BUILD2LC Project

Boosting Low Carbon Innovative Building Rehabilitation in European Regions

Annex 1. SWOT analysis and identification of needs

Östersund, 21 October 2016

Region Jämtland Härjedalen

1 STATE OF ART OF ENERGY REHABILITATION IN BUILDINGS

1.1 Brief Picture of the Region

Jämtland Härjedalen is situated in mid-Sweden and is in climate zones 6 to 8 and in the mountain zone. About half of the region is covered by pine forest with some deciduous forest, 12 % comprises wetlands and 8 % lakes and watercourses, while agricultural land constitutes about 1 %. The climate in large parts of the county is strongly influenced by the Atlantic, with mild, wet winters in the west.

Area-wise it is a large region, almost 50 000 m^2, which represents 12% of Sweden's area. With a population of 127 000 inhabitants, the region is very sparsely populated in European terms with 2.6 inhabitants per km^2. Also, half of the population lives in the region's only city, Östersund, making the rest of the region even more sparsely populated. Östersund is considered the main service and commercial center for the entire region.

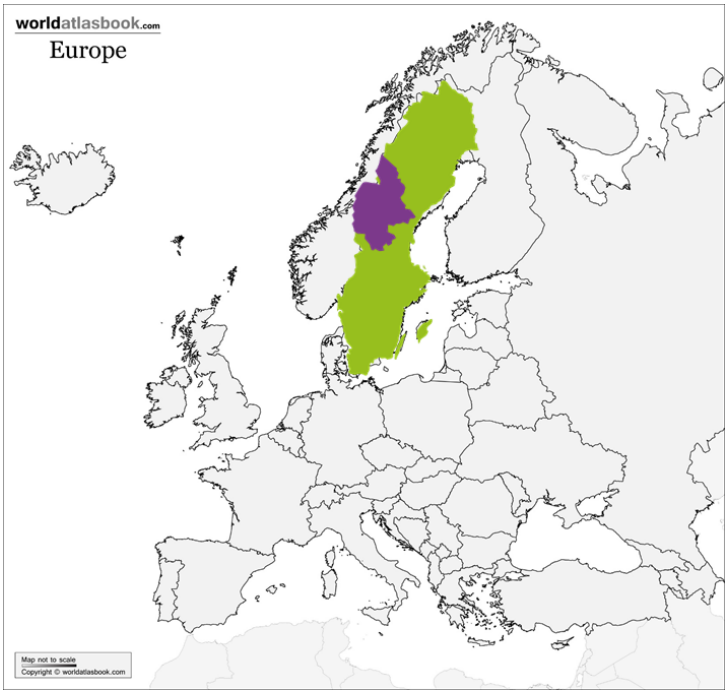

Figure 1. Region Jämtland Härjedalen (purple), Sweden.

There are no major energy-intensive industries in Jämtland Härjedalen. Instead, trade, tourism and forestry are vital parts of the economy. The region's industry is characterized by many small to medium sized businesses and public sector accounts for a large share of employment. The business consists of manufacturing companies in the forest, commercial service in the main cities and towns, and a number of tourist destinations, mainly in the mountains.

There are two regional growth areas - Östersund and Åre. Long distances to business markets both within the region and to other regions in Sweden as well as international markets are not uncommon. There are 25,000 workplaces of which the vast majority have no employees - many are agricultural and forestry companies. The number of unemployed in the region is 7.4 %.

1.1.1 The energy production is higher than the energy consumption

Jämtland Härjedalen has great potential to contribute to a climate-adapted transition of the energy system in the rest of the country and internationally, by further increasing the net export of renewable energy. This is considered the region's best opportunity to contribute nationally and internationally. To be able to increase the export, it is important to implement several energy efficiency actions. (Climate Strategy, 2012)

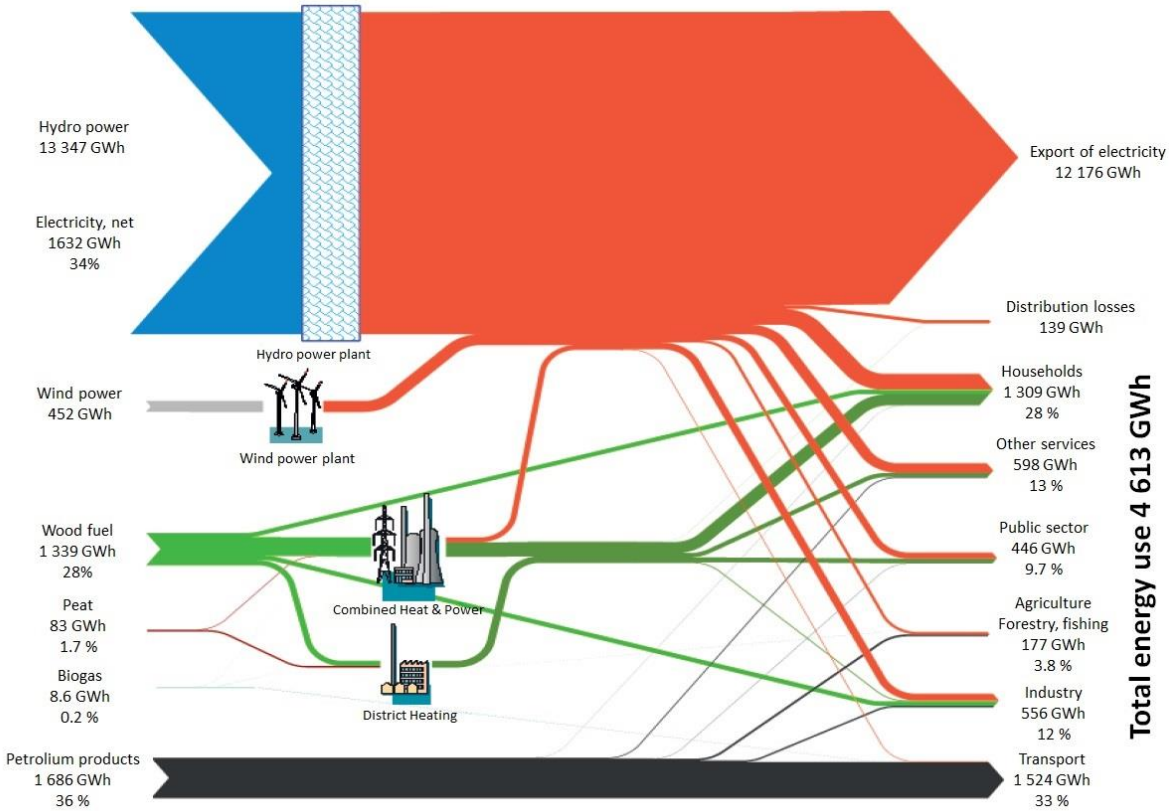

Figure 2. Sankey diagram of the energy supply and energy use in Jämtland Härjedalen, 2012.

The region has reached quite far in in the transition towards renewable energy in general and within buildings in particular. In the overall energy mix there is 65% renewables, while in heating of buildings there is already 93-95% renewables in the energy mix. Electricity production from hydropower is eightfold the electricity consumption, hence

the region is a net exporter of renewable electricity. Furthermore, it is the leading Swedish region within electric cars and plug-in hybrids, where 10% of vehicle fuel is renewable.

The energy use is slightly less per person in total than the national average. This is mainly due to the fact that there are few energy-intensive industries. A large proportion of the energy utilisation is, however, used in the transport sector and accounts for about half of the region's total greenhouse gas emissions. Both trade and industry and individuals in Jämtland Härjedalen are dependent in many crucial ways on a functional transport infrastructure and well-developed communications. Transport is therefore a very important area for the region to focus on in its efficiency improvement measures.

1.2 State of Play

1.2.1 Energy use

Households can be divided into single family houses, sometimes called one- and two dwelling buildings, and multi-dwelling buildings, where single family houses correspond to detached houses and terrace houses while multi-dwelling buildings comprise apartments.

District heating remains the dominant heating method in multi-dwelling buildings. Jämtland Härjedalen is in this respect comparable to national statistics, where 91 % of the energy used for heating and hot water in multi-dwelling buildings came from district heating in 2014. In Jämtland Härjedalen the most common energy source for district heating is biomass, which is not the case in all of Sweden.

In the 1950s, -60s and -70s, fossil oil heating was the dominating form for heating and hot water in Swedish multi-dwelling buildings. Since then, the use of fossil oil for this purpose has decreased rapidly and is continuing to decrease. Heating oil accounts for the warming of approximately 1 % of the single family houses. (Swedish Energy Agency, 2015:04)

In the region 60 % of households live in single family houses. Electricity is the most common form of energy used for heating and hot water in these buildings. Biomass such as firewood, wood chips, sawdust and pellets also accounts for an important share. Throughout the 1990s and onwards, the number of single family houses that have installed heat pumps increased steadily. In 2013 there was some form of heat pump installed in 52 % of the buildings. There has hence been a tremendous development in terms of climate impact. (Swedish Energy Agency, 2015)

A greater challenge for the region is the large amount of electricity that is still used to heat permanent and holiday homes. Since electricity has such a high exergy value (i.e. high quality energy) it is exceptionally wasteful to use it for heating instead of qualified work, e.g. industrial processes or electric vehicles.

Figure 3 shows the energy use for heating and hot water broken down into single family houses, multi-dwelling buildings and non-residential premises in 2013. (Swedish Energy Agency, 2015:04)

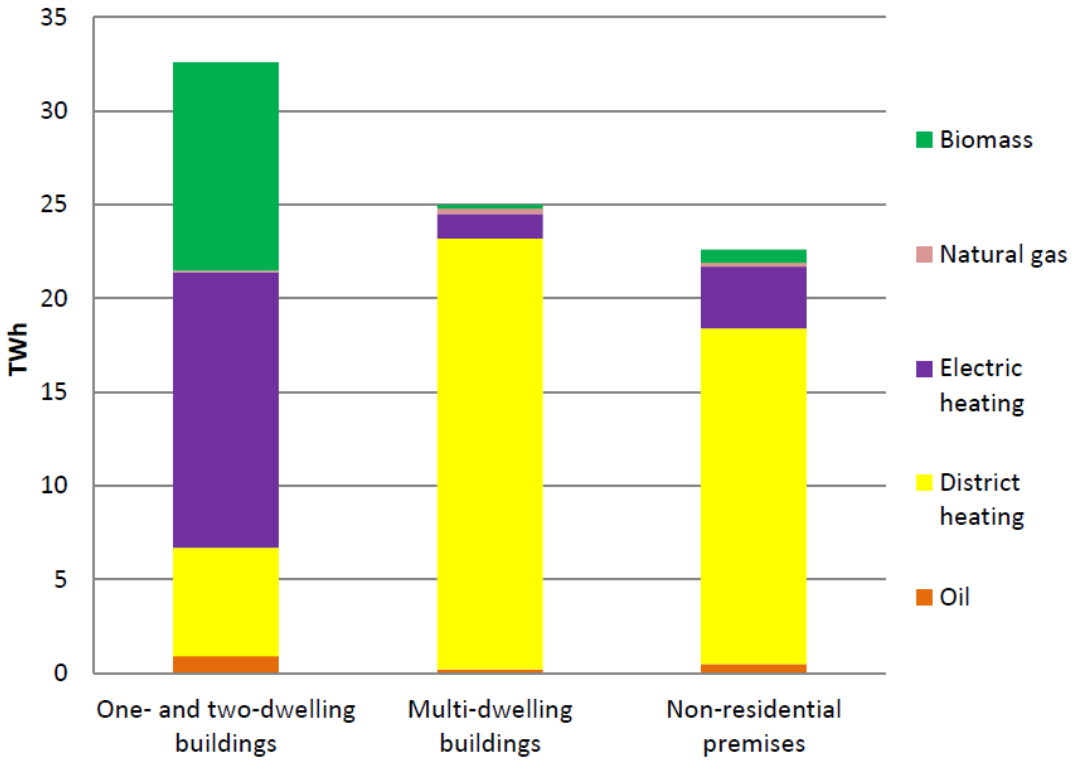

Figure 3. Energy statistics for single family houses (one- and two-dwelling buildings), multi-dwellings and non-residential premises in 2013 in Sweden. (Swedish Energy Agency, 2015:04)

The use of electricity has increased from 9 to 22 TWh between 1970 and 2013. The increase that took place over the course of the 1970s and 1980s is mainly explained by an increasing number of households and a greater number of appliances. Two opposing trends have an impact on the use of domestic electricity. The development is towards more energy-efficient appliances, which leads to a decreased use of energy. However, there is an increase in the number of households and appliances in the households, as well as the number of functions of many appliances, which counters the trend towards greater efficiency. (Region Jämtland Härjedalen)

From a national and international perspective efficiency improvement measures is by far the best climate investment the region can do. More value can be produced for the same extracted resource and the saved energy can be used elsewhere and replace fossil fuels.

By taking action to save electricity, we can have a direct impact on the region's opportunity to increase exports of electricity from renewable energy sources. Efficiency improvements are necessary to make sure that society's demand for energy can be satisfied without compromising other objectives.

Households can make a significant contribution to energy efficiency improvements. This involves everything from simple measures in the home such as switching to low-

energy light bulbs, to more major initiatives such as insulating the loft, improving the insulation of the windows and changing to a new central heating system. (County administrative board of Jämtland, 2014)

That is why both local energy companies, the municipalities in the region and Region Jämtland Härjedalen are working extensively with advice and information to the public on energy efficiency measures and its potential savings.

1.2.2 Energy poverty in Sweden

Energy poverty has not been a clear social problem in Sweden during the past decades. Though, approximately 150 000 people, representing 1.6 % of the population, have "an inability to keep the house warm enough", according to figures from Swedish Statistics/Eurostat.

Social insurance is supposed to protect the vulnerable part of the population and is an important part of Swedish security. It applies to everyone who lives or works in Sweden and provides financial security in case of illness and disability, old-age and families with children.

The share of the population at risk of poverty or social exclusion was 15% the year 2012. However, there is cause for concern. Although Swedish households have reduced their energy use by a fifth compared to 15 years ago energy costs have not been reduced. On the contrary energy prices have risen. The statistics show that the poorest households today therefore are close to the limit to be known as energy poor. (B. Johansson , 2015).

In Sweden, building standards have been used as part of the legal building regulations to reduce energy consumption, since the oil crisis in the 1970s. This has had the effect that specific energy consumption for heating in buildings (energy consumption per unit area), despite the cold climate, is near the EU-average. However, energy consumption for individuals is the order of 10-15% higher than the EU average.

A large part of the population in Jämtland Härjedalen use electricity to heat their homes, in particular single family houses in the rural areas. Electricity prices differ widely across EU countries and Swedish electricity prices for residential customers is of the same magnitude as the EU average (B. Johansson , 2015). But if electricity prices would rise to the same level as for instance Germany or Denmark, countries that have much higher rates, it would probably mean that a larger part of the region's population would find financially difficulties to heat their houses.

When it comes to fuel for transportation, people who live in rural areas, such as Jämtland Härjedalen are more vulnerable than the population in the urban areas. It is not only the fact that they are dependent on longer journeys to work and poor public transport. It is also because it is more expensive to transport food and other necessities to households in rural areas. (B. Johansson , 2015)

1.2.3 Tourism has great importance for the region and its energy consumption

In 2015 tourism in the Jämtland Härjedalen reported sales of 4.65 billion and the region is one of the leading destinations for winter tourism in Sweden. The national export value of tourism, measured as foreign consumption in Sweden, was in 2015 higher than the value of exports for several important Swedish product areas. While tourism exports totaled 112.6 billion the value of exports for example road vehicles was 138 billion kronor and for pharmaceuticals 71.2 billion kronor. Tourism in the region is an important part of the national figures, which continues to grow steadily and is predicted to do so for the coming three years. (JHT, 2015) (Tillväxtverket , 2016)

The increasing popularity is reflected in the prices of holiday homes in the mountain tourism areas. During the past seven years the prices have risen by 50%. (SBAB Analys, 2015)

The challenge for the building sector in the region is the climate. In winter the temperature can reach below 20 degrees Celsius for several months. The building standards are often set on a national – or European – level that are not adopted for the real situation. It is important for everyone to understand the necessity to go beyond the standards and that this is also good for the economy in the long term. The understanding of the long run economy is often not an issue for the producer of buildings;that is a cost that has to be covered by the user for many years.

The legal requirements for holiday houses are not as strict as for permanent housing. The Building and Planning regulations (BBR) states that holiday houses with a maximum of two apartments has no restrictions in terms of energy. Despite this most holiday houses are being heated a large part of the year as if they were permanent housing. This is a safety measure to secure the water pipes from freezing, and is also required by most insurance companies. In order to tackle this problem the majority of Swedish mountain municipalities (that include Åre, Härjedalen and Berg municipalities in Jämtland Härjedalen) has started cooperating in order for the municipalities to try to have the same energy requirements in the building permit assessment for holiday homes as for permanent homes. (Buttazzoni, 2010) (Boverket, 2016)

1.3 Link to the RIS3

The creation of the Innovation Strategy of Jämtland Härjedalen was finalized in 2015. Several key factors were identified by participating actors (i.e. representatives from organizations, companies, academia and local authorities) in the creation process. For example, the need of;

- Breaking the barriers between academia, industry, public sector and civil society
- More collaboration within and between different business sectors and
- Making innovation a strategic issue at the management of all public activities.

The implementation of the innovation strategy is an ongoing process and is done by stimulating new clusters between key actors. (Region Jämtland Härjedalen). Two of the action areas within this strategy is “Development processes by dialogue” and “Creative

bureaucrats”. There is also a political consensus that all growth must be under circular economy. An important part of the growth in the region is the building sector within tourism. One of the roles for Jämtland Härjedalen is to take the lead of the transformation to a sustainable society and through advice, seminars, and clusters push the transformation in line with Europe 2020 and the directive about energy use in buildings. (Region Jämtland Härjedalen)

An example of how this is done in practice is the Climate Council of Jämtland Härjedalen. The council gathers the region's businesses and organizations to a common platform for collaboration and exchange of ideas and knowledge exchange. It was formed in 2015 and is jointly managed by Jämtland County Administrative Board and Region Jämtland Härjedalen. The aim is to extend the group of real estate companies and other stakeholders working with energy efficiency to include a wider spectra of the building sector. That would open up for a dialogue with enterprises with the aim to change old truth to new innovative ways to reach the goal of low energy consumption in combination with sustainable building materials.

Within the area of circular economy there are four areas that are particularly interesting:

- Regions that co-create,
- How design is used in 100% recyclable product manufacturing,
- Business models for corporate business symbioses where one company’s waste becomes another company´s resource
- New business models for rent, share and lend economy.

Especially the latter is very interesting for Jämtland Härjedalen where several companies are now selling services instead of products. This can be seen particularly in tourism and outdoor recreation where ski rental concepts, which has been an established market for decades, are spreading to other areas of functionality, e.g. sports clothing and tents. (Region Jämtland Härjedalen)

When working with the strategy as guidance we need to develop new ideas that answer questions like; how can we create new business models for the real estate and building industry to promote energy efficiency and sustainable living in the long term? How do we promote a circular way of thinking during the design and construction phase, and how can we support developers and buyers into making the most sustainable material choices that have such immense impact on the building's carbon and ecological footprint? How can we make the right decision from the beginning?

There are several initiatives in terms of collaborative projects ideas at the moment. Two different project is underway with the goal of energy efficiency measures for buildings with a planned co-financing from the European Regional Development Fund and another INTERREG project is planned together with Norway, where Circular economy, digitization and co-creation is the core.

1.4 Policy Instruments. Regional and National Plans and Policies on Energy Rehabilitation of Buildings

Nationally, Sweden's overall objectives are:

- 40 % reduction in emissions by 2020 compared to 1990
- A fossil-fuel independent vehicle fleet in 2030
- No net emissions of greenhouse gases by 2050.

Furthermore, there are national targets for energy efficiency, the share of renewable energy and the share of renewable energy in the transport sector.

Jämtland Härjedalen has a *Regional Climate Strategy* that stretches from 2014-2020. The overall vision for the strategy is to be a fossil fuel free region in the year of 2030. The strategy approaches both sides of Climate work - energy conversion and adaptation to climate change. The strategy aims to provide a coherent guidance and collaboration for both these challenges. The strategy include the following objectives;

- *Improve energy efficiency by at least 30 % compared to 1990* – which is strongly linked to the work within the real estate and construction sector
- *Increase awareness of the impact of consumption* - which is related to energy use in terms of behavior and the choice of design and building material
- *The region´s climate work is quality assured and monitored in cooperation with the county stakeholders.* - The Climate Council of Jämtland Härjedalen is one way to involve and stimulate regional stakeholders to act, to find other stakeholders in order to collaborate and to offer guidance and support

In the Regional Climate Strategy it is emphasized that public bodies in the region should work to an even greater extent on energy efficiency improvement in the same, systematic way as the business community and using the same kinds of initiatives.

The strategy also states that municipal energy and climate advisors have an important role to play in offering advice to individual households, small companies and their own municipal authorities. Energy efficiency improvement as a means of improving productivity and competitiveness should be highlighted when authorities and the region's political representatives make decisions on regional programs and funding. (County administrative board of Jämtland, 2014)

The work within regional development in Jämtland Härjedalen is also guided by the Regional development strategy. The strategy is focusing on sustainable growth and efficient and effective use of resources. The region´s objectives are to increase the production of renewable energy and a sustainable power supply for the region's businesses and households, a high energy efficiency in all sectors and no reliance on fossil fuels and extensive efforts in all areas of society to deal with climate change. (Region Jämtland Härjedalen)

The Regional Innovation Strategy has resulted in an *Innovation program*. The program declares a number of activities to promote innovation in Jämtland Härjedalen, such as fostering creative meetings, seizing the ideas and the individuals that creates ideas,

promoting and creating partnerships with regions and organizations outside our own, and to use “Circular economy” as an idea development engine.

The aim is to use circular economy to put us on the map as the region that inspires to create regional economic value, confidence and commitment of today's most important issue - climate and resource efficiency. (Region Jämtland Härjedalen)

1.4.1 Informative instruments

Swedish authorities, and in particular the Swedish Energy Agency, has for many years focused on informative instruments in order to get energy efficiency results, i.e. information to the public, companies, and public organizations. Efforts have been coordinated from a national level and in most cases carried out by the local and regional Energy Agencies. The methodology is seen as successful and the regional interventions in Jämtland Härjedalen are therefore part of the nationally coordinated efforts. Here are some of the initiatives.

Energy and climate advisors

Energy and climate advisers helps individuals, companies and organizations to use energy more efficiently, switching to or increasing the share of renewable energy, reduce energy costs and environmental impact. The advisor know the local conditions and helps to get an overview of different options. The advice is a free and a commercially independent service. The municipal energy and climate advisory service is mainly funded by the Swedish Energy Agency.

Networks for energy efficiency

The Energy Agency gives financial supports to regional networks for energy efficiency. A network can consist of 8-16 companies within a certain target group. A network coordinator is appointed by the Energy Agency (from the regional energy offices and/or County administrative boards) will lead the activities. The network has an energy expert attached to it that gives support and advice. The network will host a number of meetings per year and will run for two-four years. Since the participating companies can get work done corresponding to an energy consultants work in terms of energy mappings and energy efficiency measure proposals, etc., this effort could be considered as a mix between informative and financial instruments.

The Energy lift “Energilyftet”

The Energy lift is an initiative with knowledge-enhancing training aimed at architects, engineers, construction project managers, clients, and technicians. The education is free and provides knowledge about the differences between build and renovate low-energy compared to conventional buildings. The education contains an introductory seminar with a study visit, followed by a web-based training and webinar. This initiative is on-going. (Swedish Energy Agency, 2016)

1.5 Legislation, Regulation

The Swedish legislation concerning the environment is mainly found in the "*Miljöbalken*". Miljöbalken came into effect in 1999 and is the Swedish framework that aims to promote sustainable development.

Like other EU member states Sweden is governed in the course of European law and is therefore obliged to transpose the regulations and directives into the Swedish legislation. Sweden has also acceded to 40 international environmental conventions, international agreements to protect the environment and conserve natural resources.

Miljöbalken – The Swedish environmental law

Among many things the "Miljöbalken" states that all activities/businesses must conserve energy and other resources and seize opportunities to recover energy such as heat. In the first instance, renewable energy use.

National Board of Housing, Building and Planning's building regulations (BBR)

The building regulations sets an overall requirement that the building must not use more than a certain number of kilowatt hours per square meter per year. The requirement of specific energy is different depending on where in Sweden the building is located, whether it is a home or premises, and if it is heated with electricity or not. For example, a multi- apartment building with electricity based heating, situated in the Gothenburg area (which is in the southwest of Sweden), the energy usage cannot exceed 45 kWh/m^2. For the same building in Jämtland heated with district heating the energy usage cannot exceed 130 kWh/m^2. (National Board of housing, building and planning, 2015)

However, if it is considered to be a holiday house, with no more than two residential, the regulations regarding energy efficiency do not apply. This is considered a problem by the region and the municipalities in tourism areas since the holiday houses are sometimes heated all-year-round and in some cases are being used as a permanent houses. There is great potential for energy savings through energy efficiency measures and behavioral changes in these areas.

Several of the more touristic municipalities cooperates, trying to set higher demands in their permits for new houses, according to the standards for permanent homes.

1.6 Financial Support and Instruments

To reach the 16 national environmental quality objectives, adopted by the Swedish Government is ultimately the aim for the economic instruments. Sweden must also be able to implement the commitments made in international environmental agreements, such as on climate and biodiversity.

On a national level there are a number of financial instruments to promote energy efficiency measures. Perhaps the most important financial instrument for fossil fuels is the *carbon tax*. Carbon tax applies for most fossil fuels (not jet fuel), including fossil heating fuels and gas. Carbon tax applies for everyone that uses fossil fuels, including fossil heating fuels and gas

There are a large number of financial instruments which aims to stimulate stakeholders to take action through financial support. The following examples are currently active instruments. Most of them are managed by the Swedish (national) Energy agency, the County administrative board or the Environmental Protection Agency in cooperation with the regional Energy Agency:
(Swedish environmental protection agency, 2016)

Financial support for renovation and energy efficiency of rented accommodation in areas with socio-economic challenges

The government has recently decided to provide financial support for renovation and energy efficiency in areas of socio-economic challenges.

The financial support consists of two parts, one for renovations and one for energy efficiency measures. For energy efficiency measures the support may not exceed 500 SEK per m^2 (Atemp) (approximately 50/m^2) and not represent more than 5% of the total cost of the implementation. In order to get the support approved the renovations must lead to a reduced energy consumption by at least 20%. The size of support depends on how much you improve the building's energy performance. (National board of housing, building and planning, 2016)

Klimatklivet –"The Climate Step"

Klimatklivet or the "Climate step" is a part of the state budget approved by the Parliament. The Environmental Protection Agency, in collaboration with other central agencies and County administrative boards provide financial support to local investments which, when implemented, will reduce greenhouse gas emissions. This type of financial support has been tried before with great success. Any organization of company can apply and the applications are assessed by the level of emission reduction per invested SEK. (Swedish environmental protection agency, 2016)

Grants for energy audit

Small and medium-sized enterprises with an energy use of 300 megawatt hours (MWh) or more per year can get grants to do an energy audit. The audit shows how the energy is distributed in different parts of the business and what energy costs the company have. Consultants with special knowledge of energy perform the audits and help the company to develop an energy plan. The Grant is managed by the Swedish energy agency. The regional Energy Agency works as a marketing, information, and support mechanism to help companies apply for the grant. (Energimyndigheten, 2016)

Tax deductions - "ROT-avdrag"

Individuals may deduct taxes for certain types of work done in existing residential buildings, for example additional insulation or window replacement. The tax deduction also applies for the installation of solar cells. This is managed by the Swedish Tax Agency. The company performing the service is the one that applies for the "ROT"-tax deduction. (The Swedish Tax Agency , 2016)

Investment grants for solar cells.

The purpose of this financial support is to contribute to the transformation of the energy and business development within energy technology by continuing to create interest for

solar cells on buildings. Enterprises can obtain 30% and individuals can get 20% of the investment total cost when installing solar cells. (Swedish Energy Agency, 2016)

Rural fee funds "bygdemedel"

Rural fee funds is a compensation to communities that have been affected by the expansion of hydropower. The funds be applied for by associations and municipalities. The money should be used for projects and investments for purposes that promote enterprise or service in the area such as energy efficiency measures in places of assembly, street lighting, sports facilities, etc. The fund is financed by the Swedish state and is managed by the County administrative board. (Administrative board of Jämtland County, 2016)

Landsbygdsprogrammet "The Rural Development Programme 2014-2020"

The Rural Development Programme consists of financial support and compensation is to develop rural areas. Environment, sustainable development, and innovation is a priority.

The objectives of the Programme is to provide profitable and viable companies and active farmers who provide open fields with grazing animals and an attractive countryside. The rural development program includes investment in enterprises and projects, environmental benefits, environmental, compensatory aid, animal welfare payments and locally-led development. The payments and benefits are funded jointly by Sweden and the EU and is administrated at a local level by the County administrative board. (Administrative board of Jämtland County, 2016)

European Regional Development Fund

The ERDF is intended to help achieve the objectives of Europe, which is the EU's common strategy for growth and jobs 2020, in the region of Jämtland. The fund is supposed to promote efforts such as collaboration and knowledge exchange for construction and renovation of "near-zero energy buildings", developing regional and local cooperation initiatives between actors in the construction and the real estate sector and universities and other public actors.

There is currently two initiatives in terms of pre-studies, one for public real estate owners and one for the private real estate sector. The aim is to be able to apply for two joint projects in the spring of 2017. Region Jämtland Härjedalen is coordination the pre-studies. (Swedish agency for economic and regional growth, 2016)

The regional business support

Support can be given to companies that are expected to achieve profitability and sustainable employment for employees. The support may include energy efficiency measures if it clearly improves the profitability of the company. This financial support is managed and decided by the Region Jämtland Härjedalen according to the objectives in the Regional development strategy, The Program for Regional Growth as well as the Innovation strategy and national guidelines. (Region Jämtland Härdedalen, 2016)

1.7 Construction and Buildings Market Brief Description

The construction sector covers 7.3% of employment in the region, as the 5th largest sector (see figure below). This makes the construction sector an important sector for the region. (Statistics Sweden, 2015).

In recent years, construction activity has developed strongly. Residential construction has increased significantly but the needs of housing is even greater. The industry continues to be positive and has high expectations for the coming years. More than half of the companies plan to increase the number of employees the coming year. (Arbetsmarknadsutsikter juni 2016)

In the region there are specialized enterprises in areas such as heat pumps, windows replacing, insulation, solar cells, district heating and cogeneration plants.

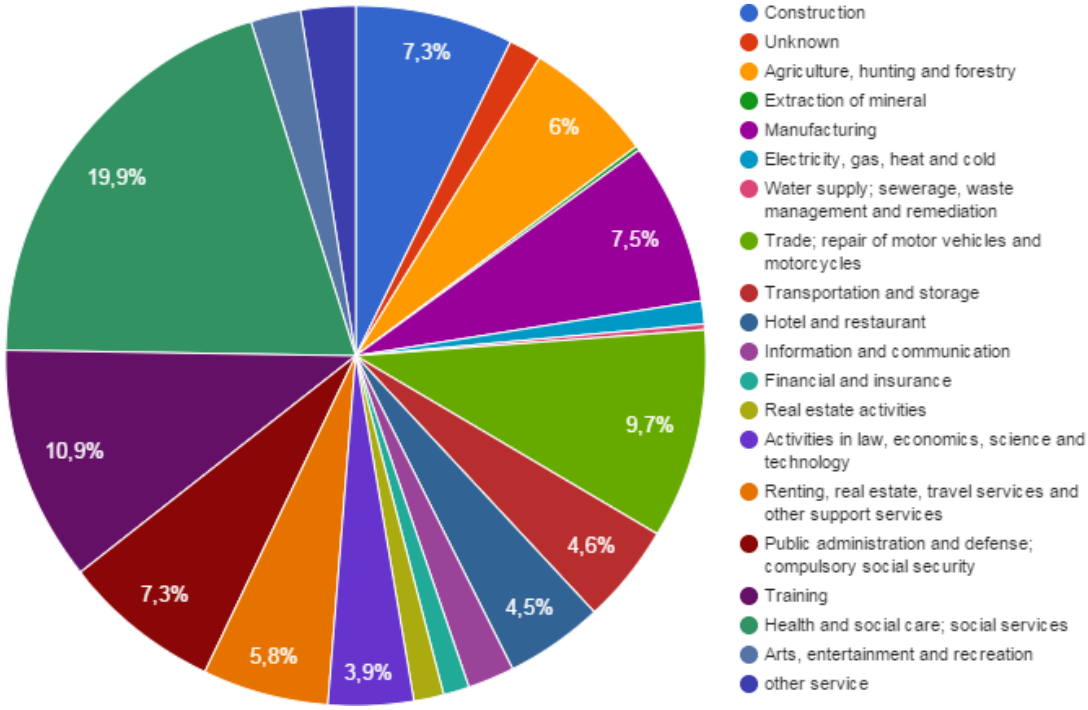

Figure 4. Sector of employment for the day population of Region Jämtland Härjedalen, i.e. the people working within the region.

1.4.2 More housing is needed

The long-term trend is clear in the region. If it continues in the same direction, there is a great need for extensive construction in all the municipalities in order to avoid shortage of housing.

In Östersund, the largest municipality, there has been a lack of housing more or less for the past 10-15 years, but in the other municipalities the lack of housing is a quite new phenomenom. The market has either been in balance or there has even been a surplus.

There is especially lack in the urban areas, while there is excess in rural areas. The sudden lack in housing is mainly due to immigration from abroad. All of the municipalities are hard at work trying to counteract the lack, and it is predicted that approximately 730 new dwellings will be started in 2016 and an estimated 1210 dwellings will be started in 2017. The planned dwellings are located in or adjacent to urban centers, which means that rural areas may be depleted even more with time. (County administrative board of Jämtland, 2016)

All municipalities but one estimate an increased need for housing over the next five years than is available in today's stock, particularly in the city centers. The greatest need is for one bedroom apartments, but apartments of all sizes is needed, both rental and condominiums. For some groups, such as young people and students, there is a great lack of small apartments with lower rents. (County administrative board of Jämtland, 2016)

The municipalities in the region mentiond several factors that mitigate construction of housing, i.e.difficulties for individuals to obtain loans, high production costs, the fact that the municipalities and /or the public housing company in some cases lacks the resources for housing, weak secondary market for housing, declining population, severe income development for households, and difficulties for developers to get reasonable lending conditions. (County administrative board of Jämtland, 2016)

The housing shortage is a contributing factor to the prices on the real estate market. During 2014-2015 they have increased with on average 24% in the region, while prices have increased on average 8% in the country as a whole. Since people move houses more seldom when there is a lack thereof and competition is higher between buyers, which drives up the prices. This particularly applies to prices for centrally located single-family homes and condominiums, which in these places is at a comparatively high level. (County administrative board of Jämtland, 2016)

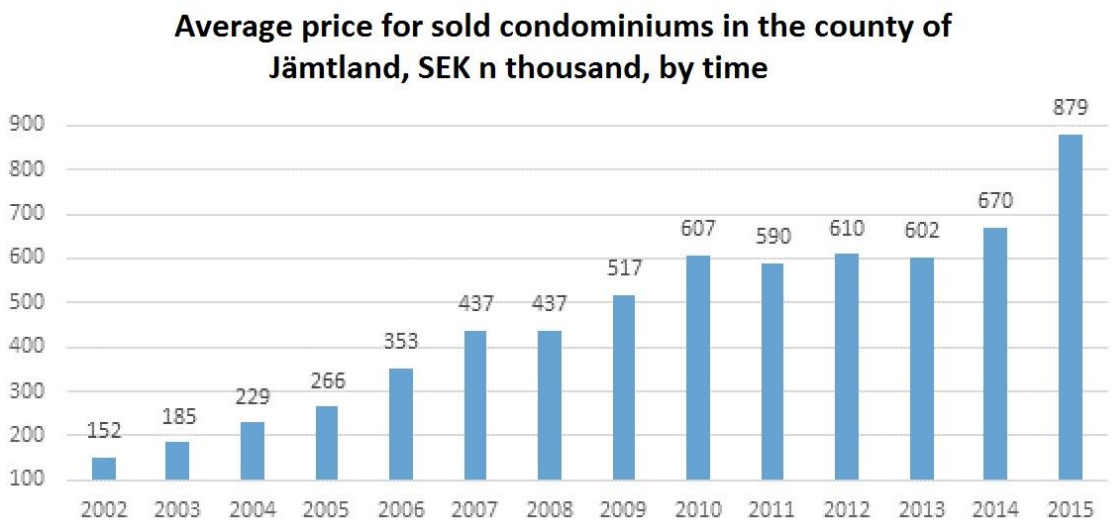

Figure 5. Average price for sold condominiums in Jämtland Härjedalen, by time. Source, Statistics Sweden (SCB).

1.7.1 Most people live in single-family houses

In Jämtland Härjedalen more than 60% of the people lives in small single-family houses, which is a higher share than for Sweden as a whole. Approximately 30% live in apartment buildings or multi-dwelling buildings. This is reflected in the type of dwellings in the region. (Statistics Sweden, 2015)

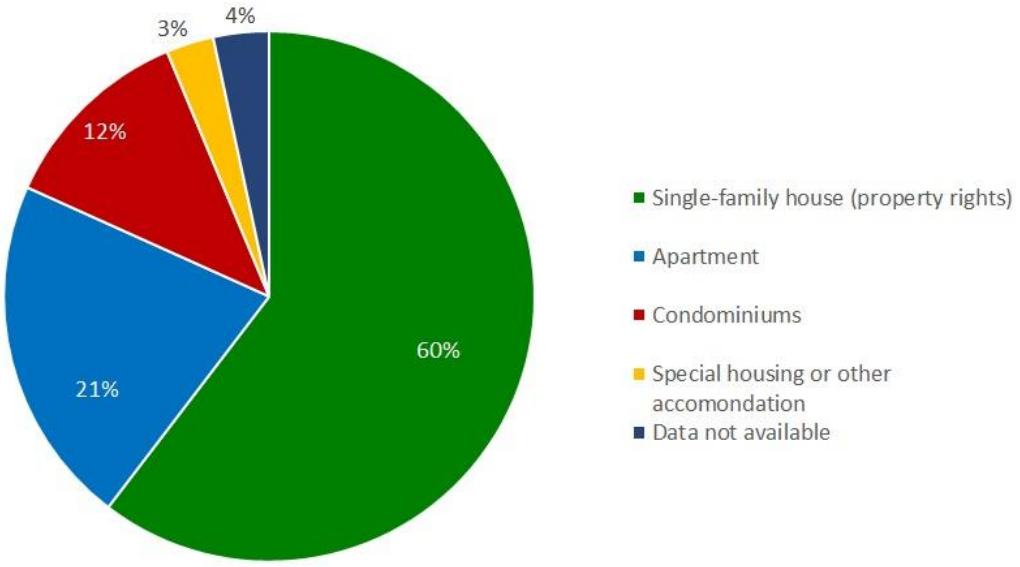

Figure 6. Share of people and type of dwelling in Jämtland Härjedalen. (Statistics Sweden, 2015)

There are more single-family houses than any other type of dwelling, e.g. 53% in Jämtland Härjedalen. In the region there is also 17 976 registered holiday houses, which is approximately half the number of single-family houses.

Table 1. Number of permanent dwellings in Jämtland Härjedalen 2015. Source: Statistics Sweden

Type of dwelling	Number of dwellings	Share	Definition
single-family	35 741	53%	Single-family implies detached one- and two-family houses as well as parties, terraced houses (excluding vacation).
apartment building	27 290	40%	Apartment buildings relate to residential buildings containing three or more apartments including balcony access.
Other buildings	1 484	2,1%	Other buildings on buildings not intended for residential purposes, eg buildings used for business or social function.
Special housing	3 157	4,7%	Special homes residential for elderly / disabled, student housing and other special housing.

Looking at the other side of the housing sector, most dwellings are privately owned, as can be seen in the table below. More than half of all dwellings are owned by natural persons. This means that there are many owners that may be difficult to reach in terms of energy efficiency and rehabilitation. On the other hand a separate ownership increases the motivation to take action and make investments that may pay off in the long term.

This also applies to holiday houses in the region, but to reach the owners of these houses can be an even more complicated, since they can be residents all over Sweden and also other countries.

When looking specifically on apartment buildings on the other hand, about one third is owned by public housing companies, 39% by housing associations (where the association owns the building and the members own a share in the association) and 29% by natural persons or Swedish limited companies. (County administrative board of Jämtland, 2016)

At present we lack the exact figures on type of ownership of holiday houses in Jämtland Härjedalen. A large part of the houses are owned by private individuals in the region but also other parts of Sweden and other countries, such as Norway. A significant portion is also owned by the tourist destination companies.

Table 2. Ownership of dwellings in Jämtland Härjedalen in 2015. Source: Statistics Sweden.

2015	Apartment buildings	All dwellings
State, municipal, county/region	0,25%	1,90%
Public housing	30%	16%
Cooperative tenancy compounds	0,03%	0,01%
Housing associations	39%	18%
Natural persons	11%	52%
Swedish limited company	18%	10%
Other legal entities	1,40%	1,80%
other legal entities	1,40%	1,80%

1.8 Professional Characterization (Labour)

The people working in the construction sector in the region of Jämtland are traditionally divided into the sub-categories presented in the table below.

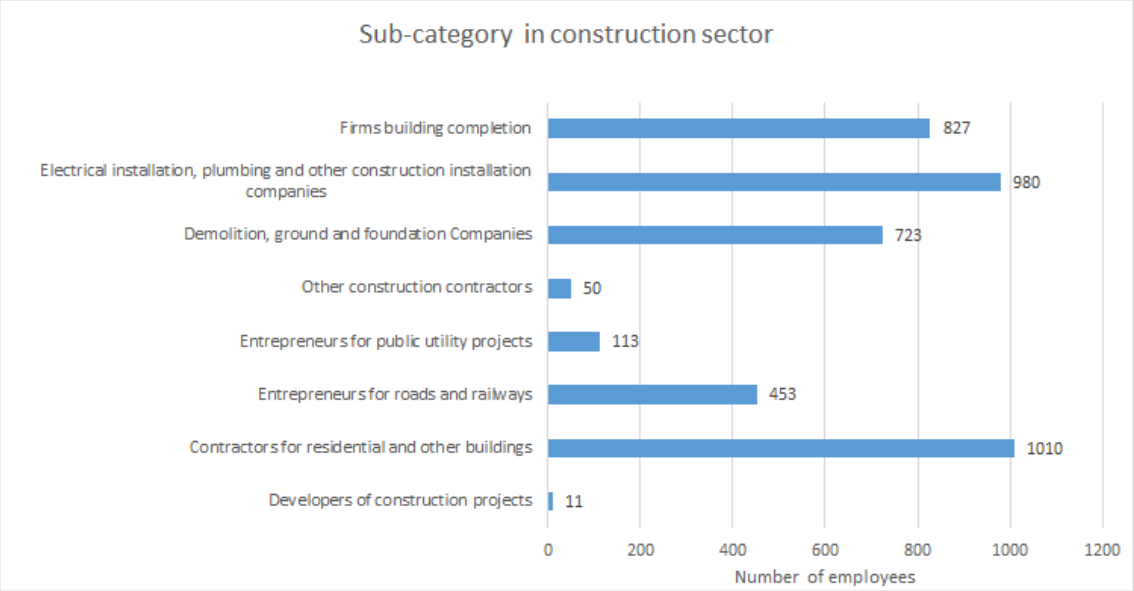

Figure 7.The number of people in in different profession sub-groups in the construction sector in 2014. Source: Jämtlands databasen, Statistics Sweden

The majority of the people working in the construction sector have high school education, see the table below.

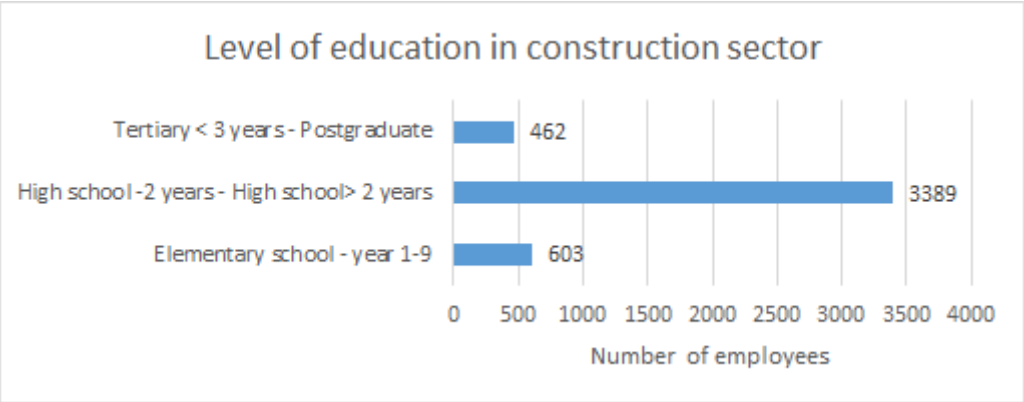

Figure 8. Level of education in the construction sector. Source: Jämtlands databasen, Statistics Sweden

Looking at the specialization of education within the region, see the table below, it is clear that the majority of are educated in engineering and technical industry, planning and construction or have a wide general education.

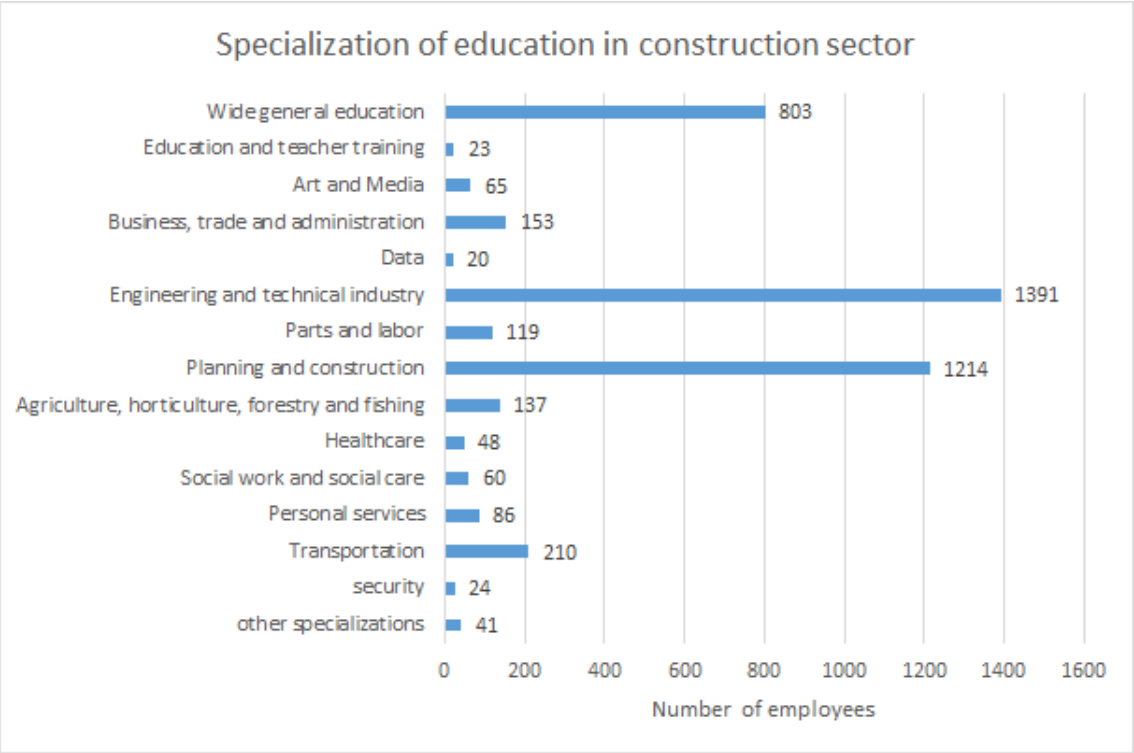

Figure 9. Specialized education within the region. Source: Jämtlands databasen, Statistics Sweden

In the Regional Development Strategy of Jämtland Härjedalen it is considered desirable that especially men in the region's smaller municipalities, go on to higher secondary education. But there is also a need of more vocational courses based on business and public sector needs. Manufacturing companies in general see a great need for technical training both polytechnic and higher education levels. (Region Jämtland Härjedalen)

Our stakeholder group, consisting mainly of real estate owners express the lack of developers and lack of skilled craftsmen and contractors within the construction sector. This reduces competition, increases prices and slows down the construction pace. It is also likely that the lack of competition decreases the motivation to develop new ideas and innovative technics.

The stakeholders have also expressed a lack of training of junior staff from senior staff, especially for operations staff. Many of the operations staff are due to retire soon and are the only ones with the specific knowledge of the existing buildings, due to lack of documentation. This can also be seen in the table below, where the average age of engineers, technicians and people with general education is very high. There is a risk that a lot of knowledge and experience will be lost if no knowledge exchange program is put in place.

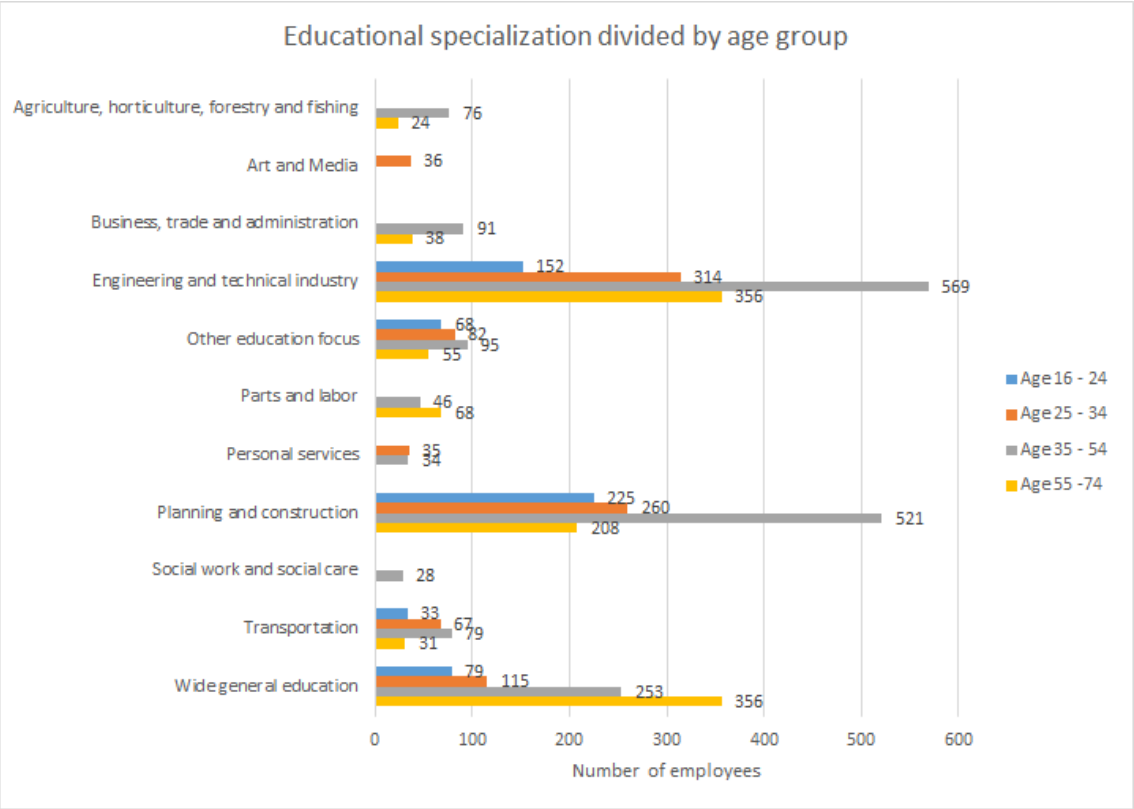

Figure 10. Specialization in education divided by age group in 2014. Source: Jämtlands databasen, Statistics Sweden

Specifically for energy rehabilitation there is a free of charge online course called "Energilyftet" ("Energy lift"). Energilyftet is an initiative with knowledge-enhancing training aimed at architects, engineers, construction project managers, clients, and technicians. The course provides knowledge about the differences between building and renovating low-energy compared to conventional buildings. The course contains an introductory seminar with a study visit, followed by a web-based training and webinar. (Swedish Energy Agency, 2016)

1.9 Preliminary Best Practices

Grant for municipal Energy and Climate advisors

The main purpose of the financial support "The Climate Step" is to reduce emissions that affect climate change.

The financial support can be used in all areas that affect climate change for example; infrastructure, waste management, transport, information campaigns, energy efficiency, reduction of gas emissions, charging stations, energy conversion in buildings and production of biogas.

The company or organization applying for the support provides the largest part of the investment. The Climate Step´s part of the funding is on average 42 percent.

Every Swedish krona invested should provide the greatest possible benefit to the climate. That means that calculating the climate benefits are a decisive factor for the measures that can be supported. The calculation shall demonstrate how GHG emissions changed by the action. The Environmental Protection Agency has presented methods of calculation and guidance on life lengths of different measures.

The county administrative boards support and guide those who wish to apply in each region. The County Board will also contribute with their knowledge of the conditions, plans, programs and strategies that are relevant.

Grant for municipal Energy and Climate advisors

All Swedish municipalities can apply for a grant for a municipal Energy and Climate Advisor. The grant has existed for most of the past 40 years. The size of the grant and the assignments for the advisors has evolved over the years as energy issues in society has changed.

The advisors target group is SMEs, organizations and individuals. The advisors provides information on relevant energy efficiency measures, technical solutions and relevant investment aids available. The advisors also provide information on renewable energy production and transport issues. The advisors have knowledge about regional conditions.

The advisors consult those who seek help, but also actively contact energy intensive target groups offering advice. The service is free of charge and commercially independent. The regional energy agencies coordinate the advisors.

The grant is provided by the Swedish Energy Agency. The size of the grant is 28 000 – 43 000 euro/year depending on the number of residents in each municipality. Many municipalities are small and it is common that the grant covers approximately a 40 % service.

Heating control with forecast

When the weather changes easily arise difficulties in maintaining the desired indoor temperature. For example, a transition from a cold night to a clear day with high solar contribution through the windows often results in too high a temperature indoors.

One of our stakeholders, Östersundshem has tested controlling heating of buildings based on forecasts. The technology calculates how much energy to be supplied to a building, based on very local weather forecasts. In this case, the technology has been used for heating control, but it can also be relevant to comfort cooling.

Practical application of forecast control generally use remote-controlled forecast receivers that send and receive data over GPRS or GSM network. The forecast receiver in turn controls the controllers placed in the building and regulate the heatdistribution. Östersundshem tested two methods in two identical buildings, manual control with weather forecasts and automatic control with weather forecasts.

Energy mapping

SME:s with an energy consumption exceeding 300 megawatt hours (including transport) per year can get a grant for energy mapping. Farms with at least 100 animal units are also eligible to apply
The grant covers 50 percent of the cost, maximum 50 000 SEK (about 5000 euro)
An energy mapping report shows how the energy is distributed in different parts of the business (including transport) and what the annual costs for energy are. The energy mapping report must include suggestions of measures, it usually shows expected investment costs and payback time for each measure.

Energy consultants can perform the energy audit and write the mapping report, but if the company have similar expertise in-house, they can get the grant and make the mapping themselves.

Once the company has completed the energy mapping and decided on the measures to be implemented is time to report to the Energy Agency; economy report, energy consumption, energy plan etc.

The grant is provided on a national level, but is combined with information activities at a local level through the regional energy agencies. All figures and numbers in this description comes from the national level. The regional energy agencies spreads information about the grant and helps/guides companies through the process of applying for the grant and moving on to action.

An energy mapping grant was available during 2010-2014. Approximately 1,000 companies applied for the grant, of which about 780 completed an approved energy mapping report. The Swedish Energy Agency now provides this support for the second time.

Smart procurement

The municipal housing company Östersundshem have used a new strategy for the procurement of new construction projects. Instead of demanding absolute energy demands for new buildings or requesting specific technical solutions,, they place a maximum energy demand, for example max 70 kWh/m2/year.

Östersundshem takes 50 years of energy consumption from the each option into account when they evaluate the best option.

In this procurement strategy entrepreneurs can give tenders based on their best practice. This model gives the entrepreneurs a chance to be innovative, and Östersundshem get a long-term view on energy consumption and costs. This metod could be applied to renovations.

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2. SWOT Analysis

2.1 Strengths

High motivation within the real estate companies

Real estate companies in the region are interested in learning from others and to cooperate with other companies. They are very positive about the coordinated network for energy efficiency in buildings.

High expertise of sustainable building at the Region´s University

The region's universities have both research and training, and offers two three-year engineering programs in structural and environmental engineer. In addition they offer other graduate programs and an international masters in environmental engineering and environmental sciences, as well as several courses. The university is very interested in working together with the industry in the region.

Bio-fuel (wood pellet etc.) – big availability

The region has large areas of productive forest land and processing facilities that account for a significant share of the region's biomass energy sources for heating in the form of wood chips and wood pellet.

Competence and knowledge within energy- and heat production and distribution

The region has several energy companies with a wide range of expertise in these in the areas of hydro power, cogeneration, district heating and block heating

Relatively extensive energy transformation already undertaken

In Sweden, building standards have been used as part of the building regulations to reduce energy consumption, since the 1970s. Hence, average energy consumption for heating in buildings relatively low considering the cold climate. 95 percent of the energy for heating is renewable.

Legal stability

In general Sweden has stable legal systems.

2.2 Weaknesses

Small companies – hard to keep expertise in-house and limited staff & financial resources

Businesses in Jämtland Härjedalen consists mostly of relatively small companies, both in the construction sector and real estate sector. This makes it difficult to maintain special expertise and a challenge to work focused because employees often have multiple areas of responsibilities.

Many privately owned small houses – hard to reach everyone

Approximately 60% of the population live in single-family houses. This means that it can be difficult to reach all individuals at information campaigns or offers of energy efficiency measures.

Lack of knowledge exchange between senior and junior staff

Stakeholders in the region express lack of training of junior staff from senior staff, especially for operations staff. Many of the operations staff are due to retire soon and are the only ones with the specific knowledge of the existing buildings. This is mainly due to lack of resources and routines for documentation.

Lack of advanced expertise within energy rehabilitation contractor sector

Stakeholders in the region express the lack of skilled consultants and contractors within the construction and rehabilitation sector, in particular skills within innovative integrated energy solutions. It is also likely that the lack of competition decreases the motivation to develop new ideas and innovative technics.

Sparsely populated areas with long distances – makes collaboration more difficult

The region has small businesses and organizations that need to work together to be competitive. The long distances complicates cooperation when the meetings are costly both in terms of time and fuel.

Level of education below the national average

The region’s inhabitants generally have lower levels of education than the national average. In order to tackle the challenges we are facing regarding and the need for energy conversion and climate change adaption good skills are a very important factor.

Limited access to capital

The region's stakeholders are small and have limited capital to make the investments required.

2.3 Opportunities

Well-developed national in-job training system via National Energy Agency

The national Energy Agency has a well-developed system for skills trainings and measures as well as collaboration with the regional Energy agency and other authorities in the region.

"Cheap" and renewable electricity for heating

The region, as well as Sweden as a whole, has relatively cheap electricity for heating, making energy poverty less of a threat.

Financial support for investments in renovation of buildings in socio-economic areas and other financial instruments

The current government has a strong focus on energy efficiency measures and there are a number of economic policy instruments that the region's players can use.

Web-based administration systems

A large share of administration systems are web-based in Sweden, such as application forms, which can simplify and speed up energy efficiency efforts.

2.4 Threats

Difficult to get loans for renovations in rural areas

Houses in rural areas have a low market value. The market value of the house is sometimes just a fraction of the cost needed to renovate and implement the energy efficiency measures. The banks have difficulties in providing loans for the renovation of these houses. Likewise, homeowners are less positive about investing.

Lack of political long-term stabile political policies

Uncertainties regarding long-term policy instruments makes it difficult for companies to know what actions to take and what investments to do.

Poor energy performance for small houses in tourism sector

The legal building standards for energy performance do not apply holiday houses. Since the region have many holiday homes that are heated as permanent housing this is an unnecessary cost and a waste of energy.

Northern location, heating needed for most of the year

Jämtland Härjedalen is located in a cold climate where temperatures in winter time reach below 20 degrees Celsius for long periods of time. This requires a high energy performance for housing.

"Cheap" electricity for heating

The region as well as Sweden as a whole has relatively cheap electricity for heating, sometimes making investments in energy efficiency measures hard to motivate.

3. Needs

List of needs expressed by the regional stakeholders:

- *Coordination and cooperation*

  (Municipalities and companies in Jämtland are small. It is a challenge for them to keep the competence and know-how needed. It is very common that the staff has several areas of responsibility, which makes it complicated to focus on one subject.)

- *Investment grants and funding*

  (The region's stakeholders are small and have limited capital to make the investments required.)

- *Education – all levels, in particular technical operators, janitors, training packages*

- *Knowledge and inspiration – innovative technics, taking the experiences of others who have tried/practical experience:*
  - Procurement - Exchanging experience and inspiration - how do we set requirements and make evaluations to promote development
  - Regulations concerning photovoltaic installations
  - Insulation – moisture diffusion
  - Forecast control and other control systems
  - Ventilation, several types, even without ducting (Pax, Luno)
  - Windows with ventilation and heat recovery
  - Construction - diffusion
  - Sports Facilities – energy efficiency measures in complicated systems