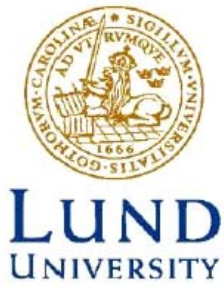
Looking at the Success of Certification Schemes for Energy Use in Residential Housing

The Case of the Klimahaus / Casa Clima Program in South Tyrol / Italy

Thesis submitted in partial fulfilment of the requirements of the International Master in Environmental Sciences Degree at Lund University, Sweden



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Abstract

The housing sector accounts for a large share of the overall energy use and CO_2 emissions in the European Union. In the light of the many environmental and economic problems that can arise from high use of fossil fuels, it is necessary to increase efficiency in this sector. In the Italian province of South Tyrol an environmental agency has designed a certification program for the heating demand in new residential houses that has been able to achieve a more sustainable building on a local level. In this thesis the methods adopted by the program will be described and analyzed, in order to point out guidelines for a successful certification scheme in the housing sector. For this purpose Systems Analysis has been applied, which is useful in describing the program from a holistic point of view and is capable of outlining the driving factors and weak points of a program. Furthermore, the fundamental calculation part has been further scrutinized in order to give information about its exactness. The analysis shows that a successful certification program for new houses has to include three factors. It has to consist of a calculation that is able to provide a framework with solid information about energy use. It has to create a demand for energy efficient houses by undertaking measures that achieve behaviour change and it also has to be apply measures that facilitate the introduction and development of sustainable technology for the building of new houses.

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Chapter I

Introduction

Humanity has to face a huge variety of environmental problems which have never existed before. In particular western society's daily consumption has led to massive destruction and pollution of our planet. The public and policy makers are aware of the situation and see the need of tackling issues, as they fear the consequences. However, due to our dependence on certain environmentally unfriendly consumption habits, the finding of solutions is complicated. Nowhere does this dilemma manifest itself better then in the energy sector. On the one hand, our life style has made us heavily dependent on high energy use and on fossil fuels; on the other hand, we have to face its negative effects on our health and environment due to climate change, smog and others (Carter, 2001). Furthermore, "affordable oil, the most widely used energy resource in developed countries, will probably be depleted within 40-80 years and will need to be replaced by other energy resources" (Miller, 1999, p.512). It appears that we will have to change our way of energy use, whether we like it or not.

Decreasing energy use and switching to renewable energy sources seems to be the most logical way of tackling modern energy issues. The Kyoto Protocol is the most important paper that deals with the mitigation of climate change and has been signed by most of the countries in United Nations (UN). The European Union (EU) as a whole commits to decrease its CO_2 emissions by 8% of 1990 levels between 2008 and 2012 (Carter, 2001). As the building sector is responsible for 40% of the overall energy use and 40% of the CO_2 emissions, it is obvious that if the Union wants to fulfil its commitments, it has to increase energy efficiency in this sector. With the Directive 2002/91/EC on the Energy Performance of Buildings (EPBD), the member states are required to develop a framework in order to regulate energy use in this sector by 2006 (Bowie and Jahn, 2003). In the Italian province of South Tyrol an environmental agency has already developed a certification program under the name Klimahaus / Casa Clima (KCP), which encourages the public to decrease energy use in residential housing. This thesis will describe and analyze the methods applied.

1.1. Aim of the Thesis

The KCP was installed as a voluntary certification program for heating demand in new residential buildings. This thesis will describe the program from a holistic point of view. In order for a certification system to work properly, many aspects have to be considered. This leads to a complex system with many interconnections, which is built up of several subsystems. Gradually the whole KCP will be analyzed in order to scrutinize its success. This work approach will be helpful when trying to answer the following questions that represent the boundaries of the thesis:

- What does the program consist of?
- How can the public opinion be sensitized in order to accept a certification?
- What are the driving factors that make a certification system successful?
- Does the project lead also to more use of renewable energy?

- Has the calculation been exact?
- Does the project fulfil the requirements of the EPBD?

The thorough analyses of these points will lead to a strengthening of the hypothesis that a certification program that wants to achieve sustainable energy use in the housing sector has to consist of three factors. A calculation method that gives exact information and is updated, measures that aim at a behaviour change and measures that facilitate the introduction and development of new technologies.

1.2. The structure of the thesis

The chapters of the thesis will introduce the reader gradually to the topic and to the analysis undertaken. After the introduction in the second chapter relevant background information will be given, which will explain the importance of the certification and the peculiarities of the province in which it has been introduced. The methods applied will be explained in chapter three. Chapter four represents the core part of the thesis. By CLD the system of the program and its influences on the energy use of the province will be analysed. These findings will then be discussed in chapter five. In addition in this chapter also results will be presented that analyse the accuracy of the technical part. Finally, chapter six will sum up the important conclusions that can be drawn from the thesis.

Chapter II

Background

2.1. The Klimahaus / Casa Clima Program in a European Context

Although the Klimahaus / Casa Clima Program (KCP) was introduced only in South Tyrol, its significance extends beyond the borders of the province because it is related to the EPBD. This directive is part of the European Union's agenda to cut down carbon dioxide emission and contains requirements that the member states have to implement. As the building sector is responsible for 40% of the overall energy use and 40% of the CO2 emissions, the Union has to develop requirements that aim at decreasing the energy use in this sector. Otherwise it will only hardly be possible to fulfil the commitment of the Kyoto Protocol.

The directive describes measures that the singular member states are supposed to undertake in order to achieve a reduction of energy use in the building sector. The paper stresses, among other things, the importance to make regular inspections of buildings. However, one of the main topics is the requirement to develop a methodology that regulates and gives information about the total energy use in houses. The different member states should come up with regionally adjusted plans for implementing the directive by 2006 (Warren, 2004).

Already before the appearance of the directive in 2003, the Office for Air and Noise, a department of the environmental agency in South Tyrol/Italy, developed a certification system that suits the needs of the province and that gives incentives to decrease energy use in the housing sector. Different from the requirements of the directive though, the agency took the decision to certify only parts of the energy use in housing, as it assumed that with a gradualistic approach it would be more successful in increasing understanding and acceptance from the public (Lantschner, personal communication).

As the climate in South Tyrol with cold winters demands highly efficient heating systems, only the heating sector was chosen to be certified (Lantschner, personal communication). Furthermore, one can assume that houses with low heating standards can also be cooled in a more efficient way, as good insulation reduces energy loss in both ways (Miller, 1999). Nevertheless, the agency is working already on a future certification system for air conditioning, which is based on the same system as the already existing project (Lantschner, personal communication).

The certification was introduced, on a voluntary basis, already in the year 2001. Over the time more and more municipalities made the system obligatory, until the summer 2004, when the local government decided to establish the program also on a provincial level. In addition it declared that it will pass a law in the course of the year 2004 that states that all future houses have to be built according to the standards set by the program (Pichler, personal communication).

2.2. Relevant Facts and Figures about the Province South Tyrol

South Tyrol represents a peculiar province in Italy. Until the ending of the First World War it was part of Austria. With the peace treaty of Saint-Germain in the year 1919 it eventually became part of Italy (Alcock, 2001). Due to its historical background the culture and traditions of the province are quite different then in the rest of the country. According to the last census in the year 2001, the app. 460 000 people living in the province are divided up into three native language groups as follows: German-speakers 69,15%; Italian-speakers 26,47% and Ladin-Speakers (old roman language) 4,37 % (ASTAT, 2002). Officially the name of the province is Südtirol in German and Ladin and Alto Adige in Italian (Alcock, 2001).

Over the last century South Tyrol was able to achieve the special status of an autonomous province within the country of Italy. This means that it can create its own laws about most of the economic and social factors. In addition, the administrative offices of those factors are installed in the province. Furthermore, also special linguistic measures were undertaken. On the provincial level German and Italian have equal status, and employers that work in institutions that administer public services have to pass exams regarding bilingualism (Alcock, 2001).

Geographically the province lies in the middle of the Alps on the borders to Austria and Switzerland. Its landscape is characterised by high mountains up to 3900 meters. Its climate can be considered continental, with cold winters and warm summers. Figure 1 shows the average daily temperature of the capital Bozen/Bolzano in the year 2003. One has to bear in mind though that that year was relatively hot and dry and that the city can be considered one of the warmest places in the province (HO, 2004).

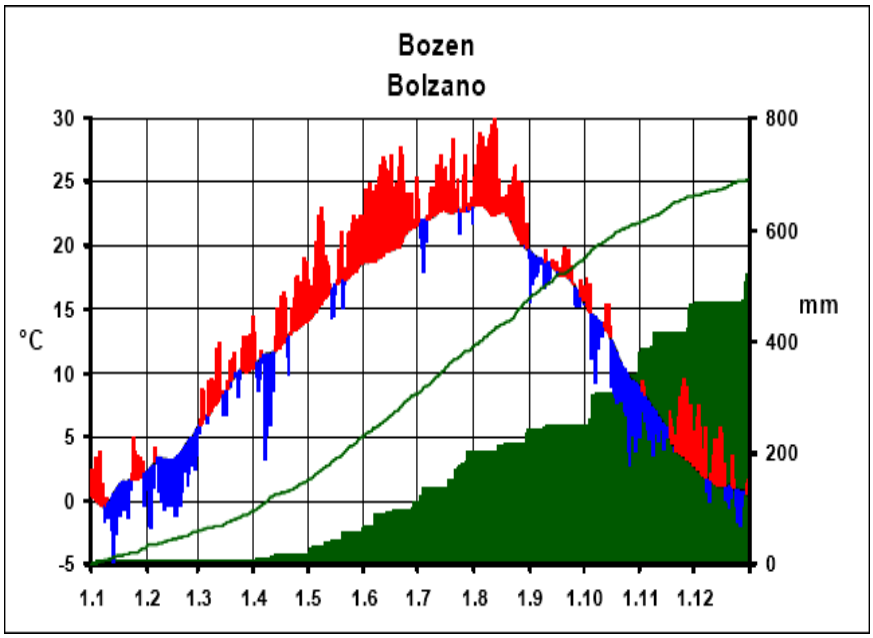

Fig. 1: Average daily temperature in the city of Bozen/Bolzano in the year 2003. Blue and red lines represent the deviances from the average daily temperature. (Blue line: negative d.; red line: positive d.); Green line: Precipitation; Green field: summed up precipitation (Source: HO, 2004)

Chapter III

Methodology

3.1. Development of data retrieval and analysis

In Chapter 1 questions have been proposed that were used as a guideline for the development of the thesis. To successfully answer these questions, four different methods have been chosen: Interviews, system analysis, literature reviews and data retrieval about the actual energy use in houses that were certified in the KCP.

The fundamental basis for the analysis consisted of two qualitative interviews. The first was held with Georg Pichler, who is one of the responsible persons for supervising the technical part of the KCP. The second interview was made with the head of the Office for Air and Noise as well as of the KCP, Norbert Lantschner. These interviews were conducted in accordance with the technique suggested by Taylor and Geller in 1998, as consisting of open end questions. This technique has been very useful in providing insights about the aims, structure and development of the KCP. In addition, the office was helpful in providing information material of the certification and the programme. Closed questions were used for obtaining data from owners of certified houses. Both interviews and information material were used as a starting point for creating the Causal Loop Diagrams (CLD).

3.2. Which Methods were chosen for answering which Questions

- How can the public opinion be sensitized in order to accept a certification?
- Does the project lead also to more use of renewable energy?
- What are the driving factors that make a certification system successful?

  Questions 1-3 represent the core part of the thesis and will be helpful when presenting and analysing the system of the program and its driving factors. Basis for answering these questions was an analysis with Causal Loop Diagrams on the information gained from the interviews and the information materials. CLDs are tools of System Analysis and are useful for analysing the behaviour of systems and will be explained further in the next section.

- Have the calculations been successful?

  In order to understand whether the calculated data for the certification corresponds to the effective energy use for heating, most of the owners of current certified houses were contacted by telephone and the data was recorded. Furthermore, information from two of the houses was obtained from the Office for Air and Noise. Although the first approach would have been to have a quantitative discussion with methods like statistics, due to the poor availability of data, only a qualitative discussion could be achieved.

- Does the program fulfil the requirements of the EU-directive?
  The literature review has been found appropriate for answering this question. The official text of the directive was compared to the information gained from the interviews and from the different information materials provided by the Office for Air and Noise in order to scrutinize to which extend the directive can be implemented with the KCP.

3.3. System Analysis as a Tool for Analysing the Behaviour of Systems

In this thesis system thinking has been used for the analysis. Briefly, this science can be described as dealing with "formulations of logic and integration of disciplines for understanding patterns and relations of complex problems" (Haraldsson, 2004, p. 3). System thinking is recognizing that in reality relationships are not made up of linear, but of circular connections. Everything, whether in natural or in anthropogenic environment can be categorised and described as a system and everything is connected to everything in a complex web of interactions (Haraldsson, 2004).

CLDs are the tools of System Analysis. In order to understand the CLDs more easily, a short description on the basis of an example of a simplified population model presented in Ford (1999) follows (Figure 2.):

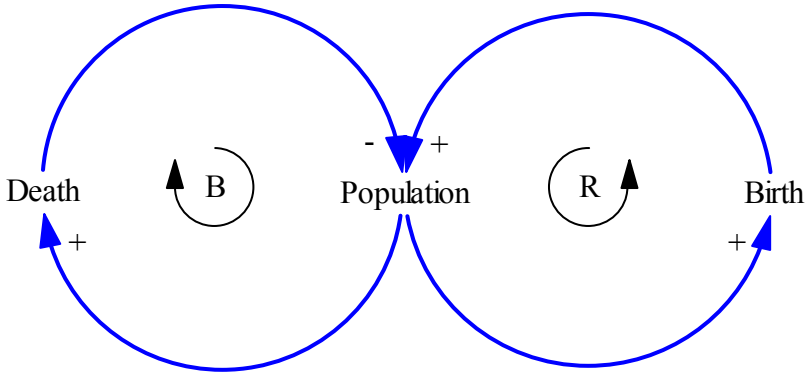

Figure 2: CLD of simplified population model.

CLDs are built up of variables and/or factors. These can be a situation, a condition, a decision, or an action. In the example one can see three variables: death, population, birth. The arrows represent the links between the different variables. Further, the polarity signs "+" and "-" show in which way the variables influence each other. Looking at the relationship between birth and population we can see that the more births there are, the higher the population will be, hence the "+" expresses that the variables are going to change in the same directions. A "-" on the other hand, means that the variables are changing in the opposite direction, as can be seen from the connection between death and population. The higher the death rate, the lower the population will be.

Whenever variables are connected to each other in a circular way, a feedback loop is created. There are two types of feedback loops which are both shown in the example.

The feedback on the right side is indicated as the reinforcing loop (R), which describes that the systemic behaviour will be reinforced, e.g. increased birth will increase population, which will again increase births and so on. The second type of feedback loop is the balancing one (B) that balances the systemic behaviour. Increased death rate leads to less population.

3.4. Scope and Limitations of the Methodology

Main purpose of the thesis is to understand how the whole system for certification works. Therefore, the three pillars will not be scrutinized in detail. It will be assumed that they fulfil the purpose the officers claim they fulfil. However, as the calculation represents the crucial part for the certification this part will be scrutinized in more detail. The analysis will be done in a qualitative way, which is also due to the poor availability of data.

Only houses that are categorized as A or B houses are certified as a Klimahaus / Casa Clima (K/C). The calculation of these houses had therefore to be controlled by officials. The calculation for houses that had an energy demand which exceeded A and B levels was not monitored; therefore, also the data of these houses has not been retrieved, as the exactness of their calculations is arguable.

Questionnaires could be designed that could explain better the motives of people to choose a K/C. The evidence gained from these surveys could be very valuable in defining which factors eventually have been decisive for the behavioural change; however, due to time restrictions this was not possible. Furthermore, recalling that the aim of the thesis is to give a holistic analysis of the KCP, this work approach would have been too specific.

System analysis is found to be very suitable for understanding complex problems. However, there are limitations to it. First of all, time might not be represented in an appropriate way. Also due to the need to simplify the interconnections, an imperfect picture of reality will result.

Chapter IV

Analysis

In Order to increase the understanding of the Klimahaus / Casa Clima Program (KCP), an analysis of the whole program with the CLD technique has been undertaken. This method is useful in understanding the driving factors and how they influence each other. In addition, also a short introduction and overview to the whole program and its different subsystems will be given. Eventually also a CLD will be presented that shows the impact of the KCP on the renewable energy use. Together with each CLD a fact sheet has been introduced, which defines the factors present in the corresponding CLD that do not have self explanatory names. Factors already explained in previous fact sheets will not be explained again. Moreover, not all the existing loops will be indicated as reinforcing or balancing loops in the figures and explained further in the text, just the ones that enhance the analysis.

4.1. The KCP – An Overview

The KCP was developed in the Italian province South Tyrol for the purpose of giving owners of houses the possibility to have information about the energy use for heating of their houses and to give incentives to build in an energy efficient way. The EPBD requires a methodology from its member states that gives information about the whole energy use of buildings by 2006. So far the KCP only focuses on single aspects of the energy use. The officers reckoned that by undertaking single steps, they could be more successful in achieving acceptance in public and politics. However, the Office for Air and Noise is already working on a follow up of the program including other aspects of energy use required, like air conditioners.

The certification process is similar to the one already known from refrigerators and the like. By filling the data of the houses into calculations developed by the Office for Air and Noise, the actual heating demand of the houses could be simulated. The climate can be considered very diverse in the province and in order to keep the system fair, the certification of the energy demand of every house was calculated on the bases of the climatic data of the capital of the province Bozen / Bolzano. According to these results the houses were then placed in different categories from A (very low heating demand) to G (very high heating demand), depending on their energy demand for heating (APB, 2003).

However, only the houses that were build with A or B standards were certified as a K/C. In addition, houses in these two categories that were built ecologically friendly and that have their whole energy supply from renewable energy were certified as K/C plus (A+ and B+). In addition, information about the energy demand for heating was displayed on a pass and handed over to the owner of the house together with a plaque that was intended to award a house as a K/C (APB, 2003).

From the beginning the program was installed as a voluntary certification. The Office of Air and Noise was aware that due to the strong resistance of the building lobby it

could not succeed in having its program implemented on a provincial level in the first place. Therefore, the office followed a different approach and instead of being obligatory, builders could certify their houses voluntarily. Nevertheless, the certification was highly acclaimed by the public. In addition, the building industry changed its attitude; over time more and more of its products were advertised as being compatible to the KCP standards (Lantschner, personal communication).

This success led to the point that the program was becoming more accepted on a political level. As of July 2004, 10 municipalities implemented the program as obligatory. Eventually the provincial government accepted the proposal and confirmed to pass a law within the year 2004 that obliges all new houses to be built according to the KCP standards. In the future, in order to meet the requirements, individuals will have to declare before the start of the building process that their houses will have at least heating level C, which means that that the energy use for heating has to be lower than 70 $kWh/m^2 \cdot a$, calculated on the basis of the data of the capital of the province, Bozen / Bolzano (Pichler, personal communication). The main reason for the success, according to the officers, is that the design of the KCP is based on three pillars: Communication, Education and the Calculation.

4.2. The three Pillars of the KCP

The three pillars are important to keep the KCP successfully running. The reader will be gradually introduced to the system of the KCP, which will increase understanding. In the following sections first each pillar will be presented together with an analysis by CLD of the subsystems they drive. Eventually these subsystems lead to the CLD that describes the whole programme.

It is important to bear in mind that, although represented like this, the different subsystems work within the system of the KCP. All of them are therefore influenced by the other subsystems. Many of the factors and their interactions are part of more than one subsystem. The borders of the single CLDs are presented by the immediate influences of the subsystems.

4.2.1. Introduction of the Communication pillar

The responsible persons put a lot of effort in making the whole program known to the public. It became highly publicised with announcements in newspapers and radio spots. The main focus was to communicate to the clientele that a K/C would increase comfort and would in the long run also economically be more attractive due to the low energy use (Lantschner, personal communication). Furthermore, the advertisement also tried to awake the environmental consciousness and a sense of pride for having a house built with high environmental standards with slogans like: ‘I am proud of my house’. Once a year, the K/C of the year will be elected, creating more public attention (Office for Air and Noise, 2003). Every K/C will be awarded a plaque that states the heating level of the house, corresponding A, B or if they fulfil ecological requirements A+ or B+.

In a way, the aspect of the user friendliness of the calculation can also be considered as being part of the communication. However, as this factor is fundamental to the calculation subsystem, its influence will be discussed further in the corresponding

section.

4.2.2. How does the Communication System work?

Before the analysis will be presented, some of the terms that are used will be explained further. In communication theory it is very common to distinguish between a Receiver Group (RG), which is the group that actually receives a message (e.g. information about the KCP), and a Target Group (TG), a group of people whose change of and influence on behaviour and/or knowledge is the actual intention of the campaign (Windahl and Signitzer, 1992).

The communication of the KCP reached large parts of the population through various media. The message sent by the Office for Air and Noise, which was to inform about the KCP and to give incentives to get certified, was received by this group. It can therefore be considered as the RG. Nevertheless, the group of people whose knowledge and behaviour the message actually tried to influence and change was a rather small part of the RG. In the end, only people that want to build a new house are the target of the KCP. This group can therefore be called the TG and the factor that the communication was aiming to influence was defined as the TG's willingness to build a K/C. Only when a future builder of a house is convinced that building a T/C is a good idea, she/he will do it, otherwise she/he will build her/his house in the habitual way.

Fig. 3: Example of the Plaque awarded to a K/C with the category of heating demand A. (Source: Office for Air and Noise, n.d.)

An increasing of the TG's willingness to build a K/C can be achieved through different factors:

First of all, members of the TG can appertain to the RG and are contacted directly through the messages send. The RG received information about the quality of the K/C, like increased comfort and low fuel costs. In addition also the environmental consciousness of the public was awakened, in which the imminent energy crisis and the negative impacts of fossil fuel use have been advised. It was communicated that by having a K/C somebody could be part of the mitigation of the problems (APB, 2003).

Another very important driving factor, which is also part of the communication program, has been the awarding of plaques for houses that fulfil the standards of a K/C. The plaque represents a novelty in the energy certification systems, and can be seen, added to the information that it provides, as a status symbol. People seem to be eager to be labelled environmental friendly. In fact, as Norbert Lantschner pointed out during the interview, several people have called the Office of Air and Noise mainly for the purpose of how to get a plaque and only indirectly about how to build a K/C.

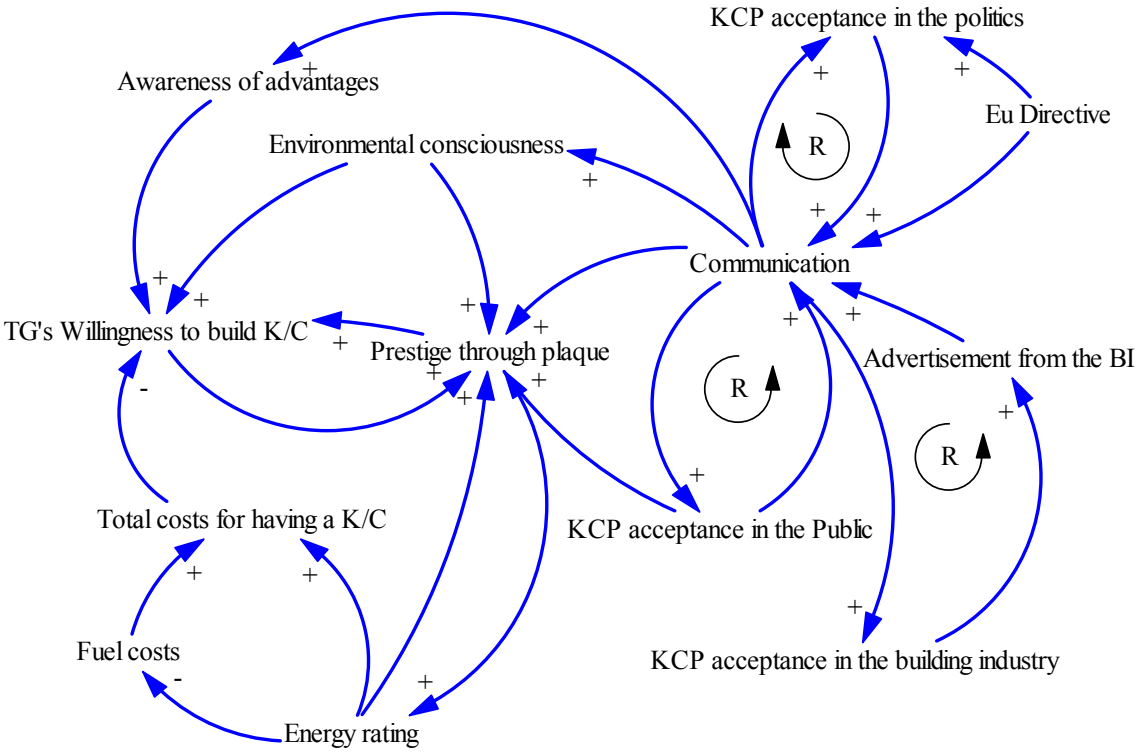

Figure 4 : The Communication CLD

Fact Sheet Communication CLD:
KCP acceptance in the Politics/Building Industry/Public: Includes awareness of the existence, acceptance and knowledge of the KCP in the Politics/Building Industry/RG;
Advertisement from the Industry: All the advertisement from the Industry related to the KCP;
Communication: Communication about the KCP;
Environmental Consciousness: Awareness of the problems caused by modern energy use and of the possibility to contribute to their mitigation by building a K/C instead of a conventional house;
Awareness of Advantages: Awareness of all the advantages of a K/C, which are not directly related to the environment, like better product quality that gives more comfort and health. Awareness of lower costs for fuel is also included;
TG's Willingness to build a K/C: Explanations in the text;
Energy Rating: Choosing of the category of energy demand for house according to the KCP;
Total costs for having a K/C: Construction costs and fuel costs.

The above mentioned factors all have a positive effect on the TG's willingness to build a T/C. the only negative influence factor indicated in the CLD are high total costs for having a K/C. The total costs for having a K/C are higher the higher the houses are rated. According to Norbert Lantschner, by choosing a K/C B the costs rise by ca. 5%, when choosing a K/C A the costs rise by ca. 15% (personal communication). On the other hand the prestige gained from the plaque increases with higher efficiency. Only houses that have the level of A and B receive a plaque. In addition, the costs can be reduced from a long term perspective through reduced fuel dependence. Costs can be reduced even further, when owners have their own energy supply, like carpenters whom can use their waste wood for energy use.

The CLD shows that eventually each person reached by the communication can be a participant in the communication process. The TG can be informed about the advantages of having a K/C not only directly, but also through the people that appertain only to the RG. The word of mouth represents an important factor; hence there is a feedback loop from the KCP acceptance in the public back to communication, because it also represents a part of communication. In addition, also the acceptance of the building industry can be increased through communication. Moreover, several companies took the occasion and found a niche by advertising their products as fulfilling the standards of the KCP. These advertisements became hence also a tool of the communication.

Reaching as many people as possible through the mass media is very useful in increasing the importance and value of the whole KCP. Furthermore, the frequent appearance of a topic in the media represents a well known pressure instrument on politicians, as they know that the public is informed about an issue. Acceptance can lead to the implementation of the KCP which leads again to higher knowledge of the public.

The appearance of the EPBD was welcome news to stress through the communication the importance of the existence of the KCP. This increased the KCP acceptance in the politics very much, as it was acknowledged for representing a possibility of implementing the directive.

4.2.3. Introduction to the Calculation Pillar

The calculation gave evidence whether a house could be certified as a K/C or not. However, as the calculation program could be downloaded from the internet together with explanations, everybody that wanted to could gain information about the heating demand of her/his house, even if she/he did not want to become certified (APB, 2003). In addition to the information it provides, the planners wanted to give architects and the like a tool with which they can calculate how high the energy use of their projects will be, without giving it first to energy experts (Lantschner, personal communication). This process leads to a decrease in work steps, and hence mistakes.

4.2.4. How does the Calculation System Work?

The planners put a lot of effort in making the calculation as user friendly as possible. The intention of this was to increase the acceptance of the public. Both, architects and ordinary people that want to build a new house are normally layman regarding the use of energy. The formulas and the tables where the data is filled in should be kept therefore as simple as possible in order not to confuse the user. However, there is a limit of how simplified and hence user friendly a calculation can be.

This limiting factor is represented by the exactness of the calculation. Exactness of the calculation means that the calculated energy demand should correspond to the actual energy use. By simplifying formulas to make a calculation more user friendly, the exactness might be affected negatively (Dijk and Spiekman, 2004). Due to reasons that will be explained further in Chapter 5, at the moment it is not possible to have enough relevant data to estimate the exactness of the calculation. A slight deviation of the calculated results from the actual energy use for heating might be accepted, an increased one not. It is therefore of vital importance that houses are monitored for a sufficient amount of time in order to correct possible errors in the system.

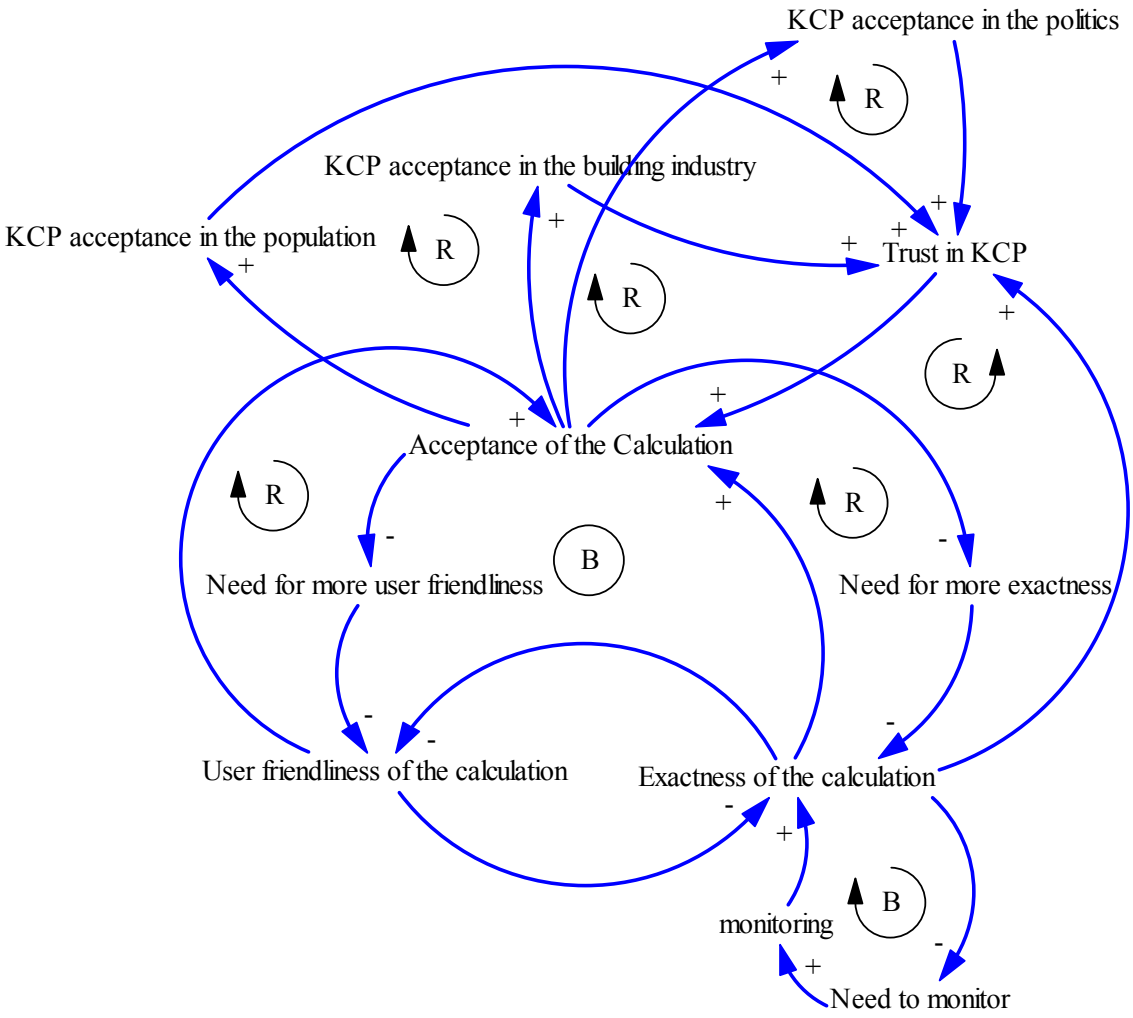

Figure 5: The CLD of the Calculation Subsystem

Fact Sheet Calculation CLD:
Exactness of the calculation: Degree to which the calculated energy demand of a K/C corresponds to its real energy demand;
Trust in the KCP: Trust that the officers of the KCP have developed a calculation method that fulfils its purpose;
User friendliness: Includes factors that enhance understanding and applicability of a calculation like transparency, simplicity and robustness [means that a calculation can "handle a variety of situations" (Dijk and Spiekman, 2004, p.5)];
Need to monitor: Need to gather and analyze data in order to see whether the calculated energy demand of a K/C corresponds to its effective energy demand.

By reading the CLD, one can see that the acceptance of the calculation is increasing the higher the two above mentioned factors are. However, once the calculation can be considered accepted by the public there is no need anymore for any of the two factors to increase. Furthermore, the two factors limit each other. The balancing loop that runs from the user friendliness over the exactness of the calculation to the acceptance of the calculation and the one that runs in the opposite direction show that there has to be an equilibrated compromise between a user friendliness and an exactness of a calculation in order to be accepted and to be committed to the ideas of the KCP.

When designing the calculation for the program the factors user friendliness and exactness were the underlying aspects that were considered. However, for being accepted in the first place after presenting the KCP, another factor was decisive. As mentioned, so far there can be no final verdicts given about the exactness of the calculation. Still, the calculation was accepted by the public, otherwise there would not have been 52 certified houses. As no official proof was given that the calculation is exact, the public simply trusted that the planners have developed a calculation that is exact. This trust of the public that increases the acceptance of the calculation is symbolised by the factor Trust in the KCP.

Although, due to the building of many K/Cs the factor trust in the KCP has shown to be big enough to drive the system, the public might demand in the future proof that its trust has been justified. This stresses how important it is to have an updated monitoring, so that corrections of the calculation, if needed, can be undertaken. In green marketing the costumers are especially critical to claims made by companies or organizations (Wasik, 1996; Welford, 1995). If the calculation shows not be correct, the trust in the KCP might decrease and the whole system of the KCP might hence be in jeopardy. Once the calculation has been proofed to be exact, monitoring for this purpose can be stopped.

4.2.5. Introduction to the Education Pillar

The education pillar provides the building industry with the knowledge about how to build in a sustainable way. One of the courses is designed to educate architects, the other to educate responsible persons in construction companies. After successfully completing the approximately 60 hours of instruction, the architects are awarded the diploma ‘Klimahaus / Casa Clima – Expert’. Companies that are lead by officers that have successfully absolved their corresponding courses will be officially acknowledged as being qualified for building houses that fulfil the requirements of the KCP. In addition, licensed individuals are offered the possibility to be registered within the KCP. Whenever people ask the Office for Air and Noise for skilled professionals they can choose hence from this list (Lantschner, personal communication).

4.2.6. How does the Education System Work?

The Subsystem of education does not appear to be as complex as the other two; nonetheless, its existence is of crucial importance as can be illustrated through the CLD. In the end, the building industry has to be provided with the knowledge to build houses that fulfil the KCP standards. With the emergence of many K/Cs the acceptance of the building industry increased significantly. What followed was an urgent need to get educated in order to be up to date. This need corresponds also to the link coming from the TG’s willingness to get certified, which expresses the increased need to get educated to fulfil the demand from the market.

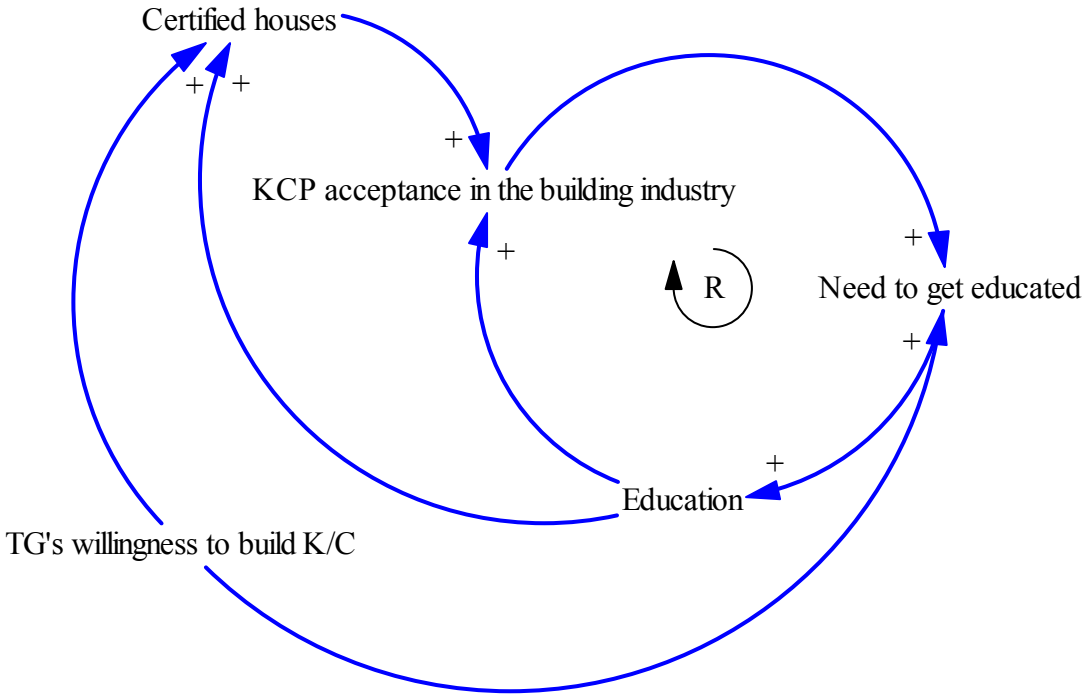

Figure 6: The Education CLD

Fact Sheet Education CLD:
Education: All education related to the building of energy efficient houses.

4.2.7. The System of the KCP

Now that the different subsystems have been analysed they can be put together and form so the system of the KCP. In the resulting CLD (shown in the Appendix) new connections are formed due to the interactions of the three pillars (signed with red arrows). In this section the System of the KCP will be analysed by pointing out some of the achievements of the program together with the factors that influenced them. As the most apparent sign of successful certification system is a high number of certifications, it will be discussed further how this has been accomplished. Another goal that the KCP could attain is the implementation of the program on a provincial level.

Certified houses
The driving factors for certified houses are the TG's willingness to build K/C, education and acceptance from the politics.

How education influences the number of certified houses has been described already in the analysis of its subsystem. The same applies to the TG's willingness to build a K/C. As pointed out in the explanation of the communication subsystem, the communication work has made many people aware of the advantages of a K/C, so that eventually they decided to build their houses in a way that fulfils the standards of the KCP.

With the increasing number of certified houses, the acceptance from the politics of the

KCP has also increased. More and more municipalities introduced the KCP system as compulsory, which eventually lead then also to an increased number of certified houses.

Of relative importance for the willingness to get certified is the reinforcing loop that passes through the factors; prestige of the plaque, TG's willingness to get certified, KCP Acceptance in the Public. The acceptance in the public influences the prestige gained through the plaque. The plaque as a standard symbol might influence people that plan to build a house to do it in a way that would suit the requirements of the KCP. With the rising number of certifications the acceptance and the knowledge of the public would increase even more and so on.

Implementation of the KCP

Before the program became implemented it had to be accepted first by the politicians. Therefore the influencing factors for this decisive aspect will be discussed further. As pointed out in the CLD those factors were communication, the resistance of the lobby, the number of certified houses, acceptance of the calculation and the need to implement the directive.

As already mentioned, the media can be a powerful means to inform people and hence pressure politicians (Filho and Bandeira, 1995). The frequent appearance of a topic that offers solutions to tackle environmental issues can pressure decision makers to react. The communication campaign tried to present its topic as frequently as possible, informing vast parts of the population. With the appearance of the EPBD the importance of the KCP could be even further stressed in the media, due to the relevance of their contents.

The possibility of implementing the EPBD might have also been a factor that eventually influenced the establishment of the program. However, the directive does not have to be implemented on a provincial as the responsibility to do so lies within the Italian Government. Still, due to the special status of the provincial government the implementation can be achieved and the province can hence obtain the prestige of becoming a precursor in mitigating energy issues.

Moreover, the 52 certified houses showed the politicians that the certification was accepted by the target group and that the market accepted the system.

In addition it was crucial to obtain through the calculation a framework for the development of policy measures.

The limiting factor for the implementation of the KCP was represented by the resistance of the building lobby. The negative attitude towards the KCP from the building industry was responsible for not implementing the program in the first place. However, as the market demanded for more and more houses that fulfil the standards of the KCP, the building industry was urged to get educated, which increased its acceptance. Furthermore, the possibility to profile themselves increased the acceptance of many companies towards the KCP.

The success on a policy level could be achieved by the KCP in a rather short time. The dynamic processes described above lead over the years to an implementation of

the program in more and more municipalities until its final acceptance on a provincial level.

4.2.8. The Use of Renewable Energy in the KCP

The KCP is an attempt to introduce a sustainable energy use in the housing sector. With the development of a certification system that eventually decreases the energy demand for heating for newly built houses, the KCP has been able to undertake one crucial step in right direction. Within the course of the year 2004 the standards of the KCP will be implemented, which means that all new houses have to be built with a energy standard that has at least level C (energy for heating < than 70 kWh/ $m^2 \cdot a$). A low energy demand for heating in new houses is hence guaranteed.

The other point that has been stressed in Chapter 1 to be decisive in mitigating future energy issues would be the switching from fossil fuel use to renewable energy use. Although, in order to get certified, it is not necessary that the houses rely on renewable energy sources, the program also gives incentives to switch to these energy sources. The main incentive is given by introducing into the certification the awarding of the plus plaque for houses that fulfil ecological requirements. To enhance the understanding these houses are indicated in the further text as K/C+.

The K/C+ are built in an ecological way, which means that only material is used that is less harmful to the environment than the conventional ones. Furthermore, no fossil fuels can be used to cover the heating demand. The kinds of consequences the introduction of K/C+ had regarding the use of the renewable energy in the province of South Tyrol is discussed in the CLD in Figure 7. However, also the general influence of the KCP in this matter will be analysed.

As already mentioned, the Office of Air and Noise left it open to the builders, which energy supply for heating they wanted to have. However, it can be assumed that through the bringing up of an environmentally important topic, the environmental awareness of the public can be raised. This leads in the end to more conscious use of energy resources. In fact, many people that have a normal K/C rely only on renewable energy resources for heating their houses, although it is not compulsory. Whether it was really the KCP that made the owners choose those resources has to be scrutinized further. However, one can at least speculate that the confrontation through the KCP with the topic of a conscious energy use made the owners of K/Cs choose energy that are more environmental friendly.

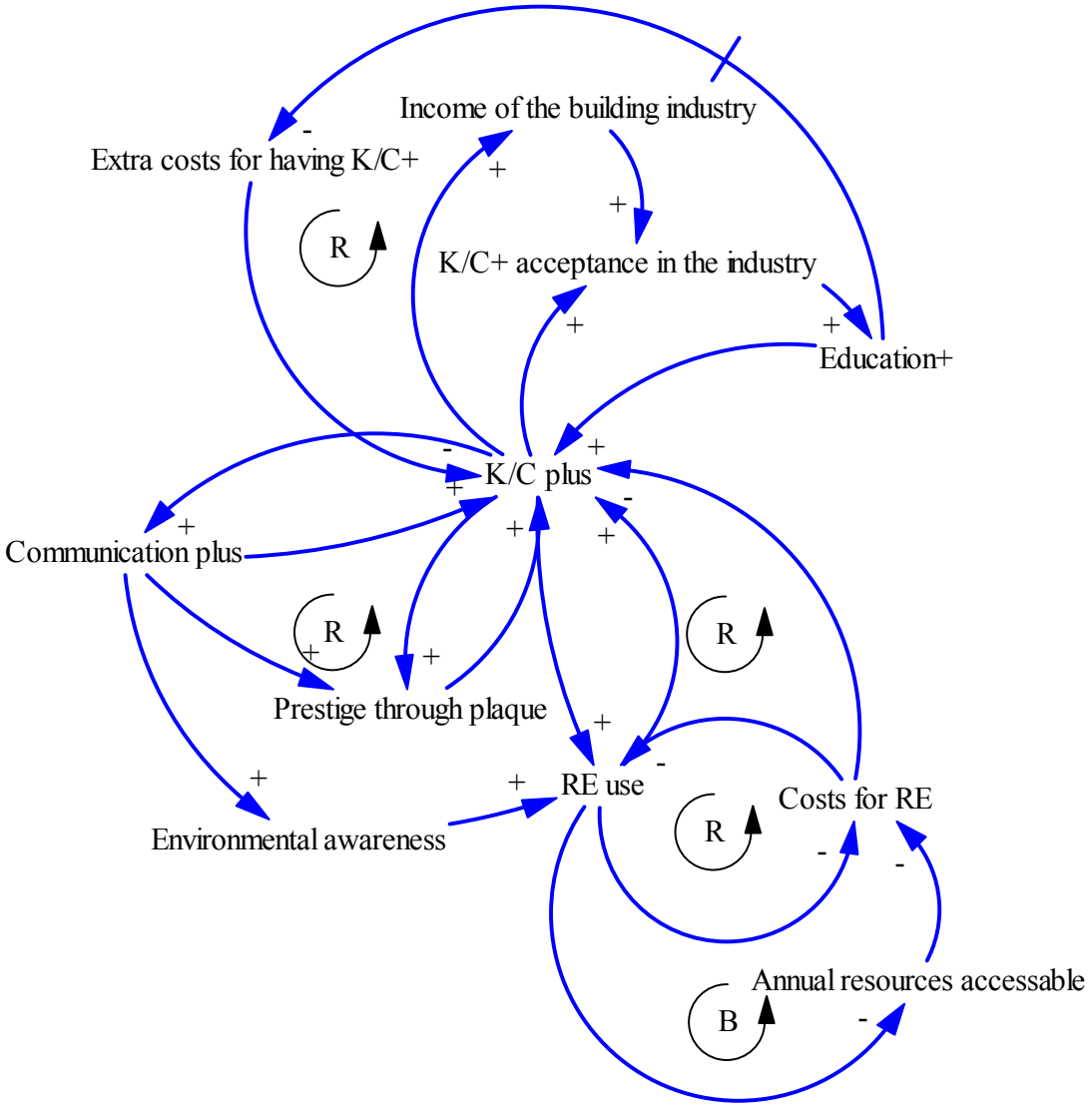

Figure 7: The effect of the KCP on the Renewable energy use

Fact Sheet Renewable Energy Use CLD:
Communication plus: Communication about the KCP with special focus about the K/C+;
RE use: Renewable energy use;
Costs for RE: Costs for using Renewable Energy;
Education+: All education related to the building of ecological friendly houses;
K/C+ acceptance in the Industry: Includes awareness of the existence, acceptance and knowledge of K/C+ houses in the Building Industry;
Extra costs for having a K/C+: Extra costs that arise for the builder when building a K/C+

Of course the use of renewable energy is also very much dependent on its prices. With increased market demand one can assume that the prices for RE would sink. Use and costs would influence each other in a reinforcing loop, as the demand from the market creates competition among the supplier with resulting lower costs, which increase demand again (Boyle, 2004; UNDP, 2000). However, this loop is balanced by the annual resource accessibility. High use would decrease accessibility, which would if critical eventually increase the costs.

With the implementation of the KCP, the communication can now focus more on making renewable energy more popular. Consequently the communication is increasing its efforts to publish the notion of the K/C+ by advertising the plus houses (APB, 2003). Again, the word of mouth plays also an important role adding to the communication, as well as the prestige of the plaque, which in the case of the K/C+ is higher as the one of normal K/Cs.

However, an increase in the number of K/C+ is also dependant on the costs one has to pay to obtain one. According to Norbert Lantschner there are still extra costs. How high these costs are and of what they consist can not easily be defined. Yet, looking at the CLD, one can see that these extra costs will be allocated to the building industry and can speed up therefore important steps in the process. The possibility of an increased income through building K/C+ is adding to the acceptance from the building industry. This acceptance urges them to get more educated in order to keep up with the latest techniques. In a long term perspective this could eventually decrease the extra costs for building ecological friendly houses, so that prices would equal conventional houses. Once the time is reached that there are no extra costs for K/C+ any more, one can assume that the number of houses would increase dramatically, as there are no obvious drawbacks anymore. One has to bear in mind though that the number of K/C+ is limited by the need to build new houses.

In CLD in Figure 8 an outlook has been taken on possible future happenings and suggestions.

Now that the laws are set that regulate the energy use for new build houses, the politicians could take one further step and give incentives to the use of renewable energy. Through the development and the implementation of the KCP, the province has gained environmental prestige. Increasing the availability of RE could increase this prestige even more. The K/C+ houses could be a driving factor for achieving this.

With more and more K/C+ appearing, the politicians will get more familiar with its concept and will understand its positive consequences on the environment. Undertaking green measures is popular (Wasik, 1996). Although the system is reinforcing itself, further policy measures could speed up the process even more and could further have beneficial consequences on the economy.

For this purpose policy instrument could be designed that facilitate the building of K/C+. Subsidies that equal the extra costs for the builders could be one policy instrument. With this the number of K/C would increase, increasing therefore also the income for the building industry. After some years, one can assume that through the market competition the extra costs would fall away, and the subsidies could fade out.

The other instrument could aim at facilitating the access to renewable energy. With this two positive aspects could be achieved. First the transition from fossil fuel use to renewable energy use could be speeded up. On the other side one can assume that also the K/C+ numbers could be increased as the access to renewable energy and therefore one of the prerequisites for obtaining a house that is ecological friendly could be achieved more easily.

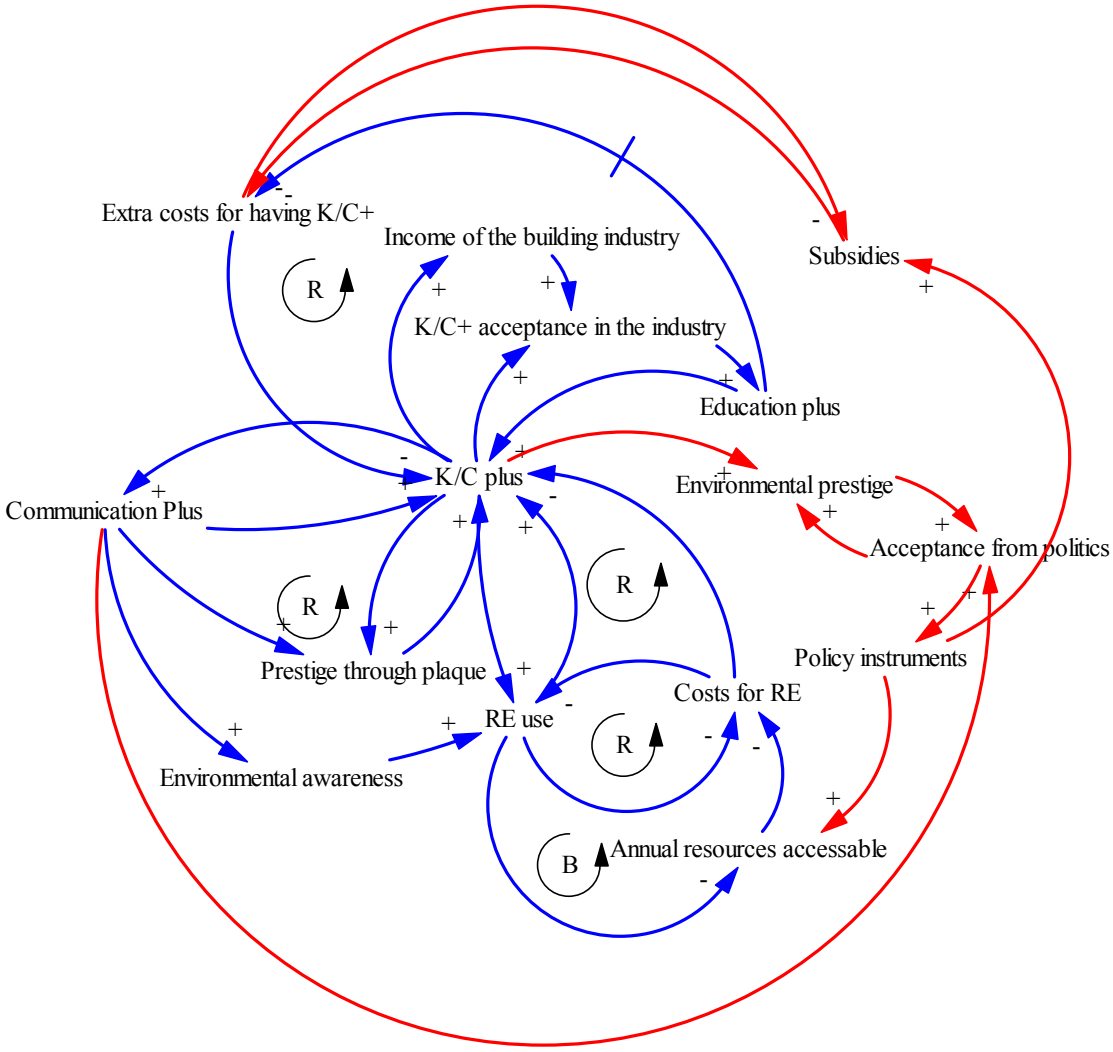

Figure 8: The effect of the KCP on the renewable energy use

Fact Sheet Renewable Energy Use CLD2:
Acceptance in the Politics: Includes awareness of the existence, acceptance and knowledge of K/C+ houses in the Politics;
Environmental prestige: Prestige Arising for the province from the existence of K/C+;
Policy Instruments: All Policy Instruments that facilitate the building of K/C+;

Chapter V

Results and Discussion

The KCP program is a good example of how a certification program can be run in order to achieve lasting success for a more sustainable use of energy in the housing sector. This was achieved through the design of the program, which is based on the three pillars presented and analysed in Chapter 4: Communication, Education and Calculation.

Roughly, each of the prerequisites that have been claimed in Chapter 1 for being necessary for achieving sustainable energy use in housing can be attributed to be represented by one of the pillars on which the KCP is based. The communication was mainly responsible for the behaviour change through giving information and the awarding of the plaque, the education provided the building industry with the knowledge of constructing houses that fulfil the standards of the KCP and the calculation provided the basic framework. However, although at first the edges of the influence and responsibility area of each of the pillars seem to be quite clear, on a second look they become more blurry. The education pillar, for example, provided the development of technology that made the building of houses possible. Still, on the other side it also had a positive effect on the attitude and on the behaviour of the building industry that was not so welcoming to the KCP in the beginning of its introduction.

The prerequisites are necessary for the success of the KCP. First of all, a calculation was presented that allowed the program to fulfil its purpose, which is "providing documented assurance that a product or management system conforms to a standard" (Toth, 2002, pp. 85). However, after setting the standards, there have to be enough companies that are able to build houses that are energy efficient. This can only be achieved through education that in this scenario was offered by the KCP itself. This facilitates the development of new, more sustainable building techniques. Still, in the end the 'product' K/C has to be bought by the people. The program has to undertake measures to create market demand.

In the following discussion the prerequisites will be discussed separately to increase understanding. However, sometimes there will be overlapping with other prerequisites. In the calculation part for example it will be stressed that it is important to achieve proper user habits in order to obtain data that can give information about the accuracy of the calculation. Nonetheless, in order to achieve proper user behaviour it might be necessary to undertake measures that achieve a behaviour change. Although this example might appear confusing at first, it is just stressing more the importance that in a successful certification program the aforementioned prerequisites have to be present at the same time and have to go hand in hand.

5.1. Achieving Behavioural Change

One of the reasons why many other environmental projects fail is that the public is simply not aware of its existence (Lundgren, 1999). The Office for Air and Noise made an effort to present its topic in the media. The public, the building industry and, last but not least, politicians were informed about the KCP. Awareness of the existence alone is increasing the value of the project and hence also its acceptance significantly. Of course the pure knowledge about the project is still not obliging people to build a K/C. Information seems to "affect attitudes, but it is not sufficient alone to promote behaviour change" (Bell et al., 1996, pp. 536).

To get certified, people had to change the way houses were normally built. The KCP therefore had to aim at a successful behaviour change. The CLDs in the analysis part already gave an insight in the factors that achieved this change. Another model presented in this part will explain further, which factors eventually resulted in a change in behaviour.

The model has been developed from scientists dealing with behavioural community psychology (Sjödén, 1999). It consists of the three factors "Self-Esteem", "Empowerment & Optimism" and "Belonging & Ownership". The probability of a behaviour change increases when one of these factors is present. The more factors are present (overlap) at the same time, the more likely a behaviour change will occur. The model was applied mainly in occupational safety, however it also "indicates important conditions for increasing the chance of individuals committing to a more environmentally friendly lifestyle" (Sjödén, 1999 p.70). The different factors above mentioned will now be analysed in the context of the KCP in order to see whether they are presented in the program.

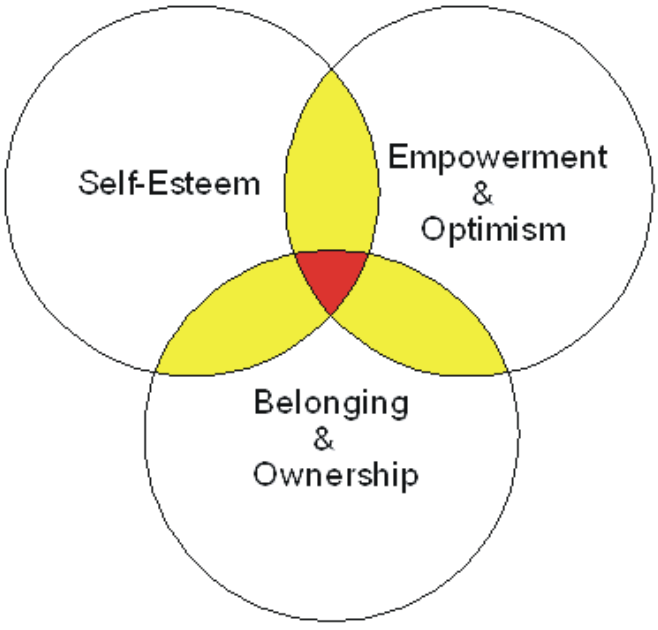

Figure 9: The Actively Caring Model (Source: Sjödén, 1999)

Figure 8: The Active Caring Model

Individuals have Self – Esteem when they "feel valuable" (Roberts and Geller, n.d., p.1). For getting certified the owners had to limit the energy for heating of their houses to 50 kWh/m2·a. Still, after fulfilling this requirement the rest of the decision could be taken by the owner of a K/C. She/he could decide which energy supply to use and also how high the efficiency of the houses will be. He could choose therefore between A, B, A+, B+, leaving it up to the builder how much he wanted to invest in the efficiency and "to develop his own justification for the new behaviour" (Sjödén, 1999 p.85). Furthermore, as the calculation was kept user friendly and accessible for

everyone, the public felt that it was involved in the process and could actively overlook the processes.

People can be attributed to have “Empowerment and Optimism” when, i.e. they “feel they can make a difference” (Roberts and Geller, n.d., p.1). When confronted with environmental problems, individuals often do not think they can make important changes. In the communication program attention was paid to let people feel that by building a K/C instead of a conventional house the builders can contribute actively to mitigate the energy issue. Furthermore, the whole development of the KCP shows how important the contribution of single individuals is for achieving high environmental goals. Although 50 certified houses within 3 years can be considered a huge success, considering the almost half a million people living in the province, the people that in the end actually ‘bought’ the ‘product’ K/C are very few. Nevertheless, their action influenced the implementation of a law that will decrease the energy use for future generations by an enormous amount.

The last factor in the actively caring model is the belonging and ownership factor that makes persons feel like they “belong to a group” (Sjödén, 1999, p.71). With the awarding of the plaque the owner of a K/C is giving this opportunity. Owning a house that fulfils the ecological standards is becoming a status symbol. Furthermore, being an environmental acting person is becoming fashionable these days. Having a plaque on the entrance of the house stating the low energy use is adding to the prestige of the owner.

One question remains of how influential the economic factor was in choosing to build a K/C. These houses cost, so far, more than conventional houses. However, from a long term perspective, there are savings in spending, as less energy has to be bought. A survey could give more information about the motives and priorities when choosing a K/C.

However, a behaviour change has been achieved in a group other than in the Target Group; the building industry. The attitude of the industry towards the KCP has not been so good in the beginning of its introduction. Nevertheless, due to the circumstances created by the program, this changed. First of all, the demand for houses with high efficiency forced companies to accept the KCP, as they had to be up to date. Furthermore, many companies understood that they could use the common trend which has “made the environment one of the key tools to gain competitive advantage” (Font, 2001 p.1) and suited their advertisement with the K/C label. Also, by offering the possibility to get educated the industry was invited to take part in the process.

Last, but not least, the behaviour changes of the politicians made the implementation of the KCP possible. From now on all new houses will therefore be built with high energy efficiency. This could be achieved through the pressuring of the media and through the presentation of a working program that was accepted by the market and offered furthermore a possibility to implement the EPBD.

5.2. The calculation

As the calculation about the energy demand represents the core part of every energy certification, its exactness will be further scrutinized in this section. Already in Chapter 4 it has been pointed out that an accurate calculation is vital for the running of the KCP. In addition, a closer look will be taken if the technical part of the program fulfils the requirements of the EPBD. This is important for a possible implementation of the KCP as part of the Directive.

5.2.1. The Actual Energy Use for Heating in K/Cs

As of July 2004, 50 houses have been certified as K/C. During the field work of the thesis, information about the availability of data about the actual energy use for heating of 36 of the houses has been retrieved from officials or through personal contact via telephone. Data from two houses were received from the Office for Air and Noise. Twelve owners could not be contacted in time.

The results that could be obtained were very poor. Only one owner could give valid information about his effective energy use for heating. For the rest of the houses the retrieval of data failed due to various reasons (see figure 10):

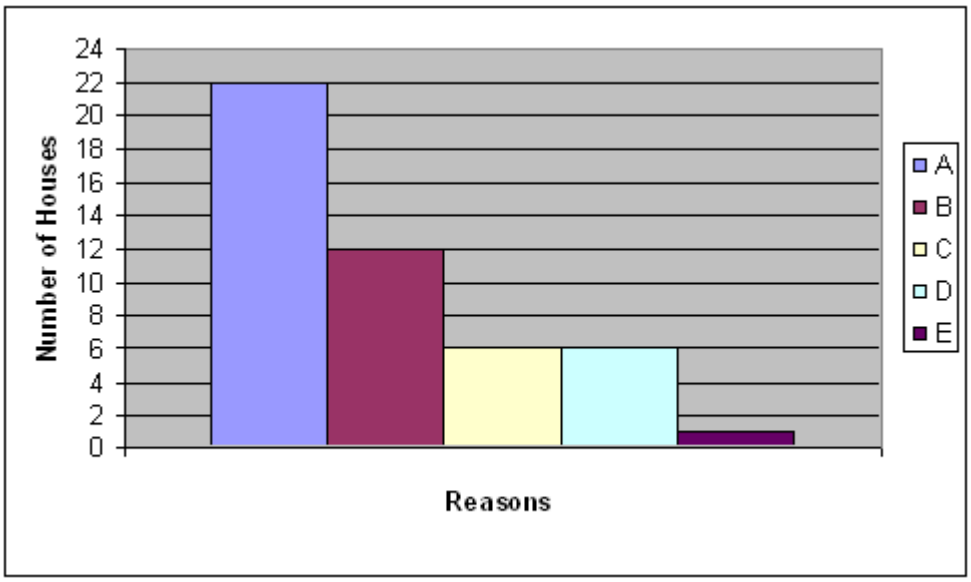

Figure 10: Reasons for not obtaining valid data. A, houses inhabited > 1 year; B, could not be contacted in time; C, mixed data; D, no book keeping; E, refused to give data. n = 47

Twenty-two of the houses were not or only partly inhabited for more than 11 months, which made yearly use calculations impossible. One owner refused to provide information.

Six owners were not book keeping their energy use for heating. This had various causes: Some people had their own energy supply, e.g. carpenters that could use their wood wasted during the working process in order to heat houses and water. As energy products were abundant they did not find it necessary to book keep their use. Another reason was that the energy supply was achieved through more than one source, e.g.

through pellets and solar energy; so that the owners reckoned it to be too difficult to book keep. Furthermore, they trusted in the low energy calculations of their houses, as they were using very little fuel.

Six owners were book keeping the energy use for their houses, but they used the same energy source for more purposes than just for heating (e.g. warming water). As it was not possible any more to differentiate between the energy used for heating and between the energy used for other purposes, the data gained from these houses could not be used for surveying whether the calculations have been exact.

As already mentioned, only one owner was able to tell how much energy he spend for heating. The person had a calorie counter installed on his heating installation. The counter revealed that he used 10669 kWh in 2003, which is, calculated on the square results 30,4 kWh/ m^2·a. This number is very close to the calculated one, which is 29,1 kWh/ m^2·a. However, there is the need to verify whether this data can be used, as it not sure if his calorie counter is calibrated in a proper way. However, the results lead to the assumption that the calculation in this case was quite accurate.

The office of Air and Noise is so far monitoring two houses. These houses were built for the account of two institutes that deal with social building situations.

House Nr. 1:
Condominium split up into 16 individual apartments. The House is certified as K/C B with the calculated energy demand for heating of 71kWh/m^2·a. All dwellings are attached to the local district heating and the official meter gave the result that in the year 2003 they all together consumed 47339 kWh which is 72 kWh/m^2·a. This number is very close to the calculated one. However, some apartments have an extremely low heating demand, which could suggest that the owners have not lived in them the whole year. Still, all residents have moved in their apartments officially before 2003. A survey on the habits of the different owners could give further information, but due to time restrictions this was not possible. Nevertheless, deviations in energy use are nothing unusual and therefore the calculation can be considered pretty exact.

House Nr.2:
This house is also a condominium, but the situation is quite different. All the apartments share the same bill. According to this official bill the whole house consumed 42500 l of oil for two years. However, the energy was used not only for heating, but also for the 1506 m^3 warm water used in this time. With some mathematical formulas an estimation of the amount of energy used for heating has been carried out.

First it is necessary to estimate the energy that has been used for warming the water. As it is not known with which temperatures the water has been heated from and to, the assumption was made that the used warm water had 60 °C at its highest point and 12 °C at its lowest point. These numbers are taken for ΔT.

The formula for energy is: $Q = c * m * \Delta T$

$=4190\ J/kg{\cdot}K * 1000\ kg/m^3 * 1506\ m^3 * (55\text{-}12) = 271336020000\ J = 84135\ kWh$

Assuming that the counter was placed in the heating room, there is the need for calculating more primary energy, as the energy of the oil can not be used to 100%.

$Q_w = Q^* \eta_p = 75371 * 1/0,85 = 98982 \text{ kWh}$

$Q_p = Q - Q_w = 425000 \text{ kWh} - 98982 \text{ kWh} = 326018 \text{ kWh}$

$Q_h = Q_p * \eta_p * \eta_r * \eta_d * \eta_e = 336328 * 0,85 * 0,96 * 0,95 * 0,96 = 242619 \text{ kWh}$

=> 121309 kWh/a

Q_w = *Energy used for water*
Q_p = *Primary energy used for heating*
Q_h = *Energy used for heating*
η_p = *0,85 oil/ production*
η_r = *0,96 regulation*
η_d = *0,95 distribution*
η_e = *0,96 Emission*

Q_h = 125146 kWh/a, which is accordingly ca. 84,9 kWh/m^2·a

The energy demand calculated with the program of the KCP was 100398 kWh, 70kWh/m^2·a. This value is significantly lower than the simulated energy use for heating.

5.2.2. Discussion of the Data

The calculation showed that one of the two monitored houses could not be heated with the energy standard calculated with the formulas from the certification. However, even in this case the calculation can not be considered as a failure. A new built residential house of average size needs at least 2 years from the point it was inhabited, until it reaches a steady state for heating demand. For bigger houses this time is considered to be even longer (Hagentoft, 2002). In the light of this fact, the deviation of the actual energy use for heating to the calculated one seems not to be too disproportionate.

Another possible explanation for the high energy use for heating could be the user habits of the different inhabitants. As the whole community shares one bill, there are no incentives for the single user for a conscious use of the energy supply. In the end of the year the costs for the whole energy supply are split up evenly between the different residents. The problem of a selfish use that can occur when people share the same resource has been already theorized in the 'Tragedy of the Commons' (Carter, 2001). On the other hand the residents could have been simply not aware of how to use their apartments properly in order not to waste energy.

Although the analysis of the data at this point can, due to the mentioned facts, give no final verdicts, its retrieval is of crucial importance for the further success of the KCP. Data that shows high deviance of theory and practice could lead to the corrections of calculations, before the trust from the public in the KCP has been destroyed.

Furthermore, if the KCP is going to be acknowledged as part of implementing the EPBD, officers might demand proof for the accuracy of the calculation.

As there are many people living in the houses that are monitored by the Office for Air and Noise, it is difficult to have exact numbers about the effective energy use, as the user habits are so different. A suggestion could be to extend surveys in the future to single family houses, as it is much easier to point out possible wrong user habits and value hence the exactness of the data. The unsuccessful retrieval of data for this thesis showed that, so far, there is not enough awareness about the importance of such data recording in the public. Many people owning a K/C did not do any recordings of energy use, which leads to the assumption that these individuals are trusting in the calculations of the KCP and presuppose that their actual energy use corresponds to the calculated one. This trust might be enhanced due to the low expenditures for the energy supply. On the other hand most of the people that were book keeping the actual energy use were doing it in a way that could give only little information about the accuracy of the calculation for heating demand. Also in this case officers could help by informing the people.

Although, as already pointed out in Chapter 4, once proof has been given that the calculation is accurate, monitoring for this purpose can be stopped, final judgements about the exactness of the calculation can only be given if the energy is properly used. The data from the two houses monitored showed that individuals living in similar apartments differ very much in terms of energy use. As already mentioned, high energy use might not just result because of the 'tragedy of the commons' problem. Providing the inhabitants of K/Cs just with the right technology is not enough, she/he should also be provided with the right knowledge on how to use it. "Sometimes behaviour change will be more important than physical technology in effecting solutions" (Bell et al., 1996, p.522) as "the impact of any technology depends on people's behaviour - how they use it" (ibid., p.523). Giving people feedback on proper energy use by checking their habits could limit wasting significantly, as surveys show (Bell et al. 1996; Sjödén, 1999).

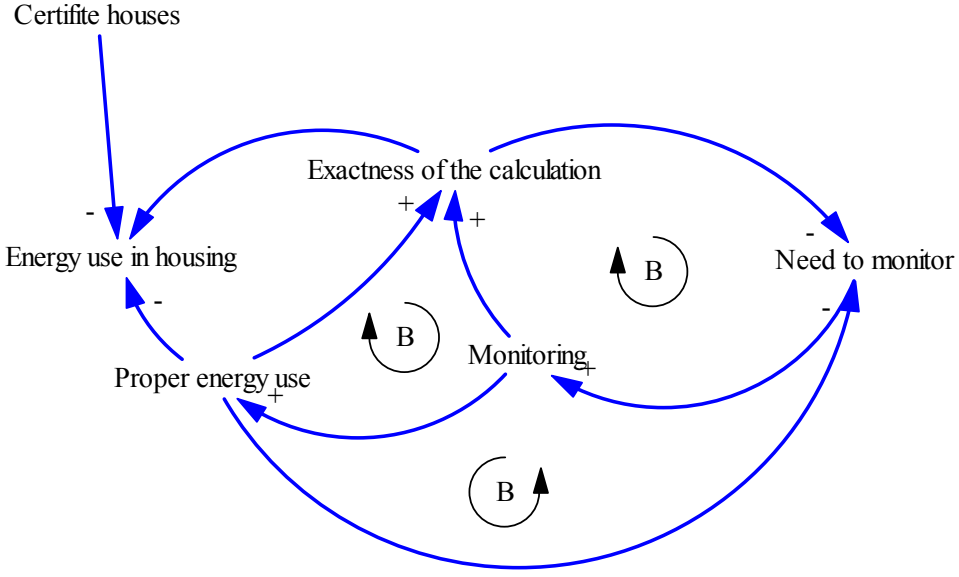

Figure 11: Importance of monitoring calculation and user behavior.

Figure 11 explains the importance of checking user habits and exactness of the calculation. It represents an extension of the CLD presented in the Appendix as the KCP system (is marked in this figure with green arrows). By building K/Cs instead of conventional houses a reduction in energy use and CO2 emissions in residential housing results. However, this can only be achieved when the calculation gives exact information about the energy use. Theoretically, the calculation could even simulate a higher demand of energy than what is actually needed; therefore, no polarisation has been given to the arrow. Monitoring the user habits is necessary for both, giving proof about the exactness of a calculation and for investigating user habits, and hence achieving low energy use.

5.2.2. Comparing the KCP to requirements of the EPBD

The EPBD is part of the EU's commitment to the Kyoto Protocol. All member states have to come up with plans on how to implement it by January 2006. The content of the KCP is related to this paper, and for a while has been advertised as a possibility to deliver the aims of the directive. In this section it will be scrutinized whether the KCP fulfils the requirements of the EPBD.

According to the official text of the EU (2003, article 1), the requirements of the directive are as follows:

> a) The general framework for a methodology of calculation of the integrated energy performance of buildings;
> b) The application of minimum requirements on the energy performance of new buildings;
> c) The application of minimum requirements on the energy performance of large existing buildings that are subject to major renovation;
> d) Energy certification of buildings; and
> e) Regular inspection of boilers and of air-conditioning systems in buildings and in addition an assessment of the heating installation in which the boilers are more than 15 years old.

By reading the requirements one can already understand that it is, from a logistics aspect, almost impossible to gather all the points in one program. A splitting up of the singular points in order to create a different program to succeed seems to be more reasonable. In fact also in the KCP only one of five points has been included. Furthermore, as energy use for warm water and air conditioning has not been included, no information about the whole integrated energy performance can be given.

So far the certification only gives information about the energy demand for heating of newly built houses, but it represents a starting point and could be expanded or supplemented. The office for Air and Noise is already working on a follow up of the actual program which includes other energy use in buildings such as air conditioning. These could be added to the already existing certification, which could expand the coverage of almost all of the five points of the requirements by the directive. Only point five seems to need a different approach.

The main objective of the directive is "to promote the improvement of the energy performance of buildings within the Community, taking into account outdoor climatic

and local conditions, as well as indoor climate requirements and cost-effectiveness" (EU, 2003, article 1). The first part of this objective can be seen as fulfilled by the KCP. Promotion for the energy performance is achieved by giving incentives to reduce energy use for heating. The fact that, on a European level, heating is accountable for more than 50% of the energy used in residential housing, stresses how important it is to increase the efficiency of this aspect (Warren, 2003). Moreover, one can assume that houses that have low heating levels can also be cooled in a more efficient way.

One of the other points of the objective that has been stressed several times throughout the whole text of the directive is that the measures that are going to be undertaken should take into account the regional and local climate characteristics. This has been achieved by introducing in the formulas several constants that give information about the climate in the different municipalities. The most important of them is the constant heating degree days, which is determined by adding over all the heating days of a year the difference between the indoor temperature (defined in the KCP as being 20 °C) and the medial daily outdoor temperature of every municipality (Connor, 1998). Although the province covers a relatively small area, due to the mountainous geography the climate can be very distinct in the different parts; therefore it is crucial to allocate a variety of constants like heating degree days to every municipality in order to be able to have accurate heating demand simulations.

Cost-effectiveness is given through the fact that the price for building houses with standard C is the same the one of conventional houses (Lantschner, personal communication). The coming law obliges builders of new houses to build with this standard; therefore there would be no extra cost. Estimation says that by building with B standards, prices increase by 5% and by A standards they increase by 15%. However, due to the low costs for fuel, from a long term perspective a house with high efficiency pays off anyway.

Furthermore the directive demands the certifications to be presented in a transparent manner and possibly with information about CO_2 (EU, 2003). This has been achieved with the pass that the owners of K/Cs obtain. Among all the necessary information it includes also the approximate amount of CO_2 that will be emitted, by heating the house.

In addition, the EU developed a general framework for the calculation of energy performance of buildings in the annex of the directive. Most of the points have been considered, except the ones that are related to warm water, lighting and air conditioning (APB, 2003). The calculation is further based on the following norms (ibid., p. 22):

> ÖNORM B 8110-1
> EN ISO 6946:1996 Building components and building elements - Thermal resistance and thermal transmittance - Calculation method
> EN ISO 10077 – 1: 2000 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance. Part 1: Simplified Method
> EN ISO 832:1994 Thermal performance of buildings - Calculation of energy use for heating - Residential buildings

All the Norms, except the ÖNORM B 8110-1 are developed by the International Organization for Standardization. The standards set by this organization are internationally recognized (ISO, 2004).

5.3 Facilitating the Development and Introduction of New Technologies

The building industry had to play a vital role in the KCP. In the end it had to provide the product K/C. The fact that the houses were built unsustainably was the reason for the development of the KCP in the first place. Communicating the need to change the way of building is a difficult and sensitive matter, even more so because of the industry's unreceptive attitude towards a more sustainable building approach. After all, this program implied major investments. However, through the inclusion of the industry in the KCP program, by offering it education, it was possible to involve the stakeholders to improve shared benefits, which is important in a holistic management (Wasik, 1996). Through the provision of this education possibility, a dynamic process was started. The industry was eventually advertising its products in the light of the KCP, which increased further knowledge about the program and hence also demand.

The second aspect that was facilitated by the program is the use of renewable energy resources. Next to the bringing up of the need to a have an ecological approach in the housing sector through the whole KCP, the introduction of the K/C+ was a main influence. Although it is not obligatory for being certified as a K/C, very few certified houses rely only on fossil fuel use, which shows how popular the topic 'renewable energy use' has become. It is up to the politicians now to design instruments that make renewable energy use more affordable, and hence also more popular. On the other side they could gain more prestige through a greening of their decisions. As the implementation of the program has been achieved, the officers of the KCP could try to make renewable energy sources more popular by focusing its communication more on this aspect.

Chapter VI

Conclusion

Energy issues are one of the most frequently discussed topics in the environmental field. There are many attempts of policy makers to mitigate the problems, of which the Kyoto Protocol is the most prominent one. In the light of this agreement, the EPBD has been developed, which requires the member states of the European Union to develop regulations to decrease energy use in the building sector. This is of special importance, as this sector accounts for large share of the total energy use and the CO_2 emissions in the Union.

In the Italian province of South Tyrol a certification scheme for heating demand in residential housing was developed already before the appearance of the EPBD. This program was able to introduce a more energy efficient building type on a local level. In particular, the design of the program was based on three factors that are of crucial importance. These are believed to be necessary prerequisites for every certification program that aspires to achieve sustainable energy use in new residential houses. These factors have to be present at the same time for the success of the program, since they all influence it and each other in a dynamic way.

In fact, the fundamental basis of the certification program was a calculation that is as accurate and user friendly as possible. It provided the building industry with a tool of how to calculate energy demand of their projects without giving it first to energy experts. In addition, with this calculation it was possible to classify buildings according to their energy use. Moreover, the local government was provided with a framework for policy measures that regulate energy use in the housing sector.

This specific certification program has also undertaken measures to create a market demand. In this sense, people have to choose to build houses that are energy efficient instead of building them in the conventional way. For this purpose measures that achieve behavioural changes have been adopted. In this case convincing individuals that they are valuable and that they have freedom in choosing between different options is of crucial importance. In addition, introducing the plaque as an award for choosing an environmental option has been a successful factor.

Still, the market has to supply sufficient number of energy efficient houses to cover the demand. This implies that the building industry must be educated in order to provide the costumers with houses that fulfil the standards of the certification program. A new, more sustainable building type has to be developed eventually. Moreover, the analysis of the thesis showed that the inclusion of the industry in the development of the program is helpful in achieving its receptiveness. Hence, the establishment of the program as a valid label can be enforced.

Few suggestions for improvement of the program have been pointed out throughout the thesis. The most important one would be to provide the users of K/C advice on how their houses could be properly used in order not to waste energy. This is because in the end the impact of every technology depends on how it is used.

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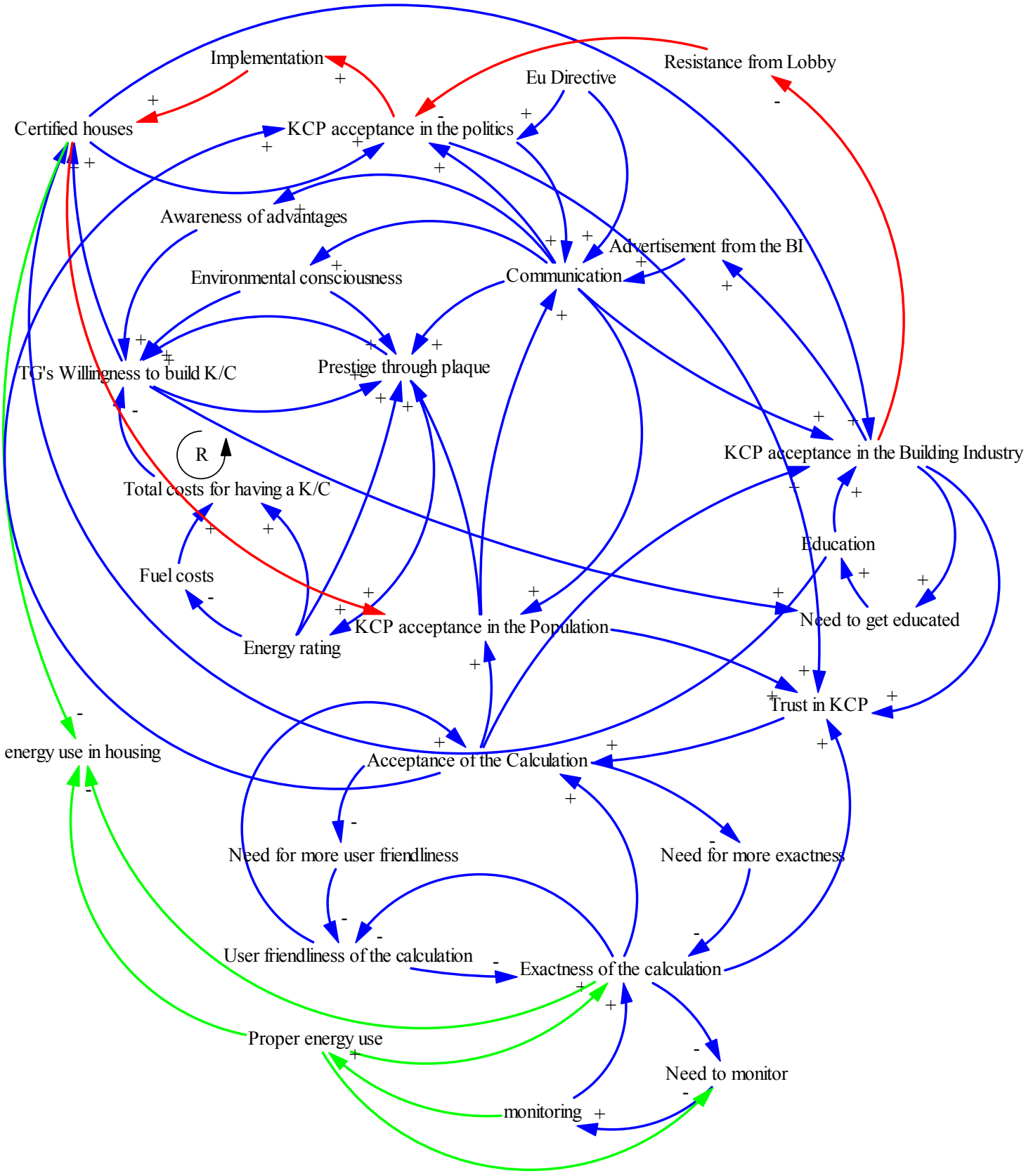
Interviews:

- Lantschner, N. Head of the Office for Air and Noise. Interview on August 24th, 2004

- Pichler, G. Engineer employed in the Office for Air and Noise. Interview on July 19th, 2004

Appendix

The CLD of the KCP



General framework for the calculation of energy performance of buildings (EU, 2003, Annex)

1. The methodology of calculation of energy performances of buildings shall include at least the following aspects:
(a) thermal characteristics of the building (shell and internal partitions, etc.). These characteristics may also include
air-tightness;
(b) heating installation and hot water supply, including their insulation characteristics;
(c) air-conditioning installation;
(d) ventilation;
(e) built-in lighting installation (mainly the non-residential sector);
(f) position and orientation of buildings, including outdoor climate;
(g) passive solar systems and solar protection;
(h) natural ventilation;
(i) indoor climatic conditions, including the designed indoor climate.