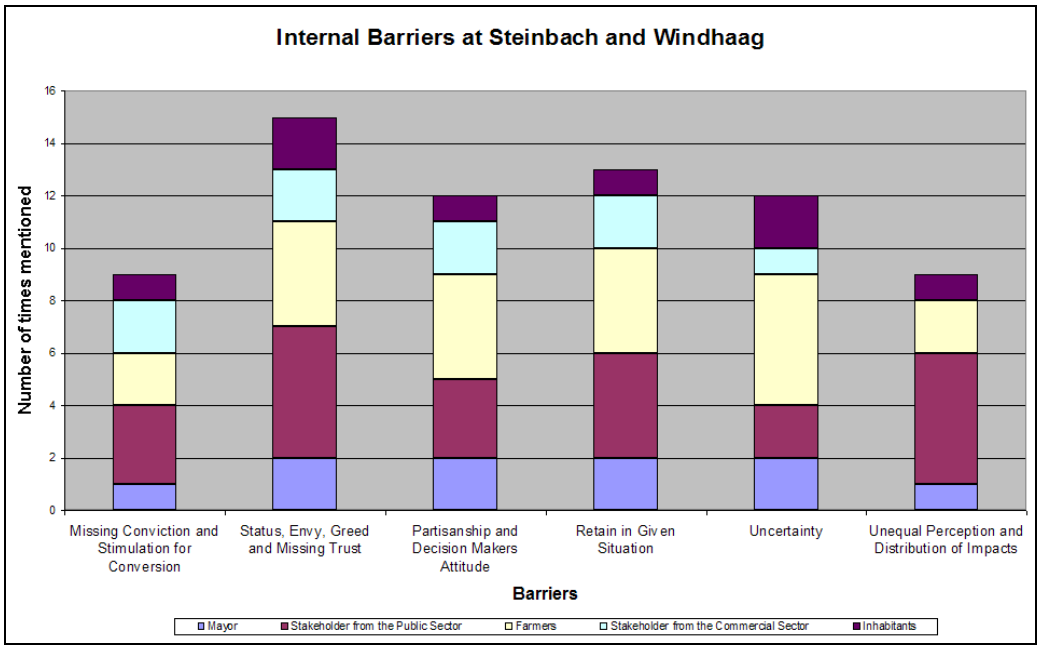


**Figure 29: Main Internal Barriers at Steinbach and Windhaag**

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SP5, SC5, WP3, WC3 AND WI2), 2010**

In the beginning the most obvious barrier in both municipalities was **partisanship and decision makers attitude** as may be described as barrier of "social acceptance" in WÜSTENHAGEN ET AL. (2007) and the local factors of MICHALENA AND ANGEON (2009). Only due to the projects pioneering character it has been possible to convince all the political parties (SM, SP1, SF1+3, WM, WF1). Based on these first (positive) results, it has been possible to agree on a mutual municipality enactment. Several interview partners explained that – around their municipalities – there has been and still are problems due to political orientation of decision makers within the municipality (SF1+2, WP2, WM). Given the fact that political boards are changing after a given time, this aspect has to be kept in mind for future development.

A further internal barrier which arises especially within the first few years was **uncertainty** (SM, SF1+2, SI1, SC3, WF1,3+4, WI1, WP1+2) as described by PAINULY (2001). There was fear if everybody will be supplied similar (WI1) as well as uncertainty about the technical aspects (for wind power as well as energy produced from biomass) (WC2+3, WF1, SM) and quality of provided wood chips (WM, WF1, SF1). Furthermore, those who feared to lose out due to the necessary structural change, stoked fears and negative mood in others (SM, SF1+2, SI1, WI1).

Nowadays the biggest internal problem is to keep people motivated. Those who initiated the first steps already retired. Even if the responsibilities for a new project have been established, there is always the need to continuously motivate people to work further on the

"big project energy autonomy" and to overcome aspects like **status, envy, greed and missing trust**. Up to now, there is a significant difference in an investment in the energy sector in comparison to an investment in another sector (SP2) and thus, a difference in status (WF1+3, SM, SP4, SF1+2, SC3). People may be envious due to the feeling that there is an unequal distribution of the positive impacts of becoming energy autonomous (SP1+2, SI1, WM, WC2, WP1+2) and finally, trust is necessary to allow a local heating system at a micro level (WF1, WI1). These aspects (described by ERDMANN AND ZWEIFEL, 2007, PAINULY, 2001) were mentioned within both municipalities and are interconnected to a further barrier, namely to **retain in given situation:**

- Windhaag has this problem to try to keep people moving forwards. People get the feeling that a lot of projects have already been done and so there is no need for further steps (WM, WF1+2, WC2). Furthermore, there are "reservation against changes" (WP1), a "narrow, sectoral view" (WP1+2) or "fear against the new" (WC1). For example the issue of mobility is far away from being autonomous and thus, further efforts are necessary if the municipality wants to reach its goal.
- At Steinbach, interviewees mentioned that inhabitants may not use new construction methods (like passive houses) or new technologies because of the reaction of their narrow surrounding (neighbours, family, friends) (SM, SP1+4, SF1+2, SI1). This goes hand in hand with a barrier which was only mentioned from interviewees of Steinbach, namely **lack of conviction and stimulation for conversion** (SP1, 3+4, SI1, SC2+4, SF1+3, SM). This was highly interesting because this was not mentioned as a barrier at Windhaag, where a broader involvement of the population has taken place. According to the interviewees of Steinbach it is not enough to provide financial incentives. It may also be necessary to raise people's awareness of topics about energy autonomy (SP3+4, SI1).

The last internal barrier is that - up to now - special groups have been involved (SP1, 2+3, SI1, WP1+2, WF1+3, WM) and thus, gained from the focus towards energy autonomy. These are people with a higher income (SP1, SI1, WP2, WF1) and higher education (SI1, WP1, WF1) or those who are working or highly interested in the topic (like farmers, plumbers and people from the building sector) (SP1+2, SI1, WP1+WF3). Furthermore, it is a topic which is mainly of interest to males over the age of 30 years (SP1-3, SI1, WM, WP1). Those are the ones who finally set the ball rolling and are involved now. But due to this **unequal perception and distribution of impacts** it could be evaluated in both municipalities that information and how it is brought to the people is mainly characterised from how already involved people think and act. This leads to an exclusion of non-involved people instead of bringing them on board. People in Windhaag already recognized this and established EBF which focus on a very broad involvement. This may be a highly interesting instrument to overcome above mentioned barriers for future projects.

## 5.3.2 External Barriers

At Steinbach and Windhaag there are seven **external barriers** mentioned (more than three times) by the interviewees of both municipalities as can be seen at Figure 30:

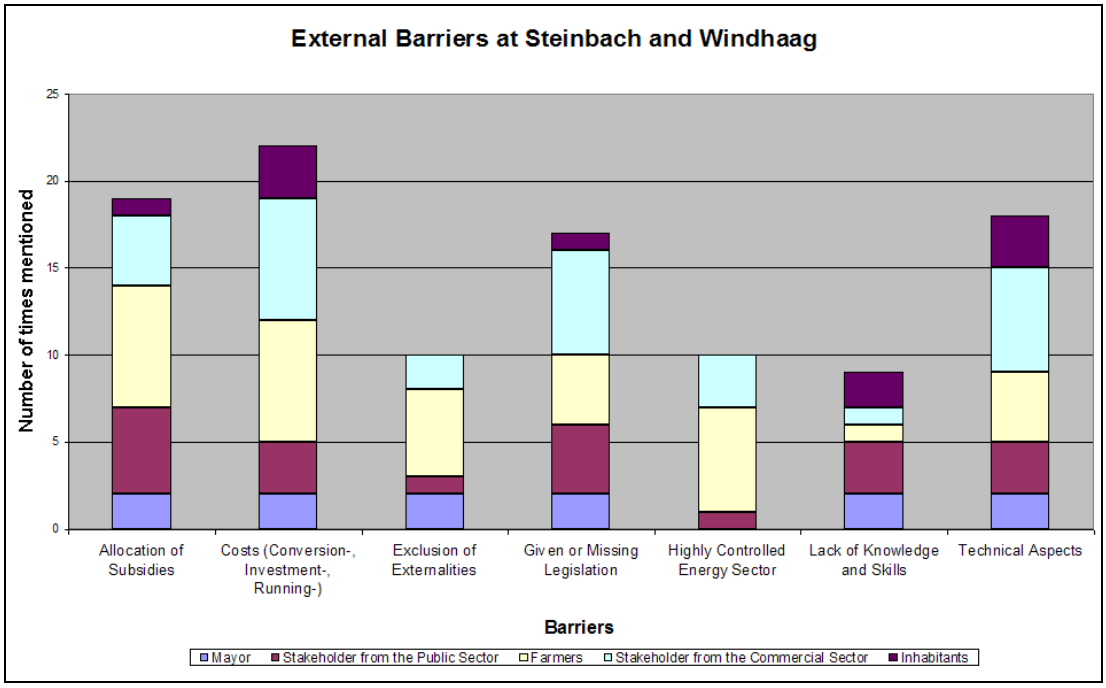


**Figure 30: Main External Barriers at Steinbach and Windhaag**

**Source: Interviewees of Steinbach and Windhaag (except for SP5, WP3 and WC1), 2010**

Except for a lack of knowledge and skills, all of these were mentioned in a similar amount from the interviewees of Steinbach and those of Windhaag:

**Table 31: Number of Mentions of Interviewees concerning External Barriers**

| Topic | Steinbach | Windhaag |
|---|---|---|
| Allocation of Subsidies | 10 | 9 |
| Costs (Conversion-, Investment-, Running-) | 12 | 10 |
| Exclusion of Externalities | 6 | 4 |
| Given or Missing Legislation | 10 | 7 |
| Highly Controlled Energy Sector | 5 | 5 |
| Lack of Knowledge and Skills | 2 | 7 |
| Technical Aspects | 9 | 9 |
| **Total Sum of Mentions** | **54** | **51** |

**Source: Interviewees of Steinbach and Windhaag (except for SP5, WP3 and WC1), 2010**

Highlighting them in detail shows that both municipalities struggled with a decreasing budget in combination with shrinking subsidies. To adapt to new energy systems, a high start up investment is required with adequate financing as described by EC (2005), PAINULY (2001) or MICHALENA AND ANGEON (2009). Interviewees of both municipalities mentioned following **costs**:

- Investment Costs: for installation of heating plants, hydro power stations, wind turbines and solar power as well as its necessary infrastructure (heat and power grid) (SM, SP1, SF1-3, SC1-4, SI1, WF1, 2+4, WI1+2, WC2+3, WM);
- Adaption Costs: for refurbishment and insulation (SC5, WF3+4, WP2);
- Additional Costs: for ecological requirements (SC1+2, WF3+4);
- Purchase Price for electric vehicles (SM, SP1+4, SC2-5, SI1, WM);

Concerning costs, age of the existing energy supply system (SC5, SP4, SI1, WP2, WI1) and low energy demand of so called "low energy houses" (SF1-3, SI1, WI1+2) were mentioned as further barrier because both may make a connection uneconomical.

LUND (2009), MCCORMICK AND KABERGER (2007) and HOHMEYER (1992) mentioned that energy produced by RES requires investment grants or government subsidies to allow for market penetration. Even if draw of subsidies could be evaluated at both municipalities, a complicated and mainly continuously changing **subsidies system** convey people that focus on energy autonomy does not have high priority at a national level (see 2.4.2). Has it been missing subsidies for local heating on micro level in the past (WM, WF1, WP1), nowadays inadequate subsidies for hydro power, solar power and wind power (SM, SC3, SF1+2, WP1, WF1-4, WC2+3, WI1, WM) act as barrier. This resulted in additional costs due to necessary financial bridge-over and costs which arose before it is clear if the subsidy will be paid or not (WM, WF1, WI1). An increase in necessary documents and supporting documents (SF1+2, SP3, SC3, SC5, WC3, WF1-4) as well as continuously changing guidelines (especially the regulations about "Green Power") (WF1+4, WC2+3, WP1, WM) hinder people to switch their energy system. Finally, focus on standardized applications (WP1+4) which can only be done from commercial stakeholders (WF1, WI1) or have to be done by internet exclude several groups of people like the elder or poor (SM, SP4).

But the impression that national priority has another focus is also reflected in **regulations by law**. Even if there is a national strategy (see 2.4.2) there are barriers due to missing legal or regulatory frameworks (see OIKONOMOU ET AL, 2009 or PAINULY, 2001). Potential sites for the use of wind energy are hindered due to strong regulations (e.g. minimum distance to next house of 800m (SC3, WC2+3)). Re-activation of small, down-closed hydro power stations are hindered due to strong ecological regulations (e.g. necessary fish climb) (WF3+4, SM, SC1, 2+4). Furthermore, regulations are missing for some projects like for small wind power stations (WC3, SC3). In addition, there are inadequate/old regulations (e.g. compulsory construction of a chimney (SF1, SI1), necessity to be owner of the building where solar panels are to be installed (WC3, WF1, WM) and misleading land use plans (SP1-3, WM, WP1, WF1)) which do not promote further progress. Also, nature conservation focuses on avoiding the impairment of landscape. If there were other aspects included such as climate, responsible administration would become possible in the broader view (WC2+3).

Thus, decisions may be found which allow for sustainable solutions. Up till now, interviewed stakeholders of both municipalities struggle with these topics.

**Technical aspects** were mentioned as fourth external barrier at both municipalities. Especially in the beginning, wind turbines or decentralised heating plants had technical problems. In addition, people were afraid about heating plants reliability (SM, SP4, WM, WF1, WI1) and thus, about products which one cannot rely on (see PAINULY, 2001). These problems could be solved, but new problems arose. Due to infrastructure of old buildings, an adaption to a renewable energy supply is handicapped (SM, SC5, WM, WF1). Both municipalities struggle now with the given, limited infrastructure for power. Wind and solar power is produced irregularly. The given power net is not able to uptake this irregularly produced power, especially if there are several suppliers (SC3+4, WF3+4, WC2+3). According to PAPADOPOULOS ET AL. (2008) it is very time-consuming and costly to upgrade them. Finally, extension of the constructed heat net is difficult due to low energy demand of new passive houses (WM, WF2, WI1+2, SI1). Noticeable is t hat several interviewees mentioned that – in addition to costs (see above) - technical aspects are the main problem concerning energy autonomy at mobility. 32% of the used energy in Austria is used for traffic (see 2.3) (AEA, 2011a). Up to now, Steinbach as well as Windhaag have not been able to find solutions to reduce their energy demand for traffic. An insufficient network of service stations for electrical vehicles, a very low nominal reach of electrical vehicles and a charging time which is too long are the reasons according to interviewees (SI1, SM, SC2+3, SP1+2, WM, WI2).

Building up of decentralized systems also leads to a shift in profit. As opposed to other European countries such as Germany, there are problems to get access to the existing grid. It was mentioned by some of the interview partners in both municipalities that players at a national and province level do not support the trend towards energy autonomy. They either demand very high prices for adaption of electric grid infrastructure or offer the provision of a grid for natural gas for a very low return (SF1+2, SC4, WF1-4, WC2). Thus, one may sum up that the **monopoly in the energy sector,** as described by PAINULY (2001) is the fifth external barrier.

Ten Interviewees at both municipalities mentioned that there is an **exclusion of externalities** and an unfair competition between energy produced from oil or nuclear power and energy produced from renewable sources. According to SM, SP2, SF1-3, SC4, WM, WF1+4, WC2 the price for energy does not reflect its real costs because e.g. fossil fuels are highly subsidised or disposal costs for nuclear power are not included (SF1).

Also in both municipalities, a **lack of qualified people** (see among others McCORMICK AND KABERGER, 2007 or RÖSCH AND KALTSCHMITT, 1999) who could independently consult was noted. Even if this was only mentioned twice at Steinbach (SM, SP1), seven interviewees at Windhaag (among all interview groups) mentioned this as a barrier in the past (WM, WP1+2, WF2, WC3, WI1+2). In the years after 1986 associations like Biomass Austria had no experience about small, decentralised solutions and there were only few experienced people who made adequate evaluations of economic efficiency. This changed over the years and in addition, this was partly solved in Windhaag (by establishing EBF).

# 6 CONCLUSION

The last 150 years of oil industry have lead to an improvement in quality of life. Heat and power, produced by oil instead of wood made peoples life easier. But over time the negative impacts of fossil energy arose. Global warming and climate change together with political conflicts and an insecure energy supply are reasons to focus on alternatives (EUROPEAN PARLIAMENT, 2001, ASIF AND MUNEER, 2007).

Energy autonomy as an alternative is the topic addressed in this master thesis. The thesis presents a comparative case study of two municipalities in Upper Austria. For 24 years Steinbach an der Steyr and Windhaag bei Freistadt focused on an alternative to fossil fuel (OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006, ENERGIEAUSSTELLUNG WINDHAAG, 2007). Windhaag was confronted with a worst case scenario of a super gau in the nuclear power station of Temelin in the neighbouring Czech Republic (INTERVIEWEES (WM, WF1, WC2), 2010). Steinbach struggled with a slump in economic activities and thus, a shrinking population (SPES, 1994, OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006). Based on these circumstances both municipalities tried to find new solutions. An alternative could be found in the vision of energy autonomy – although within a different focus.

Based on a similar starting position (like e.g. size, percentage of employed people, number of inhabitants) (see chapter 4.3.1 and 4.4.1 for details) the two municipalities chose different ways to become energy autonomous. Based on the "Steinbacher Weg" the correspondent municipality focused on a broad participation of local people in the beginning (OÖ VEREIN FÜR ENTWICKLUNGSFÖRDERUNG, 2006). But due to retirement of its mayor and thus, the leading booster focus changed. Nowadays there are almost no additional or new initiatives that are coming from inside the municipality. Nevertheless, it participates in a cooperation which has been introduced by the province of Upper Austria in 2010 (REGIONALMANAGEMENT OÖ GMBH, 2010). In contrast, Windhaag started with an extensive as-is analysis of all public and private buildings at which 77% of all the inhabitants participated (ENERGIEAUSSTELLUNG WINDHAAG, 2007). Up to now, it has been possible to find financial participation models (used for the wind park) and set up a system with high participation across all age groups and levels of community within Windhaag over the last decades. Compared to Steinbach, this lead to more initiatives, more syndicates, broader self-confidence, an educational institution and thus, higher awareness of a large group of people. Private stakeholders as well as politicians and business people are included and thus, the efforts towards energy autonomy are embedded on each decision level (VEREIN ENERGIEBEZIRK FREISTADT, N.D.). This is relevant as future steps towards energy autonomy depend on everyone, particularly regarding the reduction of energy-use as well as regarding mobility.

In general, energy autonomy demands a change from centralized to decentralized systems. Development within the last few years has shown that there is no unique way of reaching autonomy in energy (BMLFUW, 2011, SERI, 2007, CIPRA, 2010). This is reflected in the various reasons (e.g. different given resources and a missing, national wide definition of this term). Nevertheless, since 1986 Steinbach and Windhaag have focused on this independence for power, heat and mobility. For the balance sheet, Steinbach is energy autonomous at power (the hydro power stations of Steinbach supply double the households there are within the municipality) (AEA, 2009b) and reached a part-autonomy in the sector of heating. Windhaag was able to reach a part-autonomy in the sector of power and heating (ENERGIEAUSTELLUNG WINDHAAG, 2007, AEA, 2009a). As yet, there have been almost no results in the mobility sector.

Highlighting the socio-economic impacts of efforts to become energy autonomous gives the overall picture (see Table 32):

**Table 32: Main Socio-Economic Impacts at Steinbach (n=15) and Windhaag (n=13)**

| Aspect | Steinbach | Source | Windhaag | Source |
|---|---|---|---|---|
| **Starting Point [year]** | 1986 | OÖ Verein f. Entwicklungsf., 2006 | 1986 | Bioenergie Windhaag reg.GenmbH, n.d. |
| **Inhabitants [Nr.]** | 1984 (on 31.12.2009) | Statistik Austria, 2010c | 1631 (on 31.12.2009) | Municipality Office Windhaag, 2010b |
| **Migration** | - 1.44% from 1991-2009 (=municipality with net-emigration) | Statistik Austria, 2010c | - 11.74% from 1994-2009 (=municipality with net-emigration) | Municipality Office Windhaag, 2010b |
| **Employment Opportunities due to focus on EA** | 4.5 new full time working places - shared among 25 people and thus, mainly part-time | Nahwärme Steinbach, n.d., SM, SP1-4, SF1+2 | 5.5 new full time working places - shared among 63 people and thus, mainly part time | Bioenergie Windhaag Reg.Gen.mbH, n.d., WM, WF1-4, WC1+3, WP1+2 |
| | Four established companies/cooperatives | | Four established companies/cooperatives | |
| **Investments** | 1,200.000 EUR (including tax) | Nahwärme Steinbach, n.d. | 1,290.000 EUR (including tax) | Bioenergie Windhaag Reg.Gen.mbH, n.d., Municipality Office Windhaag, 2010b, WF3+4 |
| | were spent to build five decentralised heat plants | | were spent to build three decentralised heat plants, 523 m² panels for solar power and renovate two small hydro power stations | |
| **Local Investments** | 50% of costs of heat plants (600.000 EUR including tax) | SF1 | 25% of costs of heat plants (218.171 EUR including tax) | WF2 |
| **Energy Tourists** | Ø of 2.400 per year | Municipality Office Steinbach, 2010 | Ø of 2.100 per year | Municipality Office Windhaag, 2010b |
| **Social Relations/Level of Engagements** | *Changed due to:* | | *Changed due to:* | |
| | Farmers Cooperative | Nahwärme Steinbach, n.d. | Farmers Cooperative | Bioenergie Windhaag reg.GenmbH, n.d. |
| | Energy Project Group | SM, SP4 | Energy Project Group | WM, WF1, WP1, WI2 |
| | Project about Mobility | SP4, SI1 | Zukunftsforum Windhaag | Verein Energiebezirk Freistadt, n.d. |
| | | | Agenda 21 Group | WM, WP1 |
| | | | Association "Energy District Freistadt" | EBF, n.d. |
| | | | Mühlviertler Ressourcenplan | WC1, WP1+2 |
| **Self Confidence** | Increase was mentioned by one interviewee | SP4 | An increase was mentioned by seven interviewees | WM, WP2, WF1, 2+4, WC3, WI1 |

**Table 32 (Follow up): Main Socio-Economic Impacts at Steinbach and Windhaag**

| Aspect | Steinbach | | Source | Windhaag | | Source |
|---|---|---|---|---|---|---|
| **Educational and Skill Level** | *Increased due to:* | | | *Increased due to:* | | |
| | Trainings for/of the members of the biomass cooperative | | SM, SF2, SP1-4, SC3 | Trainings for the members of the biomass cooperative | | WF2 |
| | | | | 250 hour apprenticeship as skilled worker in the energy sector | | WM, WF1-4, WP1 |
| | | | | Zukunftsforum Windhaag | | Verein Energiebezirk Freistadt, n.d. |
| | | | | Association "Energy District Freistadt" | | EBF, n.d. |
| **Quality of Life** | A change in quality of life was mentioned 11 times by interviewees | | | A change in quality of life was mentioned eight times by interviewees | | |
| **Reduction of Energy Dependency and Security of Energy Supply** | *Mentioned ten times; Given due to:* | | | *Mentioned seven times; Given due to:* | | |
| | Biomass | Five decentralised heat plants | Nahwärme Steinbach, n.d. | Biomass | Three decentralised heat plants | Bioenergie Windhaag Reg.Gen.mbH, n.d. |
| | | Several private heating systems | AEA, 2009b | | Four Micro-nets | Energieausstellung Windhaag, 2007 |
| | Water | Two hydro power stations (which already existed but were renovated) | AEA, 2009b | Water | Two (small) hydro power stations | AEA, 2009a |
| | Sun | Several private solar panels and six panels for solar power | AEA, 2009b | Sun | 523 m² panels for solar power | Municipality Office Windhaag, 2010b |
| | | | | | 1.300 m² panels for solar heat | Energieausstellung Windhaag, 2007 |
| | | | | Wind | Two wind turbines | Energieausstellung Windhaag, 2007 |
| **Revenues for ...** | *Increased due to:* | | | *Increased due to:* | | |
| | Income for members of Cooperative | | SM, SP1+4, SF1-3 | Income for members of Cooperative | | WF2-4 |
| | | | | Income for local people (due to wind park) | | WC2+3 |

**Source: see each row**[22]

Investments to reach the above described overall part-autonomy at power and heat have been high. EUR 2,490.683,-- (including tax) were spent to build eight decentralised heat supply stations with 2.640 kW (five at Steinbach and three at Windhaag) and 523 m² panels for solar power and two small hydro power stations at Windhaag alone[23] (NAHWÄRME STEINBACH, N.D., BIOENERGIE WINDHAAG REG.GEN.MBH., N.D., MUNICIPAL OFFICE WINDHAAG, 2010A). It has been possible to evaluate the local investments for the largest expense group - the biomass projects - which is EUR 818.171,-- (or 39,47% of investments; including tax). In addition to these investments it has been possible to create ten full-time working places for 88 people at eight new companies/cooperatives. To sum it up, there have been – according to the size of the municipality – huge investments and efforts.

But, as described by HOPPENBROCK AND ALBRECHT (2010), one shall not oversimplify these employment opportunities. Focusing on the created jobs one has to keep in mind that it has not been possible to attract companies from outside the municipalities. For most of the people, the created working places are only part-time. One may argue that those can partly be seen as a beginning development. Several small enterprises (e.g. company Zacharias at Windhaag, or company Kals or HMH at Steinbach) have started and depending on its further development may expand their business and have the possibility to offer further jobs. As

[22] For reasons of clarity, only the main sources are mentioned. Comprehensive information on sources per topic can be found within the previous chapters.
[23] This number does not include reams of private initiatives (at Windhaag: four biomass micro power stations, 215 heating stations operated with local biomass and 1.300 m² solar collectors) as well as the renovation of the two hydro power stations at Steinbach and the wind park at Windhaag.

described migratory flow could not be stopped or even be reversed (MUNICIPALITY OFFICE STEINBACH, 2010 AND MUNICIPALITY OFFICE WINDHAAG, 2010B). Interview partners mentioned that they have the feeling that there is social pressure to act as neighbours do and build state-of-the-art or connect to local heat (INTERVIEWEES (SM, SF1-3, SI1, WI1, WP1+2), 2010). Furthermore, even if both municipalities gained national and international tribute, only one interview partner in Steinbach mentioned a change in self-confidence (SP4). This reflects the different ways both municipalities have chosen, too.

Keeping research question and its sub-questions in mind, one can sum that those 24 years of development had an influence on rural development. Joint efforts lead to economic as well as social impacts. There is no possibility to compare the actual situation with those, which would have been without such initiatives. But according to the interview partners (who know what happened in neighbouring municipalities) Steinbach and Windhaag would have had less people working as e.g. farmers and even less people living within the municipality.

Further development is also highly dependent on the barriers municipalities struggle with. The guiding personalities have been highly motivated people which fight for their vision. They are working additional to a full-time-job as well as on 24-hour-services or voluntary within their leisure time to make their plans become true (INTERVIEWEES (WF1, WC1, WF2, WC3, SF1-3), 2010). Thus, organisational commitment and motivation is given, even if there are adverse conditions. Looking on barriers in detail one may sum up that those changed over time. In the beginning there was need for idealism and a vision due to higher prices for e.g. biomass, inadequate machines, political differences and people who asked "Why do we need this?" (WM). Nowadays municipalities struggle with financial aspects, diverging legal regulations and social barriers. Nevertheless, the municipalities found solutions to tackle with those – at least partly.

The barriers mentioned the most are:

**Table 33: Main Internal and External Barriers at Steinbach and Windhaag**

| Internal Barriers | Number of Times Mentioned | External Barriers | Number of Times Mentioned |
|---|---|---|---|
| Status, Envy, Greed and Missing Trust | 15 | Costs (Conversion-, Investment-) | 22 |
| To Retain in Given Situation | 13 | Allocation of Subsidies | 19 |
| Partisanship and Decision Makers Attitude | 12 | Technical Aspects | 18 |
| Uncertainty | 12 | Given or Missing Legislation | 17 |
| Missing Conviction & Stimulation for Conversion | 9 | Highly Controlled Energy Sector | 10 |
| Unequal Perception and Distribution of Impacts | 9 | Exclusion of Externalities | 10 |
| | | Lack of Knowledge and Skills | 9 |

**Source: INTERVIEWEES OF STEINBACH AND WINDHAAG (EXCEPT FOR SP5 AND WP3), 2010**

Keeping different barriers in mind, internal barriers are ready to hand and may be overcome within a relatively short time. Focusing on the external barriers it seems as – even if there is a national goal to become energy autonomous (BMWFI AND LEBENSMINISTERIUM, 2010) - the topic does not have the adequate priority on the national level, at least from the local perspective. Drawing a bow of diverse aspects like e.g. an inadequate tariff system in combination with continuous changing subsidy system or regulations by law which are old/inadequate or missing rather give the interviewees the impression that there are topics of higher interest.

Nevertheless, it may be interesting to evaluate further municipalities and regions to get a broader view about these external barriers (e.g. less successful ones as well as bigger ones). From the point of view of the author, it was insightful to work with in-depth interviews and use a comparative case study of two municipalities. Using other methods like documentary analysis or action research would not have been adequate. According to MAYRING (2002), case study allows for focusing on the singular case (in the case of this thesis a municipality) but also makes a comparison about two or more entities possible (in the case of this thesis the overall impacts and barriers of Steinbach and Windhaag).

Since Steinbach and Windhaag were chosen due to their pioneering character and common time frame of striving for energy autonomy, one may expect that impacts and barriers are similar. Highlighting results of the empirical study, it could be shown that there were differences in the way the municipalities pursued their aim and therefore, also in the impacts and barriers they faced. Thus, an evaluation on local level makes sense to get additional knowledge of how barriers impeding progress may be overcome.

From the authors' view, the results are transferable to other municipalities within Austria and Europe, at least partly. This is e specially true, if the impacts and barriers should be transferred to municipalities with similar initial position. But differences in size and availability of resources make it harder to transfer this study as a whole on municipalities with heavily differing characteristics. Nevertheless, certain aspects (like social impacts and several internal barriers) are definitely playing a role in all other municipalities of Austria as well. Transferring results to municipalities in non-European countries may not be possible due to distinctions in culture, environment and regulations.

The past transition processes of Steinbach and Winhaag's ways towards energy autonomy were demonstrated as distinctive although both successful. and thus, cause-effect-relations were shown. Thus, it may motivate and support further municipalities and regions to start or increase their efforts of finding their own path toward energy-autonomy.

Contemplating the whole picture of this thesis leads to following over-all conclusion:

- There are highly interested and motivated stakeholders which have the necessary courage to start new projects.
- At both municipalities there is a clear focus on the supply side. Energy demand still offers high potential for reduction.
- Socio-economic impacts on rural development like an increase in social relations, created jobs or impact on energy security have been observed at both municipalities. These impacts demanded high investments and involvement of the local people.
- Even if there are negative impacts as well, the prevailing view of the interviewees is that the municipality gained from its focus towards energy autonomy – thus, they want to proceed on their path towards energy autonomy.
- Each municipality found its own way towards energy autonomy. Those differences are reflected in diverse impacts and barriers. It could be shown that an approach, which focuses on a broad integration of local people has a broader impact than a technical approach.

From the author's point of view, there are four aspects that have to interplay on national as well as regional or local level to reach an energy autonomous Austria. These are

**high priority, courage, fidelity of spoken words and information**

If those aspects will be taken seriously *and* be realized, barriers may not melt like a snowman in spring but can be overcome.

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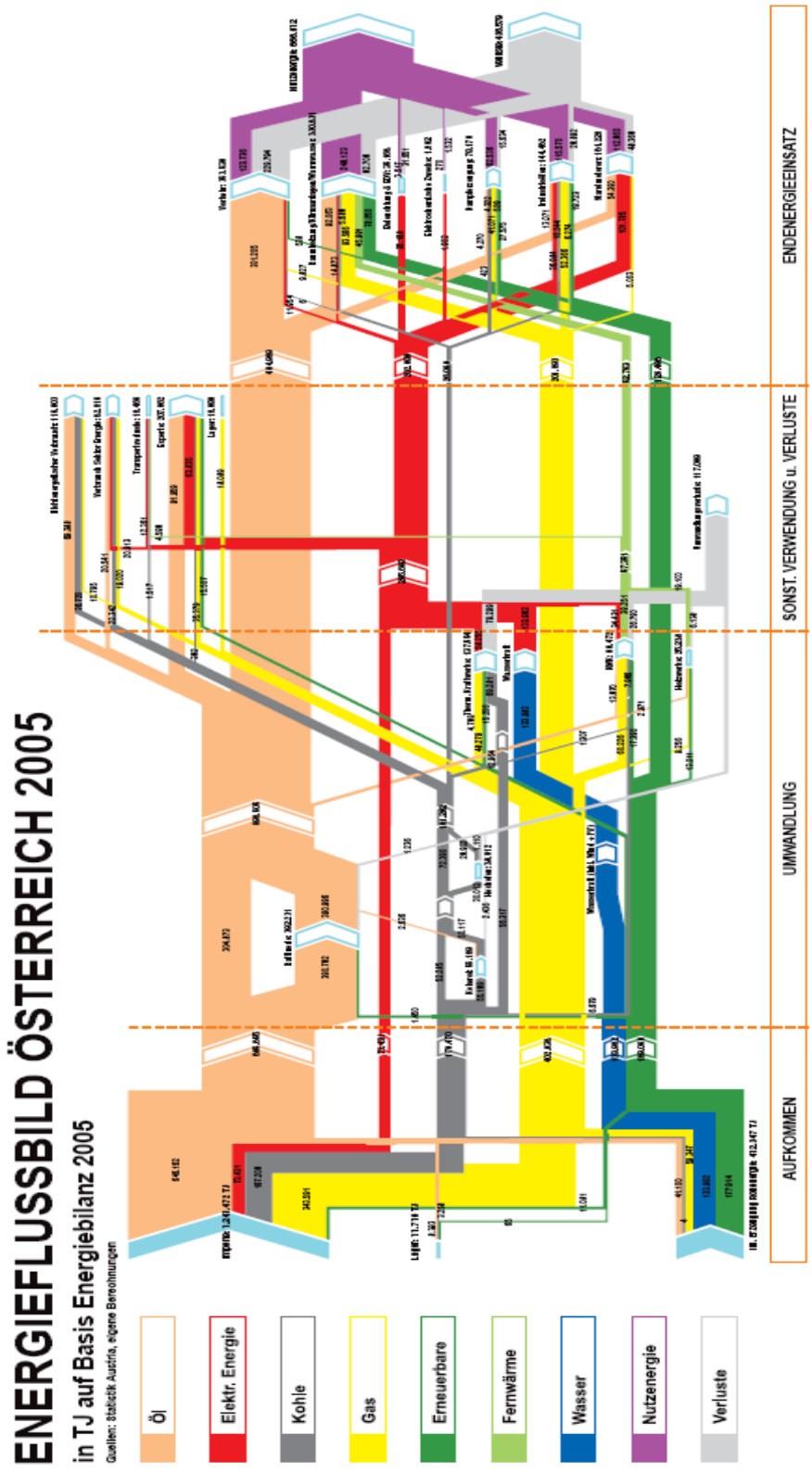
# 8 APPENDICES

## 8.1 Energy Flow Diagram




**Source: AEA, 2011a**

# 8.2 Case Study Protocol

## 8.2.1 Selection of Municipalities

**Table 34: Municipalities which Fulfilled Top- and Sub-Criteria**

| Name of Municipality/Region | Municipality / Region | State | District | Next Town | Distance to next Town [km] | Area [km²] | Sea-Level [m] | Inhabitants | Overall Aim | Cooperations | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Klima-bündnis | klimaaktiv mobil | e5 | LA21 |
| **Burgenland** | | | | | | | | | | | | | |
| There is only one municipality and thus, empirical study under chosen criteria is not possible | | | | | | | | | | | | | |
| **Lower Austria** | | | | | | | | | | | | | |
| X | M | Lower Austria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Lower Austria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Lower Austria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Lower Austria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Lower Austria | X | X | X | X | X | X | X | X | X | X | X |
| **Upper Austria** | | | | | | | | | | | | | |
| Steinbach an der Steyr | M | Upper Austria | Kirchdorf an der Krems | Steyr | 12 | 28,20 | 381 | 2.027 | 100% Heating-Supply by | yes | yes | no | yes |
| Windhaag | M | Upper Austria | Freistadt | Freistadt | 14 | 42,90 | 723 | 1.633 | Energy Autonomy | yes | no | no | no |
| X | M | Upper Austria | X | X | X | X | X | X | X | X | X | X | X |
| **Salzburg** | | | | | | | | | | | | | |
| X | M | Salzburg | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Salzburg | X | X | X | X | X | X | X | X | X | X | X |
| **Styria** | | | | | | | | | | | | | |
| X | M | Styria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Styria | X | X | X | X | X | X | X | X | X | X | X |
| X | M | Styria | X | X | X | X | X | X | X | X | X | X | X |

**Source: modified after BÜRBAUMER ET AL., 2010**

## 8.2.2 Interview Guideline

As described in chapter 4.1 an interview guideline was used. It composed of target-, guideline- and ad-hoc questions as can be seen subsequent. The target- and guideline-questions (summarized at "Hauptfragen") were the same for all interviewees and almost all of them gave their view about these questions. Depending on interviewees interest, position and knowledge, ad-hoc questions were asked as well (summarized at "Zusatzfragen").

Each interviewee received his/her interview for review and additional comments to increase validity (YIN, 2009). Additionally, the interviewees received the ad-hoc questions and were asked to give – if possible - further input to guarantee that information (which they may not thought about during the interview) can be evaluated as well. Six out of 15 interviewees from Steinbach adapted their interviews (Four of these only adapted their already given answers and cancelled/added few aspects about these, two gave further inputs about questions they did not answered during the interview). At Windhaag, eight out of 13 interviewees adapted their interviews (Six only their already given answers and two gave further inputs).

A second review process (including a presentation at each municipality, round tables and publishing at the local press) was planned but could not be realized due to lack of interest from the mayor's. They were asked three times but they either ignored the enquiry or continuously postponed appointments for realisation of the second review process up to now.

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### Gesprächsleitfaden

Datum:

Beginn des Gespräches: Ende des Gespräches:

Gesprächspartner:

Funktion: darin tätig seit:

### Hauptfragen

[Einleitung zum Projekt: Entstehung, Inhalt der Studie, Zeitplan, Bekanntmachung der Ergebnisse / Wichtig: alles was hier besprochen wird, ist vertraulich; anonymisierte Gesamtergebnisse werden in der Gemeinde präsentiert / Kurzer Überblick zum Fragebogen]

- Darf ich einleitend fragen, was für Sie persönlich der Anstoss war, sich mit dem Thema Erneuerbare Energien (EE) oder Reduktion des Energiebedarfes/Effizienzmaßnahmen (EM) auseinanderzusetzen?

- Was verbinden Sie mit dem Begriff „Energieautarkie"? [verbinden Sie dies aufgrund bestimmter Projekte (welcher?) oder durch etwas anderes (was?)]
- Wenn Sie an Auswirkungen im wirtschaftlichen Bereich denken, welche im Zuge der Umstellung auf EE/EM stattfinden. Haben Sie welche wahrgenommen und falls ja, welche?
- Wenn Sie an Auswirkungen im sozialen Bereich denken, welche im Zuge der Umstellung auf EE/EM stattfinden. Haben Sie welche wahrgenommen und falls ja, welche?
- Welche Hindernisse haben sich im Zuge von EE/EM ergeben?
    - anfangs erwartete Hindernisse?
    - tatsächlich eingetretene Hindernisse?
    - für weitere Entwicklung aktuelle Hindernisse?
    - Empfehlungen für andere (Gemeinden)?
- Wenn Sie an die Projekte zu EE/EM denken, wie war aus Ihrer Sicht die Gesprächskultur im Ort? Wurde dies offen angesprochen? Gab es auch kritische Stimmen? Wie sprechen andere über derartige Projekte bzw. die Vision „Energieautarkie"?

# Zusatzfragen

## 1 Fragen zu Auswirkungen

[*Generell bei allen Aspekten zu hinterfragen: wurden diese als positive oder negative Auswirkungen empfunden?]*

### 1.1 Wirtschaftliche Auswirkungen

1. Ergaben sich im Zuge der Umstellung auf EE/EM Jobmöglichkeiten?
2. Gab es im Zuge der Umstellung auf bzw. der jetzigen Nutzung von EE/EM Zahlungen?
3. Bei Biomasse: gab es nach der Umstellung auf EE Preisschwankungen?
4. Inwieweit kam es durch die Umstellung auf EE/EM zur Gründung oder Ansiedelung von Unternehmen?
5. Wurde durch die Umstellung auf EE/EM der Ökotourismus im Ort (wieder) belebt oder erweitert?
6. Inwieweit haben sich Synergieeffekte ergeben (bspw. Lieferung Biomasse an Heizhaus – Retournierung der Reststoffe als Dünger)?
7. Ergaben sich als Folge der Umstellung auf EE/EM höhere Steuereinnahmen?
8. Inwieweit erhielt die Gemeinde durch die Umstellung auf EE/EM Förderungen?
9. Wie haben sich die Energiekosten für die Gemeinde verändert?
10. Konnte sich die Gemeinde durch EE/EM einen Standortvorteil gegenüber anderen Gemeinden schaffen? Besteht dadurch nun ein größerer Anreiz für Unternehmen sich anzusiedeln?
11. Gibt es darüber hinaus wirtschaftliche Auswirkungen innerhalb der Gemeinde, die Sie wahrgenommen haben?

## 1.2 Soziale Auswirkungen

1. Ergab sich im Zug der Umstellung auf EE/EM die Möglichkeit für Aus- und Weiterbildung? Bzw. ergab sich die Möglichkeit einer Lehrstelle?
2. Inwieweit hatte die Umstellung auf EE/EM Auswirkungen auf das Zu-/Abwanderungsverhalten in der Gemeinde? Konnte Ausdünnung der Gemeinde reduziert / gestoppt werden? Oder ev. positiv beeinflusst werden?
3. Haben sich im Zuge des Energieprojektes in der Gemeinde Interessensgruppen, Vereine, Genossenschaften gebildet? Oder konnten bestehende/ruhende wieder aktiviert werden?
4. Inwieweit kam es durch die Umstellung auf EE/EM zu positiven Auswirkungen auf Sie / Ihr Unternehmen / die Gemeinde? (bspw. Raum der zur Verfügung gestellt wurde oder Zahlungen wie Sponsoring für Fußballverein, Pfarrbibliothek uä.)
5. Haben Sie den Eindruck, dass sich durch die Umstellung auf EE etwas in Ihrer Versorgungssicherheit verändert hat? Oder gab es Veränderungen in der gebotenen Lebensqualität?
6. Haben Sie den Eindruck, dass sich durch die Umstellung auf EE etwas bei den sozialen Beziehungen innerhalb der Gemeinde verändert hat?
7. Kam es aus Ihrer Sicht zu einer unterschiedlichen Verteilung der Auswirkungen auf verschiedene Gruppen/Personen?
8. Sind die BürgerInnen von XX stolz auf das, was Sie im Bereich EE/EM bereits erreicht haben?
9. Gibt es darüber hinaus soziale Auswirkungen innerhalb der Gemeinde, die Sie wahrgenommen haben?

# 2 Fragen zu Barrieren

1. Wenn Sie an die Planungsphase Ihres Projektes denken. Welche Umstände waren hier gegeben? Welche Hindernisse haben Sie zu diesem Zeitpunkt erwartet?
2. Sind die von Ihnen soeben angesprochenen, erwarteten Hindernisse tatsächlich eingetreten?
3. Sind darüber hinaus andere Hindernisse aufgetreten, mit welchen Sie anfangs nicht gerechnet haben?
4. Gab es aus Ihrer Sicht Verbände/Gruppen/Personen die dadurch gewonnen oder ev. auch verloren haben?
5. Aus heutiger Sicht, hätten diese Hindernisse vermieden werden können? Oder vielmehr, welche Umstände wären notwendig gewesen um diese zu vermeiden?
6. Sie haben bereits sehr vieles erreicht. Inwieweit planen Sie eine Erweiterung bzw. Umsetzung weiterer Projekte im Bereich EE/EM?
7. Welche Rahmenbedingungen wären notwendig, damit Sie die Erweiterung / Umsetzung eines weiteren Projektes tatsächlich durchführen?

## 8.2.3 Populations Statistics

**Table 35: Populations Statistics of Steinbach and Windhaag from 1991-2009**

| | Inhabitants [Number] | |
|---|---|---|
| **Year** | **Steinbach** | **Windhaag** |
| 31.12.1991 | 2013 | n.s. |
| 31.12.1994 | n.s. | 1848 |
| 31.12.1995 | n.s. | 1801 |
| 31.12.1996 | 2013 | 1761 |
| 31.12.1997 | n.s. | 1747 |
| 31.12.1998 | n.s. | 1748 |
| 31.12.1999 | n.s. | 1716 |
| 31.12.2000 | n.s. | 1710 |
| 31.12.2001 | 2027 | 1713 |
| 31.12.2002 | 2029 | 1722 |
| 31.12.2003 | 2012 | 1713 |
| 31.12.2004 | 1988 | 1694 |
| 31.12.2005 | 1993 | 1677 |
| 31.12.2006 | 1989 | 1671 |
| 31.12.2007 | 1982 | 1654 |
| 31.12.2008 | 2005 | 1637 |
| 31.12.2009 | 1984 | 1631 |

**Source: Municipal Office Steinbach (2010), Municipal Office Windhaag (2010b), Statistik Austria (2010c)**

To sum it up, since 1991, there was a decline in population of 1.44% at Steinbach. At Windhaag, there was a decline in population of 11.74% since 1994.

## 8.2.4 Secondary Data used for Empirical Study


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Regionalmanagement OÖ GmbH (2010): *Energienetzwerk Steyr-Kirchdorf nimmt Formen an. Gemeinsam die Energiewende schaffen!* Steinbach an der Steyr, Austria: Regionalmanagement OÖ GmbH.

SPES (1994): *Alter Pfarrhof. Dorferneuerungsprojekt Gemeinde Steinbach an der Steyr 1990-1993*. Steinbach an der Steyr, Austria: SPES.

Verein Energiebezirk Freistadt (n.d.): *Zukunftsforum Windhaag – Windhaager Thesen für eine lebenswerte Zukunft … aufgestellt im Zuge der Symposien 2008 und 2009.* Freistadt, Austria: EBF.

## 8.3 Comprehensive Definition of Energy Autonomy according to the Interviewees

### 8.3.1 Definition of Energy Autonomy of Interviewees at Steinbach

SM

Die Verringerung der Abhängigkeit von Gas und Öl vom Ausland und Wertschöpfung vor Ort.

SC2

Im Wesentlichen ist das die Unabhängigkeit vom Ausland. Es ist natürlich abhängig von der Region die ich betrachte. Sehe ich es auf Gemeindeebene, dann bedeutet es, das die Gemeinde die Energie die sie selbst benötigt auch in irgendeiner Form produziert. Bei uns sprechen sie meist österreichbezogen und da sagt man halt das die Bilanz übers Jahr gesehen ausgeglichen ist wobei sie zeitlich nicht immer ausgeglichen sein muss. Denn bei uns ist es eher so, das wir zeitlich immer ausgeglichen nicht hinbekommen weil wir gerade im Winter zu schwach sind. Da werden wir nie autark sein. Wobei ich es als gefährlich sehe das bei uns immer Energie und Strom vermischt wird. Denn energieautark sein, das ist ganz was anderes. Wenn man die gesamte Erdölindustrie hineinrechnet, dann weiß ich nicht ob man das jemals zusammenbringen wird. Beim Strom geht das leichter. Da sind wir zwar auch seit einigen Jahren nicht mehr autark sondern Importeur aber wenn ich die gesamte Energiewirtschaft rechne, dann wird man das nicht zusammenbringen.

Ist Mobilität ein Thema das zu EA dazugehört? Ja, wenn ich das Energiethema gesamt sehe, dann sicherlich. Meines Wissens ist es sogar einer der Sektoren mit dem höchsten Energieverbrauch.

SC3

Energieautarkie heißt so wenig wie möglich von Importen abhängig sein und die eigenen Ressourcen die wir haben bestmöglich nutzen. Und wie definieren Sie Energie? Strom, Gas, Treibstoffe aber auch Sonnenenergie, Wind, Wasser - nicht nur der Strom aus der Steckdose.

SC4

Energieautarkie bedeutet, das wir jede Energiequelle bzw. jede Form von Energie die wir derzeit benötigen und zu kaufen - das wir diese in unserer eigenen Hand haben und besitzen. Was ist für Sie Energie? Strom, Gas, Diesel.

SP1

Energieautarkie ist ein Schlagwort das man heute sehr oft hört. Ich bin da sehr skeptisch, da Energieautarkie so verstanden wird, das der Schwerpunkt in der Energieversorgung innerhalb einer Region die erneuerbaren Energieträger sind. Und innerhalb unserer Region haben wir diesbezüglich festgestellt, dass wir durch die Steyr- und Ennstal-Wasserkraftwerke eigentlich bereits energieautark wären.

SP1

Ich definiere es eigentlich von der Verbraucherseite. Ich finde es zielführender, wenn von der verbraucherseite der Großteil der Energie aus erneuerbaren Quellen stammt und auch das der Energieverbrauch insgesamt möglichst gering ist. Also Energie ist ein umfassender Begriff und deshalb haben wir es hier im Regionalmanagement auch so aufgebaut, das es fachbereichsübergreifend ist. Also für mich zählt jeder tatsächliche Energieverbrauch dazu - bis hin zur Mobilität. Und aber auch die Lebensweise, die zählt für mich hierzu. Und da stellt sich die Frage: benötige ich jedes Jahr ein neues Handy? Oder brauche ich auch wirklich alle Funktionen die hier drauf sind? Und eigentlich benötigt man 10% davon und damit könnte man bei der Produktion Energie sparen. Und das kann man eigentlich auf viele Bereiche anwenden.

SP2

EA definieren wir für uns als Verbindung zwischen Erneuerbaren Energien und energiesparender Lebensweise und Reduktion des Energiebedarfes. Ansonsten wären wir in der Region Kalkalpen und der Nationalpark-Region bereits energieautark. Denn was die Ennstal-Werke exportieren ist natürlich um vieles mehr als in der Region gebraucht wird. Aber das ist natürlich nicht relevant - das ist rein bilanzmäßig.

SP4

Was würden Sie sagen, in welchem Radius würden Sie Energieautarkie definieren? Ich würde sagen, das ist ein Radius von 15km - für die Wärme. Beim Strom denke ich, muss man offen bleiben - da wird es beides geben. Das kleinräumige aber auch die großen Stromleitungen, weil es hier um Mengen geht - wie bspw. für Industrieunternehmen - da geht das nicht kleinräumig sondern braucht diesen Mix. Aber bspw. unser Wasser-Kleinkraftwerk hier, das produziert genau die Menge Strom, die die gesamte Gemeinde benötigt und schädigt aber die Umwelt nicht. Dh es gilt zu nutzen, was an Ressourcen vorhanden ist.

SF1

In erster Linie das ich vor Ort entscheiden kann wie ich meine Energie erzeuge bzw. wie ich sie verkaufe. Und es gefällt mir auch jetzt, denn ich kaufe das Hackgut zu und entscheide selbst, was ich will. Und das ist die Freiheit und das hat mich auch bewogen es zu tun.

SF2

Erneuerbare Energien (EE) ist das einzige wo ich in Richtung Energieunabhängigkeit gehen kann. Und es ist immer die Summe der EE denn ich kann nicht alles nur mit Biomasse, Wind- oder Wasserkraft oder durch die Photovoltaik abdecken. Und in der Summe ist das auch zu schaffen. Was uns klar sein muss ist, dass die EE nicht immer das Günstigste ist - zumindest zum momentanen Stand. Aber es ist das wo die Zukunft drinnen steckt und da werden wir nicht daran vorbeikommen.

SI1

Also mit Energie fällt mir als erstes Strom ein. Der ist überall gegenwärtig - in jeder Steckdose. Wenn sich das jeder Haushalt oder jede Gemeinde selbst machen könnte, das wäre ein Traum. Also unabhängig zu werden von den großen Geschäften wie der Gestaltung des Strompreises. Energie ist auch das was in der Erde gespeichert ist. Also möglichst viel Energie aufzunehmen von dem was da ist.

### 8.3.2 Definition of Energy Autonomy of Interviewees at Windhaag

WM

= Selbständigkeit, Unabhängigkeit. Und das im kleinsten Bereich. Beginnen tut es im kleinsten Bereich - im häuslichen Bereich. Alles was gar nicht benötigt wird ist besser. Und alles was nicht eingespart werden kann, muss dann noch entsprechend abgedeckt werden. Thema ist, das man sich nach der Decke strecken muss und das Realisieren kann was realistisch ist. Ansonsten gibt man alles wieder auf. Im Heizungsbereich ist es die Biomasse. Aber wichtig ist, auch wenn wir eine große Menge haben, können wir nicht alles abdecken. Deshalb ist es wichtig einzusparen. Im Strombereich ist die Möglichkeit mit dem Windpark gegeben. Das ist eine große Möglichkeit für die Energieautarkie. Wenn man alles gemeinsam zusammennimmt haben wir eh schon einen Großteil abgedeckt. Im Heizungs- und Strombereich können wir autark werden. Im Mobilitätsbereich können wir nicht autark sein, da die Versorgung durch Fossile erfolgt. Biosprit ist natürlich möglich, aber da wachsen die Pflanzen nicht bei uns. Da muss man realistisch bleiben. Also es gibt die Möglichkeit über Elektroautos - und das wird auch angestrebt von den Konzernen. Die wollen das bald gebündelt anbieten. Und da setzen wir auch Maßnahmen wie zB mit Elektrofahrrädern. Bei

den Elektroautos ist es etwas schwierig denn da müssen wir noch etwas warten. Bei Mobilität gibt es viele andere Faktoren wie zB den Lebensstandard. Es hilft nichts wenn wir autark werden und dann aber den Lebensstandard nicht halten können. Da machen die Leute nicht mit. Das Wissen, die Energie und die Einsatzbereitschaft hat man selbst. Das kann man nutzen. Aber wenn jemand nicht interessiert ist, zB ein Motorsportler, den kann man nicht einfach so mit ins Boot reinholen. Also alle kann man nicht gewinnen. Aber mit der Zeit springen die dann auch auf zB wenn sie auf eine Heizung umstellen - so wird es immer mehr und mehr. Auch beim Autofahren wird es mehr und mehr ohne dass die Lebensqualität schlechter wird. Wenn man sich mal überlegt, einfach weniger Kilometer fahren - das wäre für keinen ein Problem. Wenn man einfach mal schaut, ein Monat lang, was man tatsächlich fahren muss, dann kommt einiges zusammen. Und dann sieht man, was bleibt unnötiger weise über - nur zur Hälfte. Da kommt einiges zusammen und es beschneidet einen aber null.

WC2

Ich verbinde weniger die Vorstellung dass ich das Netz kappen kann und habe mir den eigenen Strom gemacht. Sondern ich verbinde damit die Verantwortung, dass ich das, was eine Gesellschaft braucht, auch selbst herstellen muss. Und wenn eine Gemeinde, die Bürger, die Wirtschaft Strom braucht, dann geht es nicht darum zu sagen die Leitung haben wir sondern es geht darum die vorhandenen Ressourcen sinnvoll zu nutzen. Und das ist Autarkie in der ganzen Gesellschaft. Also nicht so sehr die technische Autarkie - denn das geht nie, denn man muss immer - je nachdem ob ich Wasser- oder Windkraft oder Photovoltaik habe. Ich muss einfach längerfristige Ausgleichsmaßnahmen setzen können. Und es gibt mal Zeiten mit viel Wind und es gibt Zeiten da gibt es mal keinen Wind und dafür ist immer das Netz der ausgleichende Faktor. Deshalb ist es auch sinnvoll was wir machen mit Speicherkraftwerken. Wenn kein Strombedarf ist, kann man das Wasser hinaufpumpen und wenn Strombedarf ist, kann ich es ablassen. Wenn man es nur nutzt um in der Nacht mit dem billigen Atomstrom das Wasser hinaufzupumpen und tagsüber abzulassen um teuren Ökostrom zu produzieren, dann halte ich das für bedenklich was hier passiert.

WC3

Autarkie ist, wenn man die verbrauchte Energie durch sein Tun und Handeln wieder erzeugt. Jeder sollte sich konkret vor Augen halten, wie viel Energie er verbraucht. Und wenn er das eingesehen hat, sollte er versuchen, die Möglichkeiten Energie zu erzeugen oder einzusparen zu nutzen. Ich als Besitzer eines 1000 Quadratmetergrundes, bin auf diesem Grund beschränkt. Eine gute Möglichkeit, die sich mir bietet, ist die Photovoltaik, da ich genügend Dachfläche dazu habe. Ein Landwirt zum Beispiel hat die Möglichkeit seinen Wald als CO2-neutrales Heizmittel zu verkaufen und für den Eigenbedarf zu verwenden. Meine

Ansichten im Generellen zum Thema Energieautarkie sind so wenig Komfort wie möglich zu verlieren, aber die richtigen Mittel einzusetzen.

WF1

Wörtlich ist es: ich mache um mich eine Mauer und versorge mich selbst. Das wäre engstirnig so zu denken, sondern es geht darum in der Größenordnung zu mindest ausgeglichen zu bilanzieren bilanzmäßig bin ich positiv und natürlich muss man sich dann überlegen, in welchem Umkreis ist es sinnvoll, Austäusche zu machen. Es ist unsinnig alles selbst zu erzeugen - zB bei den Lebensmitteln. Da ist es legitim das in gewissem Maß zu transportieren und zu verarbeiten. Aber die Frage ist einfach, wie weit soll dieser Austausch/diese Wechselbeziehung sein. Und da liegen wir heute in manchen Bereichen beim 100- bis 1.000-fachen dessen was sinnvoll wäre.
Beim Energiebereich - was wäre da ein sinnvoller (nachhaltiger) Radius? Abgesehen von einigen sehr speziellen Sachen würde ich den Kreis bei 100-200 km legen - das sollte reichen. Konkret bei Windhaag ist es bei Wärme im Umkreis von 20 km möglich. Bzgl. Strom könnte sich die Gemeinde bilanzmäßig komplett versorgen - aber um die Sicherheit und Stabilität zu haben würde ich sagen OÖ oder Ö.

WF2

Das ist Unabhängigkeit und das die Wertschöpfung in der Region bleibt. Und das wir die nachwachsenden Rohstoffe und nicht Erdöl verwenden. Also das man keine Rohstoffe verwendet, die man einmal verwendet und dann sind sie weg. Sondern die nachwachsenden. Und jedes Mal wenn die Sonne scheint oder es regnet - dann wachsen die notwendigen Rohstoffe wieder nach.

WI1

Die benötigte Energie aus der Region zu beschaffen je nach Möglichkeit durch EE (Sonne Wind Wasser oder Nachwachsenden Rohstoffen zB Hackschnitzel….).

# 8.4 Detailed Recommendations according to Interviewees

**Table 36: Recommendations according to Interviewees**

| Topic | Source Steinbach | | | | Source Windhaag | | Aspect | Internal/ External | Detailed Information |
|---|---|---|---|---|---|---|---|---|---|
| Overall | SM | SP1 | SP3 | SF2 | | | Politics | Internal | Grundsatzbeschluss in der Gemeinde beschließen |
| | SC1 | SP1 | | | | | Politics | Internal | Eine Gewichtung des Themas EA in der Gemeinde festlegen |
| | SM | SF2 | | | | | Politics | External | Grundsatzbeschluss für das gesamte Bundesland einfordern |
| | SC4 | | | | | | Politics | External | Schnelles Handeln und ein offenes Ohr bei der Politik und den Beamten |
| | SC4 | SP3 | | | | | Politics | Internal | Ein System in der Gemeinde etablieren, welches unabhängig von der jeweiligen Amtsperiode eines Politikers bestehen bleibt |
| | | | | | WF3 | | Politics | External | Verwendung der Mittel für die Zertifikate im Land nutzen |
| | SC3 | | | | WF3 | | Subsidies | External | Vereinfachte Strukturen und vereinfachtes Fördersystem schaffen |
| | SM | | | | | | Knowledge/Skills | Internal | Unabhängige Beratungsstellen beiziehen |
| | SP1 | SP3 | SF1 | SI1 | | | Involvement | Internal | Gender-Thema stärker berücksichtigen; Jugendliche stärker einbinden |
| | SP1 | SP4 | SF2 | | | | Involvement | Internal | Status-Wandel durch lokale Initiativen unterstützen --> von "groß, schwer, teuer" zu "das bringt mir die Qualität die ich benötige |
| | SP1 | SP3 | SF2 | | | | Involvement | Internal | Motivierte Akteure vor den Vorhang holen |
| | SP1 | SF2 | | | | | Involvement | Internal | Immer wieder Best-Practice Beispiele aus dem Ort vorstellen |
| | SM | | | | | | Involvement | Internal | Mit gutem Bsp. Vorangehen |
| | SC4 | | | | | | Involvement | Internal | Mut zu Projekten geben |
| | SP4 | SF2 | SF3 | SI1 | | | Involvement | Internal | Energiethema Breite bieten; Informationen im Vorfeld bieten; Hinterfragen, wer das Thema aufbereitet und wie |
| | | | | | WC1 | | Involvement | Internal | Schulterschluss von Privatpersonen, Wirtschaft und Politik |
| | | | | | WC2 | WF1 | Involvement | Internal | Kontinuierliche Information an die Bewohner um einen Boden aufzubereiten- vor allem jene, die von zukünftigen Projekten stark betroffen sind |
| | SP1 | SP2 | SP3 | SF1 | WC1 | | Projects | Internal | Ein Energienetzwerk errichten; Erfahrungsaustausch ermöglichen |
| | SP3 | | | | | | Projects | Internal | Regionale Nahversorgung modernisieren (Bestellungen bspw. für Mittagessen rasch und unkomplizert anbieten) |
| | SM | | | | | | Projects | Internal | Etablierung eines Energie- oder Themenweges (bspw. ein Radweg, welcher die 4 nahe beisammenliegenden Wasser-Kraftwerke verbindet) |
| | SM | | | | | | Projects | Internal | ein solarbetriebener Zug - entwickelt in Zusammenarbeit mit Fronius |
| | | | | | WM | | Projects | Internal | Berechnung der Fahrtkosten zu Städten --> Preise für Nahversorger relativieren |
| | | | | | WC1 | | Projects | Internal | Einen Energiesachverständigen auf Gemeindebene (Bei Bauverfahren/Widmungssachen die Stellungnahme eines Energiesachverständigen verpflichten (so wie jetzt bspw. Rauchfangkehrer)) |
| Reduction in Energy Demand | SM | | | | WF1 | | Concept | Internal | Eine flächendeckende Ist-Zustands- und Potentialanalyse |
| | SM | | | | | | Concept | Internal | Erstellung eines Energiekonzeptes, welches die lokalen Gegebenheiten berücksichtigt |
| | SC4 | | | | | | Concept | Internal | Bei Logistikunternehmen: Schulungen für die LKW-Fahrer anbieten (spritsparendes Fahren) |
| | SC4 | | | | | | Concept | Internal | Bei Logistikunternehmen: Dispositionen optimieren; Leerfahrten vermeiden |
| | SP1 | | | | WC2 | | Concept | Internal | Ein unabhängiger Sanierungs-Manager, welcher Produkt-/Firmenunabhängige Beratung anbietet |
| | SP1 | | | | | | Concept | Internal | Einen zentralen Energieverantwortlichen in der Gemeinde --> Vermeidung von doppelter Besetzung des Themas im Leader-/Regionalmanagement |
| | SP1 | | | | WF1 | | Concept | Internal | Energiesparen nicht als Einschränkung sondern als Gewinn an Lebensqualität darstellen |
| | SF2 | | | | WM | | Concept | Internal | Konzepte entwickeln, welche auch realistisch umgesetzt werden können, da Finanzierung möglich ist |
| | SP2 | | | | WF2 | | Concept | Internal | Arbeitsgruppen zur Energieeinsparung --> gemeinsame Infoeinholung, Aufbereitung, Sammelbestellungen zur Kostenreduktion |
| | SM | SP4 | SF2 | | WF1 | | Costs | Internal | Etablierung eines lokalen Fonds / Regionalfonds. Gefüllt durch Bürgerbeteiligung erhalten diese die Rückzahlung aufgrund der Einsparungen im Energiebereich (SM) |
| | SC4 | | | | WF1 | | Costs | External | Verteuerung der Benzinpreise um eine Reduktion im Bedarf zu erreichen |
| | SC4 | | | | WF1 | | Costs | External | Verteuerung der Energie um eine Reduktion im Bedarf zu erreichen |
| | | | | | WC1 | | Costs | Internal | Bei der Finanzierung Querfinanzierungen unter Einbindung der Wirtschaft erreichen |

| Topic | Source Steinbach | | | | Source Windhaag | | Aspect | Internal/ External | Detailed Information |
|---|---|---|---|---|---|---|---|---|---|
| Switch to an Energy Supply based on Renewable Energy Sources | SM | | | | | | Law | Internal | Flächenwidmungsplan mit der Information der Energieversorgung versehen so das zukünftige Ansiedelungen wissen, wodurch sie wo versorgt werden können |
| | SC4 | SF3 | SI1 | | WC1 | WC2 | Subsidies | External | Anpassung der Einspeisetarife so das diese einen Anreiz zur Umstellung darstellen (und nicht wie aktuell unter den tatsächlichen Kosten liegen); dh zumindest kostendeckende Tarife |
| | SC3 | | | | WM | WF1 | Mobility | External | Versorgungsnetz anbieten |
| | SC3 | | | | WM | | Mobility | External | Preise für Elektroautos auf jene der Preise für einen Mittelklassewagen senken |
| | | | | | WM | | Mobility | External | Eigenproduktion von Treibstoff |
| | | | | | WC2 | | Mobility | External | "Schnellbusse" in die Landeshauptstadt einführen (=Bus mit wenigen Stops) |
| | | | | | WC2 | | Mobility | External | Pendlerpauschale überarbeiten da diese aktuell das Mobilitätsverhalten zementiert |
| | SM | SI1 | | | | | Biomass | Internal | Keine Anschlusszwänge im Bebauungsplan – schlechte Erfahrungen |
| | SC5 | SF1 | | | | | Biomass | Internal | Bewerbung von Wohnbauträgern, das bereits entsprechende Struktur besteht |
| | SP4 | | | | | | Biomass | Internal | eine schrittweise und dezentraler Aufbau des Nahwärmenetzes |
| | SM | | | | | | PV | Internal | Strassenbeleuchtung auf Versorgung mit Photovoltaik umstellen |
| | SC3 | | | | | | PV | External | Umstellung der Förderrichtlinien (Gewerbliche Investitionsförderung/Private Einspeisetarif) |
| | SC3 | | | | WC1 | WF3 | PV | External | Einspeisevergütung auf einen längeren Zeitraum gewähren - bspw. wie in D auf 20 Jahre |
| | SP4 | | | | | | PV | External | Abänderung der gesetzlichen Regelung: ermöglichen, das auch nicht vor-Ort-gemeldete darauf eine PV-Anlage errichten dürfen |
| | SP4 | SF1 | | | | | Solar | External | Kombination von Solarwärme und Hackschnitzelheizungen vorantreiben |
| | SC2 | | | | | | Water | External | Hinterfragen der Notwendigkeit der Restwasserdiskussion |
| | SC2 | | | | | | Water | External | Ausnahmeregelungen der vorgeschriebenen Fischaufstiegshilfen bei großen Speicherkraftwerken |
| | SC4 | | | | | | Water | External | ein bevorzugter Wasserbau |
| | SC3 | | | | | | Wind | External | ein Einheitsgesetz für Kleinwindräder |
| | | | | | WC2 | | Wind | External | Eine Widmung von X MW als Zielwert für das gesamte Bundesland (so wie Burgenland mit 500 MW) |
| | | | | | WC2 | | Wind | External | Naturschutz einen Rahmen geben, in welchem auch positive Beschlüsse möglich sind - dh von vornherein NGO's einbinden, Klimaschutz in den Naturschutz hineinnehmen, Ziel und Realität müssen ein Verhältnis haben |
| | | | | | WF3 | | | External | Forcierung Stirling Motor damit in 10 Jahren jeder Strom aus Abwärme der Heizungsanlage produzieren kann |

**Source: Interviewees (SM, SC1-5, SP1-4, SF1-3, SI1 and WM, WC1-2, WF1-3, WI1), 2010**