How to specify the building energy use to realize sustainability in the upcoming project of Östra Sala backe

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Abstract

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In this report the upcoming sustainable residential district of Östra Sala backe in the city of Uppsala is studied. The aim of the thesis is to map and analyze the content of the chosen constructor's specific energy use and how they have calculated it. The aim is also to analyze how some actors in the energy sector recommend that the specific energy use should be calculated. The study is based on interviews with the constructors and reviews of their applications. With the information from the interviews the specific energy use could be mapped and compared. The result shows uncertainties in the presented values, mostly due to the early stage of the project. The project is the first of this kind in Uppsala but similar projects has been both planned and built in other Swedish cities. Differences and similarities between the earlier projects and Östra Sala backe are considered.
Definitions

A\textsuperscript{temp} \textsuperscript{1} 

The definition of A\textsubscript{temp} is the building floor area that is heated to more than 10 degrees Celsius.

BBR 

BBR, Boverkets Building Rules, is the Swedish National Board of Housing, Building and Planning (SNBHBP) demands and regulations for new Swedish buildings regarding for example design, hygiene, safety and energy-saving.

BREEAM 

BREEAM is the most used certification system in Europe and is based on a grading system of different sections.\textsuperscript{2} Energy use is just a small part of the entire evaluation, and a BREEAM certified building does not need to be a low energy building.\textsuperscript{3}

COP 

Coefficient of performance, amount of heated energy generated per unit of contributed electricity.

District heating 

District heating is a system where buildings are connected to a grid of underground pipes. Heat for space heating and domestic hot water is produced in a central heating plant and distributed to the connected buildings.\textsuperscript{4}

FTX-system 

A FTX-system recycles heat from the exhaust air. Heat is transferred from the warm exhaust air to the cold supply air in a heat exchanger.

Specific Energy Use 

The specific energy use consists of the energy that is delivered to a building for space heating, domestic hot water and the property electricity. It is measured in kWh/m\textsuperscript{2} A\textsuperscript{temp} and year.\textsuperscript{5}

Svanen labeling 

The most important quality of a Svanen labeled building is that they are energy-saving, have a small impact on the climate, are built with material which has a low environmental effect as possible, that they have a good indoor environment which is healthy to live in and finally that the buildings has a simple

\textsuperscript{1} Boverket: Vad är Atemp?: Internet.
\textsuperscript{2} Sweden Green Building Council: BREEAM: Internet.
\textsuperscript{3} Wahlström et al., (2011) Marknadsöversikt av uppförda lågenergibyggnader.
\textsuperscript{4} Energimyndigheten: Fjärrvärme: Internet.
\textsuperscript{5} Boverkets författningssamling (2011), BBR 19.
operation and supporting plan to ensure that the buildings stays energy efficient during a long time. In an energy perspective, the building should have water-saving toilets and blenders, good insulation values, a low energy need and energy marked appliances.6

**Waste water recycling**

A waste water heat exchanger recycles the heat from the sewer pipe to preheat the cold water. The heat from the waste recycling could then be used in a heat pump.7

**Weighted energy**

The concept of weighted energy is used in order to relate different kinds of energy use to their respective source. This enables a comparison between the use of different energy carriers. The concept is related to the concept of primary energy. The weighted energy includes all the environmental effects through the energy’s life cycle and the weighting factor relates to the energy source’s whole energy content, from extraction to the energy use in the building.8,9

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6 Veidekkebostad, *Om Tellhus*: Internet.
8 Riksdagen, *Statens offentliga utredningar*: Internet.
1. **Introduction** .................................................................................................................. 5
   1.1 Aim .............................................................................................................................. 5
       1.1.1 Research questions ............................................................................................... 5
   1.2 Disposition .................................................................................................................. 6

2. **Background** .................................................................................................................. 6
   2.1 Östra Sala backe ......................................................................................................... 6
   2.2 Requirements for new buildings in Sweden .............................................................. 8
   2.3 Energy sector recommendations ............................................................................. 9
       2.3.1 Sveby .................................................................................................................. 9
       2.3.2 FEBY ................................................................................................................ 10
       2.3.3 The Swedish Energy Agency (SEA) .................................................................... 11
   2.4 Parameters for energy use ....................................................................................... 11
       2.4.1 Domestic hot water ............................................................................................ 12
       2.4.2 Property electricity ............................................................................................ 12
       2.4.3 Heating ............................................................................................................... 12
       2.4.4 Internal Heat gains from human presence ......................................................... 13
       2.4.5 Indoor temperature ............................................................................................ 13
       2.4.6 Household electricity ........................................................................................ 13
       2.4.7 Heat recovery using FTX systems ..................................................................... 14
       2.4.8 Building integrated energy utilization ............................................................... 14
       2.5.9 Airing ................................................................................................................. 15
   2.6 Similar projects ......................................................................................................... 15
       2.6.1 Malmö - Västra Hamnen .................................................................................... 16
       2.6.2 Stockholm - Norra Djurgårsstaden and Hammarby sjöstad ......................... 18

3. **Methodology** ............................................................................................................... 18

4. **Result** .......................................................................................................................... 19
   4.1 Constructors ............................................................................................................. 19
       4.1.1 Hauschild + Siegel Architecture AB ................................................................. 19
       4.1.2 TB Exploatering AB ......................................................................................... 20
       4.1.3 Veidekke AB ..................................................................................................... 21
       4.1.4 ByggVesta AB ................................................................................................... 22
       4.1.5 Svenska Vårdfastigheter AB ........................................................................... 22
       4.1.6 Wallenstam AB ................................................................................................. 23
       4.1.7 Järntorget Bostad AB ....................................................................................... 24
       4.1.8 Åke Sundvall Byggnads AB ............................................................................... 25
       4.1.9 Summing ............................................................................................................ 26
   4.2 The municipality of Uppsala ...................................................................................... 26
   4.3 Parameters of energy use – results sum up ............................................................... 27
4.3.1 Domestic hot water ................................................................. 27
4.3.2 Property electricity ................................................................. 28
4.3.3 Heating .............................................................................. 28
4.3.4 Human Heating ................................................................. 29
4.3.5 Indoor temperature ............................................................... 29
4.3.6 Household electricity .......................................................... 29
4.3.7 Heat recovery ....................................................................... 30
4.3.8 Building integrated energy utilization ..................................... 30
4.3.9 Airing ................................................................................. 31

5. Discussion .................................................................................. 32
5.1 The content of the specific energy use ....................................... 32
5.2 How to realize sustainability in Östra Sala backe ...................... 33
5.3 Östra Sala backe vs. similar projects ......................................... 34

6. Conclusion .................................................................................. 36

7. References ................................................................................ 37
   Internet ....................................................................................... 37
   Printed source ........................................................................... 38
   Interviews ............................................................................... 40
1. Introduction

A lot of the greenhouse gas emissions, which are considered to influence the climate on the earth, stems from electricity and heat production. The building sector today constitute 30% of the total energy use in Sweden.\textsuperscript{10} The Swedish government has decided to reduce the energy use in buildings with 20\% until year 2020. Constructors have the opportunity to influence the energy use in buildings, especially in new buildings.\textsuperscript{11} The municipality of Uppsala is currently in the planning stage of a new sustainable district in Östra Sala backe where the buildings are going to be energy efficient and environmentally friendly.\textsuperscript{12} The new buildings are aiming for a low energy use and due to this, become a role model for other new sustainable districts in the future.

There have been similar projects to Östra Sala backe in Sweden where sustainable districts have been built. The energy use in two of these projects, Västra Hamnen in Malmö and Hammarby Sjöstad in Stockholm was measured after the residents moved in. These measurements showed that the pre-calculated energy use levels had not been reached. By learning from these previous projects, Östra Sala backe has the potential to reach its sustainability goals. However, several actors are involved in the planning and building of new city districts and therefore there is a need to formulate common strategies in order to realize the overall sustainable vision of the project.

Several constructors applied to the municipality of Uppsala and described their future building plans and assigned an approximated value for the buildings energy use. Eight constructors has been chosen by the municipality of Uppsala for the first stage in the Östra Sala backe project.

1.1 Aim

The aim of this thesis is to map, analyze and compare the chosen constructor’s calculated specific energy use for the planned buildings in Östra Sala backe. The study will also investigate if these values are comparable. Further the thesis investigates the role of the municipality of Uppsala as a project leader regarding requirements for the calculated building energy use and strategies to realize the sustainable vision of Östra Sala backe. The thesis also intends to compare the Östra Sala backe project with similar sustainable districts. The mapping of the constructors energy computing is expected to result in a discussion and a suggestion for how to make the comparing of the specific energy use easier between the constructors to be able to ensure that the sustainable vision fulfills.

1.1.1 Research questions

- What is included in the assigned numbers for the energy use in the constructor’s applications?
- What is done in the Östra Sala backe project to sustain and realize the vision of sustainability throughout the project?

\textsuperscript{10} Sveriges bygginsdustrier, Byggesektorns energifrågor: Internet.
\textsuperscript{11} Byggvärlden, Härare krav på energiförbrukningen: Internet.
\textsuperscript{12} Energy strategist, municipality of Uppsala, interviewed 12 May 2012.
What is a preferable project model, regarding energy use demands to ensure that the project fulfills the sustainable vision?

What can be learned from previous similar projects?

1.2 Disposition
This report starts with some relevant background information (section 2) about Östra Sala backe, the energy use parameters, the energy sectors demands and recommendations, environmental certifications and result from previous projects. This section provides the reader with a deeper understanding regarding the project in Östra Sala backe. The background is followed by a presentation of the methodology (section 3) used for the mapping and the analysis. In section 4 the results from the interviews with the constructors’ are presented. The final section consists of a discussion of the presented results and the conclusions drawn.

2. Background
The human population of Uppsala increases every year and is expected to grow with 2000 persons per year. Because of this, more houses need to be built in the upcoming years. There are currently several ongoing building projects all over Uppsala and one of those is Östra Sala backe which is located in the eastern part of the city.

2.1 Östra Sala backe
The area of Östra Sala backe consists of a former power line street which is owned by the municipality of Uppsala. As the power line has been removed, residential buildings are planned for in this area. The expansion is expected to contribute to a densification of the districts of Årsta and Sala backe and to give this east part of Uppsala an inner city- feeling. (See Figure 1)

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13 Uppsala Kommun (2010), Östra Sala backe planprogram.
14 Energy strategist, municipality of Uppsala, interviewed 12 May 2012.
Figure 1 - The planned area of Östra Sala backe.

The expansion aims to ensure the area a long-term and sustainable profile, from an ecological, economical and social perspective. Östra Sala backe’s ambition is to be Uppsala’s most climate adapted city district and it is going to be a pilot project when it comes to sustainably constructions. The objective is that Östra Sala backe will consist of nearly zero energy buildings. The vision also features utilization of renewable energy on site. For example, if made possible, there will be generation of solar power on the roofs and recycling of waste water for heating. A life-cycle perspective and energy efficiency is supposed to characterize

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15 Uppsala Kommun (2010), Östra Sala backe planprogram.
the new buildings. The expansion is estimated to last for 10-15 years. The municipality of Uppsala has now confirmed eight different constructors who have been given the permission to construct buildings in Östra Sala backe. (See Figure 2).

Figure 2. Area of the first phase where the chosen constructors are operating.

2.2 Requirements for new buildings in Sweden

The Swedish National Board for Housing, Building and Planning (SNBHP) is a central government agency for building environment. BBR is SNBHP’s requirements for new buildings and SNBHP’s require that buildings should be designed for low heat losses and effective electricity use. SNBHP’s request for new buildings is a specific energy use of 90 kWh/m² Atemp and year if the building is not heated by using electricity. If the building is heated by using electricity the request for specific energy use is set to 55 kWh/m² Atemp and year. These numbers are valid for Uppsala since it is located in climate zone III, this is the south of Sweden, in the

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16 Uppsala kommun (2011), Statsutveckling Östra Sala backe.
17 Uppsala kommun (2010), Östra Sala backe Planprogram.
18 Uppsala kommun (2011), Kvalitets- och hållbarhetskriterier.
19 Boverket, Om Boverket: Internet.
northern parts the required energy use levels are slightly higher. The meaning of this is that the energy use, which supplies the building for heating, domestic hot water and property electricity, cannot exceed 90 or 55 kWh/m² A_temp and year depending on the installed heating system. Electric heating consists of geothermal heating pumps, air heating pumps, electric resistance heaters and electric floor heating. If both district heating and a FTX system with a small installed electric power heat the building, the building is not considered to be heated with electricity.

The household electricity is not included in the specific energy use; neither are the heating of the garage area and the building areas that are not heated up to a temperature exceeding 10 degrees Celsius. The specific energy use can be reduced with energy from building integrated energy utilization such as solar energy and wind power. According to SNBHBP the expected specific energy use should be calculated at the planning stage of the building and when the building is constructed and then measured during the upcoming 12 months. A safety margin should be used in the calculations to ensure that the finished building fulfills the energy use requirements. The calculations should be based on the climate of the location, the indoor temperature, the use of hot water and the ventilation power demands. A building has a low energy use if its specific energy is less than 75% of 90 kWh/m² A_temp and year, and a very low energy use if the specific energy use is less than of 50 % of 90 kWh/m² A_temp and year. Today it is not required to consider weighted energy in SNBHBP’s framing of building requirements. SNBHBP also consider it inappropriate to use such factors in the building requirements since buildings have a long lifetime and the energy supply system can change in the future.

In 2010, SNBHBP stated that the term near zero energy building would be unfortunate in the Swedish legislation, since the term suggest that this type of buildings do not need any energy supplied at all and that would not be possible in a Swedish climate. SNBHBP points out that an energy use near zero is not possible with the Swedish climate. For example will a well insulated building with 80 % heat recovery in the south of Sweden still needs 50 kWh/m² and year supplied to the building.

2.3 Energy sector recommendations

Different organizations have rules and suggestions on how a buildings specific energy use should be calculated and assigned. There is also different definitions of low energy buildings, depending on the building’s specific energy use and if the building is equipped with technique for utilizing renewable energy or not.

2.3.1 Sveby

Sveby is an acronym for”Standardisera och verifiera energiprestanda i byggnader”, which can be translated to “standardization and verification of energy performance in buildings”. Sveby

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21 Boverket, Byggkonstruktionsregler: Internet.
23 Boverket (2011), Konsekvensutredning.
24 Energimyndigheten (2010), Nationell Strategi för lågenergibyggnader.
is a multi sectorial program for energy use and the program has three different parts; calculations, contracts and validation. Together all the different parts cover the whole building process, from planning to follow-up. Sveby is mostly addressed to sectors that are affected by how energy performance is defined and verified. BBR’s energy use requirements result in a need of knowledge regarding how to calculate the amount of energy a building is expected to use, and the amount of energy the building actually use when it is completed. The program develops standardized user data for calculations of energy performance, which helps the constructors to meet their own demands. The Sveby program is also the building sectors interpretation of BBR’s demand of energy management. Sveby states that if everyone in the sector has the same view of BBR, disagreements between different actors in the building process can be avoided.25

2.3.2 FEBY
FEBY is an acronym for “Forum för Energieffektiva Byggnader”, which can be translated to “Forum for energy efficient buildings”. FEBY has a vision to increase the construction of energy efficient buildings and energy efficient restoration of buildings in Sweden. FEBY wants to establish a Swedish standard for energy efficient buildings in Sweden. A confirmation in two steps is needed for a building to meet FEBY’s demands. The first step is a certification, and the second step is an authentication when the building is finished.26

For the definitions of zero energy buildings, passive houses and mini-energy houses FEBY have a demand that the energy use should be able to be measured monthly, and that the use for property electricity, household electricity and heating should be able to be measured separately.27

For a passive house the total heat losses must be at a maximum of 15 W/m² A_temp and year in climate zone III. The specific energy use including heating, domestic hot water and property electricity must be at a maximum of 50 kWh/m² A_temp and year with non-electric heating buildings, and 25 kWh/m² A_temp and year with electric heating buildings. According to FEBY, their definition for buildings heated with electricity is not the same as BBR’s definition, and includes all electric heating systems, such as heating pumps and resistance heaters regardless the installed electric power. For systems using mixed types of energy carriers there are specific demands for weighted energy. For this kind of systems the energy use for heating and domestic hot water cannot exceed a supplied weighted energy of 63 kWh/viktad/m² A_temp and year for climate zone III.28

The requirements of a zero energy building should according to FEBY be the same requirements as for a passive house, but the supplied weighted energy to the building has to be less or equal to the annually supplied weighted energy utilized in the building.29 The building can for example yield surplus electricity from solar cells to be supplied to the grid

25 Sveby, Om Sveby: Internet.
26 Energieffektivbyggnader, Energieffektivbyggnader: Internet.
27 FEBY (2012), Kravspecifikation för nollenergihus, passivhus och minenergihus.
28 FEBY (2012), Kravspecifikation för nollenergihus, passivhus och minenergihus.
29 Ibid.
and used elsewhere. Different energy carriers have different worth and value, and the same weighting factor has to be used for the supplied energy to and from the building.\(^{30}\)

A Mini-energy house is a demand level in between Passive house and BBR. The heat loss factor measures 20 W/m\(^2\) A\(_{\text{temp}}\) and year. The specific energy use measures 70 kWh/m\(^2\) A\(_{\text{temp}}\) and year for a non-electric heat building, and 33 kWh/m\(^2\) A\(_{\text{temp}}\) and year for an electric heat building. For a non-defined system the weighted energy is the same as a passive house with an additional 20kWh\(_{\text{viktad}}\)/m\(^2\) A\(_{\text{temp}}\) and year.\(^{31}\)

If a building is producing more energy than it uses, it is called a “plus–energy house”.\(^32\) With a combination of solar heating, solar cells or wind power and a house with high insulation the habitants might be able to sell electricity to the grid. In the current situation there are very few plus-energy houses in Sweden, but there are hopes that the number will increase with new building techniques. A plus-energy house does not have to be a passive house but it is to be preferred since a passive house has a very low energy demand.\(^{33}\)

2.3.3 The Swedish Energy Agency (SEA)
The Swedish Energy Agency, SEA, is a governmental agency that operates to create conditions for energy efficiency and sustainable energy use.\(^{34}\) SEA has been commissioned to develop a national strategy to increase the number of low energy buildings. In 2010 EU adopted a commission for a buildings energy, which among other includes establishing national plans to increase the number of nearly zero energy buildings. According to SEA a nearly zero energy building is a building with high-energy performance. The low energy demand in this kind of buildings should be supplied from renewable energy sources produced on site or nearby the building. Nearly zero energy buildings can be seen as a collective name for all kinds of low energy building definitions that at least fulfills the future demands for near zero energy buildings. The energy demands for nearly zero energy buildings are to have an efficient building envelope, efficient installations and that a high proportion of the energy demand should be supplied from renewable energy sources. SEA proposes that SNBHBBI in consultation with SEA explore the possibilities to include the household electricity and operational electricity in the definition of nearly zero energy buildings. To gain a complete understanding of the building’s energy use the household electricity and operational electricity should be included. If it is not included, comparisons between different buildings energy use can be inaccurate. For example a building with high energy demand of operational electricity can be evaluated with a better energy performance than it really has.\(^{35}\)

2.4 Parameters for energy use
In order to reach the level of energy standard required by BBR it is important to use correct input data already in the planning process of the building. This due to that small error might have a relative large impact on the calculated values. Right choice of device and maintenance

\(^{30}\) Nollhus, Nollenergihu: Internet.
\(^{31}\) FEBY (2012), Kravspecifikation för nollenergihus, passivhus och minienergihus.
\(^{32}\) Nollhus, Nollenergihu: Internet.
\(^{33}\) Plusenergihu, Plusenergihu: Internet.
\(^{34}\) Energimyndigheten, Om oss: Internet.
\(^{35}\) Statens Energimyndighet (2010), Nationell strategi lågenergibyggnader.
of heat- and ventilation systems is important to get the actual energy use to match the calculated energy use.\(^\text{36}\) There are three parameters that affect the specific energy use. The residents’ behaviors have an impact on the hot water use. Other important parameters are for example the indoor temperature and how much the residents air. Some parameters are also depending on technology such as heat recovery, building integrated utilization of energy and household electricity.

2.4.1 Domestic hot water
Domestic hot water use depends on the residents’ hot water consumption habits, armatures and the hot water circulation. Sveby suggests that a template value of 25 kWh/m\(^2\) A\(_{\text{temp}}\) and year or 1000 kWh/person and year is used.\(^\text{37}\) The use of domestic hot water is based on measurements of warm water flow. According to Sveby, the domestic hot water use can vary a lot between households and therefore is difficult to predict. Studies show that the domestic hot water use can be reduced with 28% by switching from two-handle blender to one-handle blender. To reduce the energy use of domestic hot water in new buildings it is important to plan for it in an early state. It also requires short and well isolated pipe systems to obtain warm water at the tap location, wiring that enables individual measuring, water-saving faucet and a well-functioning warm water circulation.\(^\text{38}\)

2.4.2 Property electricity
Property electricity is the electricity that is used to operate a building. That includes for example the lights in the stairwell, the pumps for the heating system and the electricity for the elevators. The residents do generally not have influence of the consumption of the property electricity.\(^\text{39}\) About 10 % of the total energy use in a building is property electricity. A newly built house often has a higher energy use of property electricity because of the more frequent installation of elevators and heating pumps.\(^\text{40}\) Town houses generally have a lower property electricity use due to the fact that there are no elevators and stairwell lights installed.

2.4.3 Heating
The heat demand is the sum of the heat losses from a building minus the internal heat gains. You can do a lot of things to decrease a buildings heating demand, for example a better insulation. It is important that walls and roof are well insulated to reduce the heat losses.\(^\text{41}\) There are also internal heat gains that consist of solar isolation, waste heat from electrical household appliances and heat gains from human presence (see section 2.5.4).\(^\text{42}\) The internal heat gains are important aspects when calculating a buildings heating demand. There are different ways to heat up your house, it could be for example a heat pump or district heating.\(^\text{43}\). In Östra Sala backe it will be possible to connect the buildings to the district-heating grid.

\(^{36}\) Boverket (2011), Konsekvensutredning.
\(^{37}\) Svebyprogrammet (2009), Brukarindata för energiberäkningar i bostäder.
\(^{38}\) Boverket (2002), Hushållning med kallt och varmt tappvatten.
\(^{39}\) Energirådgivningen, Fastighetsel : Internet.
\(^{40}\) Freiholtz. A (2009), Fastighetsel och belysning i flerbostadshus.
\(^{41}\) Energimyndigheten, Isolering: Internet.
\(^{42}\) Varmahus, Ditt värmebehov: Internet.
\(^{43}\) Energimyndigheten, Isolering: Internet.
2.4.4 Internal Heat gains from human presence
Sveby has a suggestion on how to approximate the heat gains from human presence. By Sveby’s calculations a grown up person delivers 100 W/day of heating and a child 60 W/day heating, but often a mean value of 80 W/person is used. Time of presence is calculated to 14 hours per day per person. The specific energy use depends on how many people that live in apartments and the area of the apartment. Sveby have made a mean value of the number of persons living in the apartment, depending on the size of the apartment.

2.4.5 Indoor temperature
When calculating the indoor temperature, the temperature must be set to a value that is likely to be used when the building is completed. The lowest temperature to meet SNBHBP’s demands in habitation and working spaces is 18 degrees, and 20 degrees in hygiene spaces and nursing homes. If the indoor temperature is unknown during the planning of the building, SNBHBP recommends the use of 22 degrees as an average indoor temperature. The indoor temperature however depends on many factors of the building, for example thermal insulation capacity, the size of the windows, heating system and ventilation system. The energy use generally varies with the indoor temperature and SEA states that when the indoor temperature is reduced by one degree it results in a 5 % energy saving. Sveby states that each reduced degree reduces the energy use with 3-5 kWh/m² in apartment blocks in Stockholm, and this value depends whether heat from the exhaust air is recovered or not. A study made by Sveby of apartment blocks showed that the average indoor temperature was 22.2 degrees. Measures from passive houses in Sweden show an average indoor temperature of 23.3 degrees in the winter, and 25.2 in the summer. The higher temperature in the summer is likely to be caused by for example more solar heat gains. When calculating the energy demand, this high value of indoor temperature can lead to an increased use of energy for heating. For small houses with FTX-systems studies show that the heat demand will increase with 7-14 kWh/m² if the actual indoor temperature is more than two degrees higher than the calculated temperature.

2.4.6 Household electricity
Household electricity is a term that describes the electricity consumed by use of common household devices such as refrigerator, freezer, cooking devices, lamps, TV, computer and other electronic devices. Measures may be applied to prevent residents from overusing household electricity. For example to install appliances that use less electricity and to install timers that prevents unnecessary use of electricity. The use of household electricity is however increasing every year, even though we are installing more energy effective household appliances.

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44 Boverket, Vilken inomhustemperatur ska användas vid energiberäkning? : Internet.  
46 Boverket, Vilken inomhustemperatur ska användas vid energiberäkning? : Internet.  
47 Energimyndigheten, Kom igång-lista för villaägare: Internet.  
48 Svebyprogrammet (2009), Brukarindata för energiberäkningar i bostäder.  
49 Boverket, (2011) Konsekvensutredning  
50 Statens energimyndighet (2007), Hushåll och energibeteende.  
51 Boverket (2007), Indata för energiberäkningar i kontor och småhus.
It can be difficult to approximate a general amount of household electricity that is used in a residence since the use of household gadgets differ and is highly individual for each residence. A mean value for household electricity the last years have been calculated to 30 kWh/m² A temp and year. According to Sveby’s recommendations 70% household electricity use can be assimilated as internal heat gains.  

2.4.7 Heat recovery using FTX systems

A FTX-system is an energy efficient system to recycle heat from the exhaust air of a building. The exhaust air is taken from kitchen and bathroom and the supply air goes into the bedroom and the living room. Heat is transferred from the warm exhaust air to the cold supply air in a heat exchanger. (See Figure 6)

![Figure 6- FTX-system](image)

1) Supply air. 2) Cold supply air is heated from the exhaust air in the heat exchanger. 3) Heated supply air moves in the house. 4) Exhaust air moves from the house. 5) Exhaust air that have heated the supply air moves out of the house.  

According to SEA a FTX system saves 50-80 % of the energy in the exhaust air compared to if the heat is not recycled. In an advanced system, the airflow is adjustable so that the flow can be reduced when no one is at home and increased when there are people in the building. A lot of energy can be saved this way. In newly built low energy buildings, for example in passive houses, which do not have a conventional heating system, a heat recovery system is very important. It is important to know the efficiency of the system. If the actual efficiency of the recycling is 70 % and you calculated with an efficiency of 85 %, the heat demand would be 4-8 kWh/m² and year larger then calculated. 

2.4.8 Building integrated energy utilization

According to BBR, the buildings specific energy use can be reduced by the energy that the solar collectors or solar cells that are placed on the building can provide. But the specific energy use can only be reduced if the solar energy is intended specifically for the building. In

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52 Svebyprogrammet (2009), Brukarindata för energiberäkningar i bostäder.
53 Energimyndigheten, Från- och tilluftsventilation med återvinning: Internet.
54 Ibid.
56 Boverket (2011), Konsekvensutredning
the planning state it is recommended to calculate the possible solar energy potential.\(^{57}\) However SNBHBP and SEA do not find it appropriate to integrate energy utilization with building energy use requirements. The building rules on energy use are supposed to apply to the building’s technical features, and are usually separated from energy utilization. According to SNBHBP new buildings will exist for a long time, but energy supply can quickly change.

SNBHBP also identifies some problems with plus-energy houses. A plus-energy house occasionally produces more solar heat and electricity than what the building requires and SNBHBP believes this does not necessary promote an energy efficient building and a lot of installed solar energy might lead to that the specific energy use will be neglected. According to SNBHBP, solar cells and solar collectors should be installed where it is most beneficial to the society, and should not be controlled by building rules. SNBHBP believes that small scale wind turbines are not an integrated part of a building, in contrast to solar energy. With a lot of wind power installed the demands on the buildings specific energy use can be neglected. SNBHBP’s rules do not prevent small scale wind power, but the wind power should not be installed at the expense of the buildings energy performance. SEA also argues that solar cells and wind power should be regulated separate from the specific energy use and that solar cells and wind power should not be allowed to be deducted from the buildings specific energy use. This is because they strive for energy efficient building envelopes and technically neutral building rules.\(^{58}\)

### 2.5.9 Airing

A parameter that relates to the residents’ activities is airing. The residents airing depend on the building’s ventilation system and how much the building is exposed to wind. Studies show that airing has a large impact on the energy use. Sveby recommends that a template value of 4 kWh/m\(^2\) and year should be added to the specific energy use after the calculation of the specific energy use is completed. BBR allows a correction to compensate from variations in normal airing.\(^{59}\)

Internal heat gains (i.e. heat from solar isolation, human presence and electrical devices) represent a large part of the buildings total heating demand in energy efficient buildings. This “free” heating thus represents a large proportion of the total energy use, but it might also at times lead to problems with over temperatures in the building. There is therefore a risk that these energy efficient buildings do not save as much energy as intended, if the residents have to air to lower the temperature in the building. Another aspect of the airing impact is that big windows provide more excessive heat, and therefore increase the need for airing.\(^{60}\)

### 2.6 Similar projects

There are interests all over Sweden to build energy efficient and environmentally friendly city districts. In both Malmö and Stockholm there are already projects in progress similar to Östra

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\(^{57}\) Boverket. Energi från solfängare och solceller: Internet

\(^{58}\) Boverket (2011), Bör byggereglerna ändras för att öka användningen av förnyelsebara energikällor i byggnelsen?

\(^{59}\) Svebyprogrammet (2009), Brukarindata för energiberäkningar i bostäder.

\(^{60}\) Harrysson, C. (2009), Variationer i energianvändning och innemiljökvalitet hos flerbostadshus med olika tekniska lösningar.
Sala backe, where social, economic and ecological sustainable issues are in focus. Here these projects are used as references for Östra Sala backe and for the municipality of Uppsala that might benefit from the previous project’s experiences.

### 2.6.1 Malmö- Västra Hamnen

A project similar to the one in Östra Sala backe has been developed in Malmö in cooperation with the municipality of Malmö and E.ON. This project started in 2001 and many of the buildings already have been inhabited, for example in the neighborhood called “Flagghusen”. In the year 2004, 13 constructors started to plan these buildings and the idea was to build houses where the constructors would benefit from each other’s knowledge and reach sustainable dwellings within reasonable costs. The aim for Flagghusen was to reach high architectural design, social, economical and ecological sustainability. Ecological sustainability means for example energy efficiency. In 2004, when this project started, the BBR energy use restriction was a maximum of $110 \text{ kWh/m}^2 \text{ A}_{\text{temp}}$ and year. Flagghusen was built with the vision to reach $120 \text{ kWh/m}^2 \text{ A}_{\text{temp}}$ and year including the household electricity. In 2007 the first residents moved in and in 2010 WSP environment made a study to see if the buildings had reached the goal. The rapport shows that none of the buildings had fulfilled the vision. All of the buildings used more energy than what was first calculated in 2006. (See Figure 3) The reason why the measured energy use is higher than the calculated is not clear, but according to the study, one factor may be that the residents aired a lot, which might have increased the heat demand. The residents also experienced a draught, which also might have increased the heat demand and deteriorated the heat recovery. The study also show that the indoor temperature were higher than the calculated. \footnote{Malmö stad, Det goda samtalet om Flagghusen: Internet.}

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\footnote{Malmö stad, Det goda samtalet om Flagghusen: Internet.}
Most of the buildings use more energy for heating and domestic hot water than what is a reasonable within the error margin. (See Figure 4) 

The pre-calculated energy use level of Flagghusen was 120 kWh/m² and year including the household electricity. When the energy use was calculated the domestic hot water use was generally

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62 Kjellman et al (2010), Uppföljning Flagghusen – Energi och inneklimat
63 Ibid.
approximated to 30 kWh/m² and year, but if the building had individual water measuring the value was set to 21 kWh/m² and year. Only four constructors decided to have individual measuring of domestic water. The household electricity was approximated to 38 kWh/m² and year and all of this electricity was assumed to supply the building with internal heating.\footnote{Kjellman et al (2010), *Uppföljning Flagghusen – Energi och inneklimat*}

### 2.6.2 Stockholm- Norra Djurgårdsstaden and Hammarby sjöstad

Another sustainable city district, similar to Östra Sala backe is a district in Stockholm called Norra Djurgårdsstaden. The construction of this district started in May 2011 and the first residents will move in to the apartments in October 2012.\footnote{Stockholm stad, *Norra Djurgårdsstaden*} Norra Djurgårdsstaden is going to be a city district with energy efficient buildings such as passive houses and plus-energy houses. The buildings will be built with the ability to utilize renewable energy.\footnote{Stockholm stad, *En miljöstadsdel*} Stockholm has earlier experiences of developing environmental projects. One example is the project in Hammarby Sjöstad, which was started in 1996. The buildings in Hammarby Sjöstad at first had a goal of a specific energy use of 60 kWh/m² and year of which a maximum of 20 kWh/m² and year were electricity. This goal was later modified to 100 kWh/m² and year. Evaluations of the project show that neither of the goals were achieved. The final average value of the energy use lies between 142 kWh/m² and 165 kWh/m² of which 50-60 kWh/m² is electricity. The reason why the project did not turn out the way they had expect is that Stockholm city had been unclear with their goals and no clear demands were made for the constructors to follow.\footnote{Pandis, S & Brandt, N,(2009), *Utvärdering av Hammarby Sjöstads miljöprofilering - vilka erfarenheter ska tas med till nya stadsutvecklingsprojekt i Stockholm?*}

The failure of this project led to that the city of Stockholm now have developed a model for the upcoming project in Norra Djurgårdsstaden where there it is going to be better continuous follow up where demands and goals is set in every phase of the planning and building stage.\footnote{Hållbara Städer, *Norra Djurgårdsstaden*} Another reason that the objective of the specific energy use did not succeed is that some constructors were not a part of the project when the energy goals were designed. This led to that some of the constructors did not accept the environmental goals of Hammarby Sjöstad. The objectives of the specific energy use was received differently by the different constructors and some thought it would be unrealistic, with the technology they had, to reach a value of the specific energy use as low as 60 kWh/m² and year. This led to a reduction of the demands and to that the specific energy use ended up a lot higher than first predicted.\footnote{Pandis, S & Brandt, N,(2009), *Utvärdering av Hammarby Sjöstads miljöprofilering - vilka erfarenheter ska tas med till nya stadsutvecklingsprojekt i Stockholm?*}

### 3. Methodology

This thesis is based on interviews and building permission applications from the different constructors in the Östra Sala backe project. The applications gave an understanding for the constructor’s goals and visions, and the interviews purpose was to give a more profound understanding for their calculations of the specific energy use. Interviews were considered the
best method to get this information. The interviews took place via telephone. A personal meeting with the constructors would have been preferred, since that method gives the possibility to see body language, and also gives a calmer environment to carry out the interview. However, since it was of importance that all constructors were represented combined with the schematic difficulties at arranging physical meetings, telephone interviews was the most reasonable option. The interviews were based on an interview guide and specific questions was followed up with questions during the dialogue and sometimes also after the interview via e-mail. One person from each constructor was interviewed. The interviews lasted for about 30 minutes and were focused on energy use numbers in the constructor’s applications. The interview with one of the constructors (Hauschild + Siegel) was cancelled, and therefore the result from this constructor is based on the building permission application only.

4. Result
In the following sections, results from the various interviews and gathered data from the constructors’ applications are presented. The results for the different energy use parameters are presented as well.

4.1 Constructors
36 constructors each applied for building permission in Östra Sala backe. The municipality of Uppsala has now sold land to eight constructors, who will constitute the first building phase in the new district. When the municipality of Uppsala decided which constructors who should be a part of the project they considered the constructor’s innovative and sustainable solutions. Also the social, ecological and city environmental quality was considered. This thesis will mostly focus on the constructor’s assigned figures for energy use and the energy saving solutions. In the current situation none the constructors have a blueprint of their future buildings.

4.1.1 Hauschild + Siegel Architecture AB
Hauschild + Siegel Architecture AB plans to build 40-60 apartments in Östra Sala backe, depending on the projects size. They will either build condominiums only, or both condominiums and leasehold estate. The goal is to build passive houses or mini-energy houses according to FEBYs’ definition. They will at least build mini-energy houses with contributed weighted energy of 80 kWh/m² Atemp and year. If they build passive houses, the contributed weighted energy will be 60 kWh/m² Atemp and year. Hauschild + Siegel want to invest in solar collectors and they will build a well-insulated and energy efficient building. There have been difficulties in contacting Hauschild + Siegel during the writing of this thesis. Therefore these results are only based on Hauschild + Siegels application only and no interview. That is also the reason to why there is lack of data in Table 1. The information about the total specific energy use comes from the application.

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70 Uppsala kommun, Kopia av utvärderingsunderlag ÖSb etapp 1 bostäder och lokaler (2011)
71 Hauschild + Siegel, Ansökning om markanvisning Östra Sala backe
Table 1 - Hauschild+Siegel AB’s energy use.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>No data</td>
</tr>
<tr>
<td>Property electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Household electricity</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Total specific energy use</strong></td>
<td><strong>60 or 80 kWh/m²</strong></td>
</tr>
</tbody>
</table>

4.1.2 TB Exploatering AB

TB Exploatering AB is planning to build town houses with the goal to reach a lower energy use than SNBHP’s requests of 55 kWh/m² A_{temp} and year when electric heating is used. They aim for an energy use of 43 kWh/m² A_{temp} and year regardless the energy source used. TB Exploatering AB has used calculations from a previous project in Stockholm, Mälardalen, where the energy use is 43 kWh/m² and year. See table 2 for more information about the calculated specific energy use. Their houses will have heat recovery of the ventilating air. TB Exploatering AB’s opinion is that the heat energy from the air always should be recycled. They also want to use renewable energy as much as possible, by for example using solar energy. Though it is not cost-effective to generate solar power, they still project for the ability to connect different kinds of solar power solutions to the buildings in the future. TB Exploatering AB has however not included solar power in the calculations of the specific energy use. They have claimed to only install electric household appliances, which fulfill the energy efficiency class A. They are also investigating the opportunity to reduce the household electricity by letting the residents keep track of their own energy use. Given that TB Exploatering AB wants to build town houses, the property electricity constitutes a small part of the total energy use. They have calculated a household electricity of 4100 kWh per year, in an apartment with two persons and 70% of this total sum is assumed to generate internal heat. In their calculations they have assimilated energy from the heat pump with a COP of 3-3.4 by reducing 6202 kWh from the energy use. According to TB Exploatering AB, there should be stricter rules about household electricity, but it should not be included in BBRs requirements of energy use. They think the best regulation is a higher electricity price.

Table 2 - TB Exploatering AB’s energy use.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>23 kWh/m²</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>20 kWh/m²</td>
</tr>
<tr>
<td>Property electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Household electricity</td>
<td>45 kWh/m²</td>
</tr>
<tr>
<td><strong>Total specific energy use (excluding household electricity)</strong></td>
<td><strong>43 kWh/m²</strong></td>
</tr>
</tbody>
</table>

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72 CEO, TB exploatering, interviewed 26 April 2012.
73 Fröjmark, J. TB Exploatering, *Beräkning av specifik energianvändning för Hus med frånluftsvärmepump*(2011)
74 CEO, TB exploatering, interviewed 26 April 2012.
75 Fröjmark, J. TB Exploatering, *Beräkning av specifik energianvändning för Hus med frånluftsvärmepump*(2011)
4.1.3 Veidekke AB

Veidekke builds houses with their own concept, TellHus. TellHus is Svanen labeled and focus on energy efficiency and energy balance. They prefer the terminology climate building, rather than the terminology low energy building.\(^{76}\) There is a possibility that Veidekke’s buildings in Östra Sala backe will meet the demand of a passive house, but it is still too early in the building process to know this for sure.\(^ {77}\) Veidekke use the same definition of specific energy use as SNBHBP, including domestic hot water, heating and property electricity. Veidekke have used template values from previous projects in their application to the municipality of Uppsala.\(^ {78}\) They have calculated a specific energy use between 55-65 kWh/m\(^2\) A\(_{temp}\) and year since the use can vary depending on the building’s location and design.\(^ {79}\) See Table 3 for more details about the specific energy use in the previous project.\(^ {80}\)

Veidekke will not use building integrated energy utilization. They think it is important with a renewable primary energy source, but bio energy will be a scarce commodity in the future, so it is also important to build an energy-saving building. They will connect their buildings to the district-heating grid.\(^ {81}\) Veidekke think the household electricity is an important factor, and electricity can be saved if high technology is used in household appliance, if for example the dishwasher and the washing machine are connected to the district-heating grid. This is a smart solution to use heat instead of electricity, since electricity is more valuable than heating.\(^ {82}\) Veidekke think that the most important components for reaching a low specific energy use are windows, effective hot water preparation and heat recovery. They will use a FTX system with 90% efficiency. When calculating the specific energy use they believe the household electricity should be included in the calculations, but Veidekke point out that it is not easy to do. Veidekke believe that the building’s energy needs, and not the bought energy should be considered in the specific energy use of a building. For example if a heating pump is used, this results in a lower amount of bought electricity compared to the amount of bought district heat, but the heat demand of the building is not different in a house without a heating pump.\(^ {83}\)

Table 3- Veidekke AB’s energy use.\(^ {84}\)

<table>
<thead>
<tr>
<th>Component</th>
<th>Specific Energy Use (kWh/m(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>22</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>25</td>
</tr>
<tr>
<td>Property electricity</td>
<td>12</td>
</tr>
<tr>
<td>Household electricity</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Total specific energy use (excluding household electricity)</strong></td>
<td><strong>59 kWh/m(^2)</strong></td>
</tr>
</tbody>
</table>

\(^{76}\) Veidekke, *Ansökan om markanvisning Östra Sala backe.*

\(^{77}\) Technical- and environmental manager, Veidekke, interviewed 17 April 2012.

\(^{78}\) Ibid.

\(^{79}\) Veidekke, *Ansökan om markanvisning Östra Sala backe.*

\(^{80}\) Veidekke, *Miljö - och lågenergikonceptet Tellhus Svanencertifierad.*

\(^{81}\) Technical- and environmental manager, Veidekke, interviewed 17 April 2012.

\(^{82}\) Technical- and environmental manager, Veidekke, interviewed 17 April 2012.

\(^{83}\) Technical- and environmental manager, Veidekke, interviewed 17 April 2012.

\(^{84}\) Veidekke, *Miljö - och lågenergikonceptet Tellhus Svanencertifierad.*
4.1.4 ByggVesta AB
ByggVesta generally builds apartment blocks and student housing. Their on-going projects are built according to their own concept, “Egenvärmehus”. The energy consumption level for an Egenvärmehus is on the same level as for a passive house. Egenvärmehus do not have radiators and is heated by solar insolation, household appliances, lighting and residents. The specific energy use for an Egenvärmehus in Uppsala is restricted to less than 55 kWh/m² Atemp and year. ByggVesta uses energy use figures from a previous project in Barkabystaden in their application (see Table 4). They also build with environmentally friendly material and will have an individual measurement for electricity, heating and domestic hot water in every apartment. To reduce the household electricity use and the domestic hot water use, ByggVesta intend to install energy effective household appliances, which is A-plus classed, and water-saving faucets in all the wet areas such as WC and kitchen. All apartments will be equipped with a washing machine and therefore the buildings will not contain a common laundry facility. District heating will be used for heating and domestic hot water. Electricity from wind power generation will be used for the property electricity and household electricity. 90% of the apartment’s energy consumption will be recycled with a FTX system. ByggVesta will build with pre-made concrete blocks. As this report is being written, they do not intend to utilize any energy from solar cells or equivalent renewable energy source.

Table 4- Byggvesta AB’s energy use.

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Specific Energy Use (excluding household electricity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>14 kWh/m²</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>25 kWh/m²</td>
</tr>
<tr>
<td>Property electricity</td>
<td>12 kWh/m²</td>
</tr>
<tr>
<td>Household electricity</td>
<td>32.5 kWh/m²</td>
</tr>
<tr>
<td>Airing</td>
<td>4 kwh/m²</td>
</tr>
<tr>
<td><strong>Total specific energy use (excluding household electricity)</strong></td>
<td><strong>55 kWh/m²</strong></td>
</tr>
</tbody>
</table>

4.1.5 Svenska Vårdfastigheter AB
Svenska Vårdfastigheter build and own environmentally friendly nursing homes at different locations in Sweden. The building planned in Östra Sala backe will be a low energy building and use less energy than SNBHBP’s demands. It will be built with a wooden frame. The building will not reach the level of a passive house, but a low energy building. They have calculated the energy use in 2014 to be less than 30 kWh/m² Atemp and year, and have a goal to reach less than 10 kWh/m² Atemp. Due to difficulties with reaching Svenska Vårdfastigheters energy expert, there is no data about the specific energy use (See Table 5). They will use district heating or geothermal heating, and they will also use heat recovery. The building will have high quality of insulation and water-saving faucets to reach high energy efficiency. Svenska Vårdfastigheter uses the certification BREEAM for their

85 ByggVesta, Ansöknings om markanvisning Östra Sala backe.
87 CEO, ByggVesta, interviewed 23 April 2012.
buildings. In Östra Sala backe Svenska Vårdfastigheter will build their first nursing home aiming for as low as 30 kWh/m² $A_{\text{temp}}$ and year. They have previously built a nursing home with an energy use aiming for 45 kWh/m² $A_{\text{temp}}$ and year. This project started in 2010. According to Svenska Vårdfastigheter, a nursing home has a lower use of domestic hot water than regular residential buildings and that is why they can reach a lower energy use. They motivate this by claiming that the residents in nursing homes shower less frequently than the average person. Because the building is built for old people, the calculated inner temperature is 21.5 degrees Celsius, which is a bit higher than the numbers of the remaining constructors in Östra Sala backe.

Table 5 - Svenska Vårdfastigheter AB’s energy use.

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Energy Use (kWh/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>No data</td>
</tr>
<tr>
<td>Property electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Household electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Total specific energy use</td>
<td>30 kWh/m²</td>
</tr>
</tbody>
</table>

4.1.6 Wallenstam AB

Wallenstam will build energy efficient leasehold estates in Östra Sala backe with high quality building materials and windows. Wallenstam’s figures for specific energy use is 65 kWh/m² $A_{\text{temp}}$ and year, (see Table 6). They have calculated the energy use from previously finished buildings. Their goal is to have a specific energy use of 55 kWh/m² $A_{\text{temp}}$ and year, and hope to achieve this with for example waste water recycling. The waste water recycling will reduce the domestic hot water use, but it is still an expensive technique and in the current situation it is still not very effective. The waste water recycling could potentially cover 25% of the domestic hot water demand. Wallenstam’s goal is to 2013 be self-sufficient of electricity, via their investment in wind power. The property electricity in Östra Sala Backe will stem from wind power supplied by Wallenstam’s own energy company. The customers in Wallenstam’s buildings are also offered to buy their household electricity from Wallenstam’s energy company. They will not utilize any energy on site in Östra Sala backe because they believe that wind power should be placed where the conditions are the best, and that is not necessarily in Östra Sala backe. Wallenstam’s own company produces electricity to fulfill their building’s demands, but they do not believe in the concept of wind power generation in urban areas. They believe it is the same way with solar cells and solar collectors; it is much more economically justified to build a large facility where the sun shines the most, and then let the facility produce the energy for the buildings. It is not clear if Wallenstam will use the district heating or not in their Östra Sala backe buildings.

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89 Svenska Vårdfastigheter, Ansökan om markanvisning Östra Sala backe.
90 Svenska Vårdfastigheter, Sickla ö – Unikt äldreboende vid Stockholms införr.
91 CEO, Svenska Vårdfastigheter, interviewed 4 May 2012.
92 Svenska Vårdfastigheter, Ansökan om markanvisning Östra Sala backe.
93 Wallenstam, Ansökan om markanvisning Östra Sala backe.
94 Project Manager, Wallenstam, interviewed 26 April 2012.
95 Wallenstam, Ansökan om markanvisning Östra Sala backe.
The ambition is to build passive houses, or low energy buildings, with heating supplied from heat pumps without using radiators. However it might be that the buildings will need radiators. If so, Wallenstam will use the district heating instead of heat pumps. Wallenstam believe that individual measuring is the easiest way to save energy and they normally install individual measuring for electricity and water. A relatively efficient and cheap way to distribute heat is to use water. But according to Wallenstam the price for district heat follows the electricity price and therefore Wallenstam finds it more interesting to use heat pumps. They will use a FTX-system for heat recovery with 90% efficiency. Wallenstam will try to install energy efficient household appliances. However the purchase price is also important in this choice. Wallenstam will install washing machines in every apartment, and will not have a common laundry facility. 96

Table 6- Wallenstam AB’s energy use. 97

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Specific Energy Use (kWh/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>25</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>25</td>
</tr>
<tr>
<td>Property electricity</td>
<td>15</td>
</tr>
<tr>
<td>Household electricity</td>
<td>No data</td>
</tr>
<tr>
<td><strong>Total specific energy use</strong></td>
<td><strong>65 kWh/m²</strong></td>
</tr>
</tbody>
</table>

4.1.7 Järntorget Bostad AB

Järntorget Bostad AB is a construction company located in Stockholm and they intend to build 50-100 apartments in wood in Östra Sala backe. They have been involved in former similar projects such as “kv Fendern” in Henriksdalshamnen, Hammarby Sjöstad and Norra Djurgårdsstaden in Stockholm. In “kv Fendern” a housing cooperative is formed that owns parts in a wind power plant with the purpose to contribute with as much electricity as possible to increase the amount of electricity from clean and renewable energy sources. 98 In Norra Djurgårdsstaden waste disposers will be installed to take advantage of the energy from household waste and decrease the amount of domestic waste for treatment. Whether these solutions will be implemented in Östra Sala backe is not decided at this point in the project. 99

In recent projects, Järntorget’s buildings have reached an energy use of 65-70 kWh/m² and a year A\_temp. With improved construction technique, such as thick and better insulated outer walls, Järntorget hope the energy use will measure 55 kWh/m² A\_temp and year in upcoming projects. 100 They have used calculations from previous project in Johanneslundstoppen in Stockholm to calculate the specific energy use, for more detailed information see Table 7. 101

The figure for heating in table 7 was obtained with a heat pump and therefore represents the bought energy however the actual heat demand of the building is higher. They will connect their buildings to the district heating grid if possible. Järntorget will install devices that measures and visualizes the electricity and water use in all their buildings and according to

96 Project Manager, Wallenstam, interviewed 26 April 2012.
97 Wallenstam, Ansökning om markanvisning Östra Sala backe.
98 Järntorget, Ansökning om markanvisning Östra Sala backe.
99 Project manager, Järntorget, mail interview.
100 Järntorget, Ansökning om markanvisning Östra Sala backe.
101 Project manager, Järntorget, mail interview.
studies this is expected to lower the energy use by 10-20%. Järntorget does install effective heat recycling systems in all their newly produced buildings.\(^{102}\)

\[\text{Table 7- Järntorget AB’s energy use.}^{103}\]

<table>
<thead>
<tr>
<th>Service</th>
<th>kWh/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>23.5</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>22.5</td>
</tr>
<tr>
<td>Property electricity</td>
<td>8</td>
</tr>
<tr>
<td>Household electricity</td>
<td>27</td>
</tr>
<tr>
<td>Airing</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total specific energy use (excluding household electricity)</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>

4.1.8 Åke Sundvall Byggnads AB

Åke Sundvall Byggnads AB intends to build a mixture of townhouses and apartments in Östra Sala backe. Their goal is to reach 55 kWh/m²\(^{\text{Atemp}}\) and year (See Table 8). Åke Sundvall Byggnads AB do however not know in detail how they will reach this. This due to that they have never constructed a building with this low energy use before. However, reference figures from recent similar project, such as “Skagerhuset” which is located in Årsta south of Stockholm, have been taken in consideration. “Skagerhuset” is built with wooden material and the specific energy use is calculated to 75 kWh/m²\(^{\text{Atemp}}\) and year. It is not yet decided whether the buildings in Östra Sala backe will be built in wood or concrete, it depends on the surrounding environment and location.\(^{104}\) To accomplish their goal they plan to build housings that are well insulated with windproof walls and low energy windows. They will connect their buildings to the district heating grid and combine this with a FTX-system. The apartments will be equipped with low energy household appliances. Household electricity, domestic hot water and heating will be individually measured per apartment and measurements will be made available for the residents. Åke Sundvall Byggnads AB also intend to use renewable energy sources to supply parts of their own property electricity use, for example by integrating solar panels in the facade. An ambition is also to install small scale wind power plants on the roof of the buildings for utilization of energy. Depending on how much heat or electricity that will be utilized and if a possible energy surplus can be supplied to other users the buildings might be classed as plus-energy houses.\(^{105}\) According to the project manager though, the project is still in its cradle and the location of the building will be a critical factor for the actual energy use of the building. Thus it depends on the amount of solar radiation that the buildings are exposed to. The project manager also point out that the location of the entire district is important, for example is Norra Djurgårdsstaden a more attractive location and the residents is willing to pay more for an apartment in that district, then what they probably are willing to pay for an apartment in Östra Sala backe. At this point

\(^{102}\) Project manager, Järntorget, mail interview.  
\(^{103}\) Bergstedt, L. PeLaTor VVS-Projektering AB, Energiberäkningar Johanneslundstoppen (2011)  
\(^{104}\) Project manager, Åke Sundvall Byggnads, interviewed 3 May 2012.  
\(^{105}\) Åke Sundvalls Byggnads, Ansökning om markanvisning Östra Sala backe.
of the project figures are not assigned as they are expected to change during the design of the project.\textsuperscript{106}

Table 8-Åke Sundvall Byggnads AB’s energy use.\textsuperscript{107}

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat</td>
<td>No data</td>
</tr>
<tr>
<td>Domestic hot water</td>
<td>No data</td>
</tr>
<tr>
<td>Property electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Household electricity</td>
<td>No data</td>
</tr>
<tr>
<td>Total specific energy use (excluding household electricity)</td>
<td>55 kWh/m\textsuperscript{2}</td>
</tr>
</tbody>
</table>

4.1.9 Summing
The most common value for the specific energy use lies between 55-65 kWh/m\textsuperscript{2} and year. Not all constructors have values in this interval though. Figure 5 below shows a summing of the constructors and their calculated specific energy use. However, the values are difficult to compare when some constructors only have put up approximated values that they want obtain, while other constructors have calculated their values from reference projects.

![Figure 5- The constructors’ specific energy use, kWh/m\textsuperscript{2} and year.](image)

4.2 The municipality of Uppsala
The municipality of Uppsala owns the land where Östra Sala backe is planned to be located and therefore it was the municipality of Uppsala that decided which of the constructors that would be included in the first phase of the project. The project is supposed to lead to a sustainable and modern inner-city area and because of this the municipality welcomed a variety in the applications. To obtain this variation, the municipality of Uppsala found it necessary not to form too strict energy performance demands for the new buildings. According to the energy strategist at Uppsala municipality, strict demands might scare off the constructors and their creativity. Another reason is that the first buildings of Östra Sala backe

\textsuperscript{106} Project manager, Åke Sundvall Byggnads, interviewed 3 May 2012
\textsuperscript{107} Åke Sundvalls Byggnads, \textit{Ansökning om markanvisning Östra Sala backe}
will not be finished until about five years. In that time, the demands may have become irrelevant and it is best not to be locked to specific requirements. Instead, the municipality of Uppsala announced their vision and future plan for the area, along with these visions the constructors sent in their applications and presented what they had to offer. The municipality of Uppsala chose eight constructors based on clearness in the emphasis of sustainability. Other relevant factors were also whether they would use wood or concrete frames in the buildings and if they were to build leasehold houses or co-operative apartments. In the end, the assigned energy use figures were considered, but not essential, when the final choices of constructors were made. Instead it was important for the municipality of Uppsala that the new area consisted of a mixture in building types and energy systems to withhold the social sustainability.\footnote{108}

Considering the energy use, which was assigned differently in the constructor’s applications, it seems like the values presented by the constructors are more elaborated by some constructors. The energy strategist at the municipality of Uppsala believes that it is better to build a house with a low energy demand rather than to build less efficient and compensate for this by using a heat pump. The values can be misleading when adjusted by energy reduction from a heating pump and risks are that it does not provide information about the actual heat demand of the house. Some of the constructors have experience of building low-energy houses, while some have never done it before. But the municipality of Uppsala hopes that together with the constructors they can fulfill all the goals and ambitions of the project. According to the energy strategist it is important not to force the constructors to change their constructing routines too much as they have developed own habits and experiences regarding their construction processes.\footnote{109}

The energy strategist himself thinks that the specific energy use should consist of the household electricity as well. He says that new buildings should be constructed in a way so that the residents can make an impact and reduce the household electricity use and their domestic hot water use, because in the end, they are the ones who can influence the values the most.\footnote{110}

4.3 Parameters of energy use – results sum up

The constructors have been using different parameters and different methods to obtain their assigned figures for the energy use. The ones who have been more specific in their figures however have all included domestic hot water, property electricity and heating which are the included parameters in the specific energy use defined in the BBR regulations.

4.3.1 Domestic hot water

Five of the eight constructors have assigned specific values for domestic hot water use (See Table 9). Observation of the table shows that the constructors use the same value for the domestic hot water more or less. Only TB Exploatering and Järntorget aim to reach a lower value than the other constructors.

\footnote{108}{Energy strategist, municipality of Uppsala, interviewed 12 May 2012.}
\footnote{109}{Ibid.}
\footnote{110}{Ibid.}
Table 9- The constructors calculated domestic hot water use

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Domestic hot water [kWh/m² A_{temp} and year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>20</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>25</td>
</tr>
<tr>
<td>Veidekke</td>
<td>25</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>-</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>25</td>
</tr>
<tr>
<td>Järntorget</td>
<td>22.5</td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>-</td>
</tr>
</tbody>
</table>

4.3.2 Property electricity
Five constructors that assigned values for domestic hot water also assigned specific values for property electricity. Except for TB Exploatering that does not have a specific value for the property electricity because they are building town houses and not apartment blocks. They include their value in the calculation for heating (See Table 10). The constructors which have assigned a value all use a similar figure of approximately 12 kWh/m² and year except for Wallenstam which calculates with a value of 15 kWh/m² and year.

Table 10- Constructor’s property electricity

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Property electricity [kWh / m² A_{temp} and year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>Included in the calculation for heating</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>12.4</td>
</tr>
<tr>
<td>Veidekke</td>
<td>12</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>-</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>15</td>
</tr>
<tr>
<td>Järntorget</td>
<td>12</td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>-</td>
</tr>
</tbody>
</table>

4.3.3 Heating
Almost all of the constructors have confirmed that they are interested in connecting their buildings to the district-heating grid. Some constructors have the intention to use a heating pump also. It is possible to combine the two systems. However the constructors have indicated different heat demand (See Table 11). ByggVesta aim to build along their own certification “Egenvärmehus” and the value for heating is lower comparing to other constructors. Note that the same three constructors that did not assign specific values regarding domestic hot water and property electricity have not either given any figures for space heating demand.

Table 11- Constructor’s calculated heating

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Heating [kWh/m² A_{temp} and year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
</tbody>
</table>
4.3.4 Human Heating
Three of the constructors have included their calculations of internal heat gains from presence (See Table 13). TB Exploatering uses a different unit than ByggVesta and Järntorget.

Table 13- The constructor’s calculated human heating

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Human heating</th>
<th>Attendance time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>80 W/person</td>
<td>14 hours/day</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>9 kWh/m²/year</td>
<td></td>
</tr>
<tr>
<td>ByggVesta</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veidekke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>9.125 kWh/m²/year</td>
<td></td>
</tr>
<tr>
<td>Järntorget</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ake Sundvall</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.3.5 Indoor temperature
Six of the eight constructors have confirmed that they calculated their specific energy use with a stated temperature (See Table 14). Svenska Vårdfastigheter has calculated with the highest temperature due to the fact that they are building nursing homes.

Table 14- The constructors calculated indoor temperature.

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Indoor temperature [degrees Celsius]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>21</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>21</td>
</tr>
<tr>
<td>Veidekke</td>
<td>20</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>21.5</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>20</td>
</tr>
<tr>
<td>Järntorget</td>
<td>21</td>
</tr>
<tr>
<td>Ake Sundvall</td>
<td>-</td>
</tr>
</tbody>
</table>

4.3.6 Household electricity
Even though the household electricity is not included in the specific energy use, some of the constructors have confirmed the household electricity in their calculations (See Table 15) as a separate post. TB Exploatering calculates with a higher value comparing to the rest and according to them it is because they are building town houses.
Table 15- The constructor’s calculated household electricity

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Household electricity [kWh/m² A-temp and year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>45</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>32.5</td>
</tr>
<tr>
<td>Veidekke</td>
<td>30</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>-</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>-</td>
</tr>
<tr>
<td>Järntorget</td>
<td>27</td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>-</td>
</tr>
</tbody>
</table>

4.3.7 Heat recovery
Almost all of the constructors have indicated that they will use a heat recovery system and three of them have even confirmed an efficiency of 90%. (See Table 16)

Table 16- The constructor’s heat recovery

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Heat Recovery</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>ByggVesta</td>
<td>Yes</td>
<td>90%</td>
</tr>
<tr>
<td>Veidekke</td>
<td>Yes</td>
<td>90%</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Wallenstam</td>
<td>Yes</td>
<td>90%</td>
</tr>
<tr>
<td>Järntorget</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

4.3.8 Building integrated energy utilization
Most of the constructors do not know yet if they are going to use building integrated energy utilization or any kind of energy utilization on site and many of the constructors say that it is a matter of cost whether they will do so or not. Almost all of the constructors sounded rather uncertain in the interviews regarding this issue. The table below shows the aim for the different constructors (See Table 17).

Table 17- Energy utilization on site

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Energy utilization on site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>Solar collectors</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>Maybe solar cells</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>Do not know yet</td>
</tr>
<tr>
<td>Veidekke</td>
<td>No</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>-</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>No</td>
</tr>
<tr>
<td>Järntorget</td>
<td>-</td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>Maybe solar cells and wind power</td>
</tr>
</tbody>
</table>
4.3.9 Airing
Airing depends a lot on the residents’ habits but Järntorget and ByggVesta have added the parameter in their calculations based on template values (See Table 18). It is possible that the other constructors already have calculated the airing in their energy use calculations; it has not however been possible to identify.

Table 18- Airing

<table>
<thead>
<tr>
<th>Constructor</th>
<th>Airing [kWh/m² and year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauschild + Siegel</td>
<td>-</td>
</tr>
<tr>
<td>TB Exploatering</td>
<td>-</td>
</tr>
<tr>
<td>ByggVesta</td>
<td>4</td>
</tr>
<tr>
<td>Veidekke</td>
<td>-</td>
</tr>
<tr>
<td>Svenska Vårdfastigheter</td>
<td>-</td>
</tr>
<tr>
<td>Wallenstam</td>
<td>-</td>
</tr>
<tr>
<td>Järntorget</td>
<td>5</td>
</tr>
<tr>
<td>Åke Sundvall</td>
<td>-</td>
</tr>
</tbody>
</table>
5. Discussion

5.1 The content of the specific energy use
An interesting notion regarding the specific energy use is whether it should include household electricity or not. The energy strategist at the municipality of Uppsala states that the household electricity is not included because it largely depends on the resident’s habits. According to this it seems interesting that domestic hot water in fact is included in SNBHBP’s definition but not household electricity. These since both these parameters are strongly influenced by the resident’s habits. An idea would be to only include the building envelope in the calculations and focus in making the buildings well insulated to decrease the heat demand but still improve the conditions for the residents to reduce their household energy consumption. Even though household electricity is not included in the specific energy use, some of the constructors have assigned figured for it, since they want to know how much energy from the household electricity use that can be utilized as internal heat gains. The constructors values for household electricity differs from 32.5 kWh/m² A_{temp} and year to 45 kWh/m² A_{temp} and year. Since Sveby recommends that 70% of the household electricity for internal heating is calculated to be utilized, different values of the household electricity may affect the total specific energy use between the different constructors. In this study it has only been confirmed that TB Exploatering follows this recommendation.

A low indoor temperature gives a lower specific energy use, and that may be the reason why the constructors have calculated with a lower temperature than SNBHBP’s suggestion of 22 degrees, and in some cases, lower than Sveby’s template value of 21 degrees. A study from Sveby shows that the average temperature in apartments is 22.2 degrees, which is higher than any constructor’s calculated value. Maybe it would be better to use SNBHBP’s suggested value, although it is a higher value and will risk increasing the calculated energy use, but it may lead to a final energy use that better will match the calculated. Since a change in just one or two degrees of the indoor temperature will affect the energy use, the constructors’ calculated energy use may differ a lot when they use different values of the indoor temperature. The calculated energy use would be easier to compare between buildings if all the constructors had used the same indoor temperature. This excludes Svenska Vårdfastigheter since the building rules are different for nursing homes.

Some of the constructors have calculated the heat gains from human presence that will reduce the building’s heat demand. The units in which they have calculated varies between the units W/person with attendance time 14 hours/day to the unit kWh/m². When they use different units it becomes difficult to compare the constructors, and a standard unit had been preferred.

The building integrated renewable energy utilization is a part of the municipality of Uppsala’s vision for Östra Sala backe, but for the constructors it seems to be a matter of cost. Maybe stricter demands from the municipality of Uppsala on this issue are necessary to fulfill this vision. If so, the constructors would be forced to install energy utilization devices. On the other hand the municipality is keen that people should afford to live in Östra Sala backe and
higher installation costs might result in higher housing prices. This could be the reason they do not have strict demands for the constructors to install energy utilization techniques.

The calculated heating demand of the building varies between the constructors, where ByggVesta has the lowest of 14 kWh/m\(^2\) A\(_{\text{temp}}\) and year and Wallenstam has the largest of 25 kWh/m\(^2\) A\(_{\text{temp}}\) and year. If a heat pump is used, the heating demand will appear to be lower. This makes it difficult to compare the constructors’ calculated heating demand. Both Veidekke and the energy strategist at the municipality of Uppsala points out that it would be best to calculate the building’s energy demand, not the bought energy like in the cases where heating pumps are used. SNBHBP states that a building is electrical heated if the installed electric power is larger than 10 W/m\(^2\) A\(_{\text{temp}}\). This means that if a building for example uses a heat pump with low installed electric power, the building will be considered non-electrical heated, even though it uses electricity. To realize sustainability it may be better to use FEBYs definition of weighted energy. Instead of evaluating the building after it is finished and hope to obtain values to pass the building as one of Feby’s certifications, a suggestion would be to decide a certification before the building project has started and then strictly form the building along the guidelines of the chosen certification to be sure to obtain it. Since the certification consists of a follow-up of the energy use, it could increase the possibilities of realizing the Östra Sala backe sustainability vision. Then again it is a matter of costs.

Some of the constructors have clearly added a value for airing to their calculated energy use. The remaining constructors may have done this but it does not show in their calculations and therefore it should be clearer described. It would also make the comparing between the constructors easier. A study from Västra Hamnen shows that the residents air a lot, which was the reason for the high value of the total specific energy use for the buildings of Flagghusen. This is another argument to why airing should be calculated in the energy use.

5.2 How to realize sustainability in Östra Sala backe

The fact that SNBHBP has strict rules considering the specific energy use makes the energy performance of new buildings an important factor. It is a central concept in every application for Östra Sala backe and the constructors are all keen to emphasize a low value for the specific energy use. After investigating all the applications and contacting the constructors with questions regarding the specific energy use it is clear that there are difficulties in identifying how the mentioned value are to be obtained. As this thesis have been developed, it is clear that the difficulties are larger than first predicted. Many of the constructors believe that the project still is in its cradle and that it is impossible to guarantee that the use will be as low as they have mentioned. Many factors, such as location and building layout, are playing important roles for the outcome of the value and it is understandable that these factors are hard to predict when the construction has not even been started yet. However, the specific energy use is important and therefore questions can be raised whether it should be described in more detail despite the difficulties. Apparently there are no strict demands or guidelines from the municipality of Uppsala regarding the specific energy use for the reason not to scare off the constructors and to invite as creative solutions as possible for the buildings. The municipality of Uppsala is concerned not to force the constructors to change their building routines. This notion is also a bit contradictory. If there are not any specific demands or
restrictions, then what will be the difference regarding sustainability for Östra Sala backe compared to any other newly built residence area?

The vision of sustainability in Östra Sala backe is a bit diffuse. It is however obvious that sustainability is a keyword and a guideline for Östra Sala backe. To make the concept sustainability a bit more substantial it could be wise to define clearer restrictions regarding, for example, the specific energy use. A suggestion could be to give the constructors a form along with the application where they would be able to fill in some specific parameters and motivate the values and how to accomplish them more in detail. It would be much easier to compare the applications this way thus all constructors would calculate the specific energy use using the same parameters. Then again it is worth mentioning that the municipality of Uppsala believes that the specific energy use only is a small part in a big and complex solution where factors as social sustainability and building lay-out are as much important. This however might not give the constructors the incitements to describe their calculations of the specific energy use more in detail because it is not asked of them. The municipality also mentions that houses are not built for the environment’s sake. It is important to remember that the main reason to create dwellings is that people are supposed to live in them. Even if it seems that critic could be pointed at the municipality of Uppsala’s direction for not setting stricter demands or the constructors for not specifying the energy measures, one must remind oneself that the will to pay for the finished building is critical. On the other hand it does not seem entirely impossible to build both sustainable and attractive dwellings within reasonable financial cost. In fact, studies show that energy efficient buildings are not that more expensive to build.

5.3 Östra Sala backe vs. similar projects
The city of Stockholm had earlier experienced a failure regarding the predicted specific energy use in Hammarby Sjöstad, where the demands, similar to Östra Sala backe, were not very strict. The city of Stockholm was criticized for not being proactive enough with their goals. This is said to be a reason to why the actual values exceeded the predicted values. The constructors were able to compromise with less energy efficient building methods as the demands decreased. The city of Stockholm, who had learned from this mistake, therefore developed stricter demands when plans for Norra Djurgårdsstaden were made. In Östra Sala backe the demands are not as strict as in Norra Djurgårdsstaden, which can be a disadvantage to reach the aimed goal for the specific energy use. On the other hand, the constructors have been participating in setting and developing the goals for Östra Sala backe alongside the municipality which can lead to a better result than what was achieved in Hammarby Sjöstad. Besides, Östra Sala backe has better conditions to reach their goals considering that the project of Hammarby Sjöstad started in 1996 and the energy efficient building techniques has developed a lot since then. It is also important to remember that Norra Djurgårdsstaden has not been built yet and therefore only the future can tell if the measures of stricter demands will be successful or not. Maybe Uppsala’s answer is not to set strict demands rather to develop a good communication with the constructors at an early stage. Then again, the communication between constructors was one of the main ideas when Västra Hamnen in
Malmö was developed but, despite the communication, this project also failed to reach its goals.
6. Conclusion

All constructors have included heating, domestic hot water and property electricity in their calculation of the specific energy use, just as in SNBHBP’s definition. In this early stage of the project it has been difficulties for all the constructors to describe in detail how they will obtain the specific energy use that was mentioned in their applications. In the current situation there are no blueprints ready and therefore it will be difficult to predict the values for energy use. The fact that it has been difficult to collect data from the constructors indicates that there are uncertainties of the sustainability outcome of the project.

Previous similar projects indicate that a lack of clearly defined goals for energy use and poorly made assumptions in calculations of energy use might lead to lower energy performance than what was intended. At this early stage in the Östra Sala backe project no such clear goals are assigned. This is also mirrored in the building permission applications from each of the constructors that are part of the first phase of the Östra Sala backe project.

An intention in the project is to use building integrated energy utilization. Almost all of the constructors sounded rather uncertain in the interviews regarding this issue. Also, no demands regarding the use of building integrated renewable generation have been “expressed” from the municipality. This might lead to lack of such technology in the finished project due to cost issues.

To contain an energy profile, which is the municipality of Uppsala’s wish for Östra Sala backe, the specific energy use should be lower than SNBHBP’s demands. To increase the possibilities of realizing the sustainable vision it may be better to follow Feby’s recommendations due to the fact that they use weighted energy. Also, it could contribute with a framework for post evaluations of the project after it is finished. A suggestion is that the municipality of Uppsala determines a certification or a specific energy use demand which the constructors have to follow, just as in Norra Djurgårdssstaden. Our suggestion for a general model is that all constructors could use the same template values for parameters such as indoor temperature, human heating and domestic hot water based on the size of the apartment. Even if it is unrealistic, the best way ought to be that every constructor uses the same calculation program to calculate the specific energy use for more comparable values.
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40