Energy Efficiency and Preservation in our Cultural Heritage in Halland, Sweden

H. Norrström Ph.D. stud. & M. Edén Dr. Prof. Arch.
Department of Architecture, Chalmers University of Technology, Gothenburg, Sweden

ABSTRACT: With the implementation of directive 2002/91/EC on energy performance issues have arisen on the complex set of problems that hold between energy efficiency and preservation perspective.

The aim of this paper is to describe the state of art in Swedish sustainability regarding energy efficiency and integrated conservation and how these have been carried out in our built heritage represented by the regional co-operation project the Halland Model where case studies are performed.

The aim of EEPOCH, Energy Efficiency and Preservation in Our Cultural Heritage;

– Through generic research the case studies form a foundation for a theoretical model directed on application for integrated balancing of energy and preservation demands without diminishing intangible values in our built heritage.

– The qualitative research part includes interviews for analysis on communication between different occupational cultures to illuminate methods within and between connected professions, especially their interdisciplinary approach.

1 UNDERSTANDING THE HALLAND MODEL – A SHORT SUMMARY

Objects for studies are chosen within a concept called the Halland Model for preservation of historic buildings aiming at regional sustainable development. The County of Halland is situated in the south of Sweden. The regional joint venture, the Halland Model, includes the construction industry, the historic environment sector, the labour market sector, estate owners, local and regional authorities and trade unions. It was started in the 1990s recession to increase the total volume of construction. The very first motto of the scheme was: Save the jobs, save the craftsmanship, save the buildings. It soon developed into a regional cross-sectoral joint-action network aiming at sustainable growth. The aim also was strengthening competitiveness, sustainability including use of renewables and reuse/recycling of materials and development of building conservation.

In Christer Gustafsson's dissertation on the Halland Model (Gustafsson 2009) an application-oriented theoretical platform and a new model, providing adequate approaches to solving boundary-spanning challenges is presented. A generic and entrepreneurial model is developed where the "trading zone" is defined as an active arena for negotiations and exchange of services or a field of force corresponding to the actors' policies, values, facts and resources.

In the Halland Model both preservation and energy efficiency have been taken into account in the conservation work. Over 1100 building construction workers and apprentices were trained in traditional building techniques operating in about 100 historic buildings at risk, under supervision of skilled craftsmen and conservation officers. Selected objects include castles, windmills, industrial sites, dwellings, warehouses, theatres among others.

After the completion of conservation work the improved premises made new functions available inspiring the start of several new businesses. The chosen buildings were seen as resources to be taken advantage of and to develop. Preserved built environments are often seen as attractive for dwelling and if used properly they can be an integral part in trade activities and other businesses and even increase their market value. This is one of many added values which have come out of the concept. About 1500 contractors and suppliers have been involved and about 400 new jobs have been created directly depending on the execution of the Halland Model and about 200 indirectly. The Halland Model has been exported e.g.to the Baltic Sea Region, Russia, Poland and Iceland as regional project for sustainable development and the experiences of the Halland Model has been disseminated in several conferences in other parts of the world.

When conservation and retrofitting are carried out the running costs must at the same time be reasonable and the energy use efficient. The overarching Halland Model gives good examples on managing of energy performance without diminishing the cultural value and social history in our built heritage. All these facts and the reuse and improvement of existing resources, both material and human resources, implies that the concept is not only building on the three pillars of sustainability i.e. environmental, social and techno-economic, but also manages to enhance the five capitals: human, environmental, social, financial and manufactured capital as described by the Royal Academy of Engineering in London (The Royal Academy of Engineering 2005). The Halland Model concept has a direct as well as an indirect effect in the societal system and thus contributes to it.

2 FORMING OF THE RESEARCH QUESTIONS

A building can be seen as a historical document from social aspects but also purely constructional. The starting of the ”million programme” in 1965 when one million flats were built in one decade was a parting point that changed the epoch of craftsmanship in the construction sector and the industrial era with prefabricated parts mounted on the construction-sites had its' beginning. Sweden has a young building stock. Habitations constructed before 1945 only amounts to about 33 %. Today we have about 4.4 million flats in Sweden of which about 2 million in detached houses (Boverket 2004). It is the handicraft produced building stock i.e. built environment constructed before 1945 that is studied in this research project.

During 1960s and later when the ROT-programme (Reparation-repair, Ombyggnad-reconstruction, Tillbyggnad-extension) was carried out many mistakes were made in the existing built heritage. Our Swedish stock of insulated and plate covered buildings emanates from these years. A later evaluation made by Boverket or The National Board of Housing, Building and Planning in English (Boverket 2003) shows that projects financed by this programme premiered huge reconstructions and added insulation without consideration for cultural and historical values in our built heritage. There is an obvious need of guidance on efficiency in the tertiary sector now with the new law on Energy Declaration and many measures and actions on energy efficiency will be put forward in the years to come.

According to the Swedish governments national environmental objective Good Built Environment (Environmental Objectives Council 2009) the cultural, historical and architectural heritage as buildings and built environments with special values should be protected, developed and identified latest in 2010.

Earlier about 3000 objects/buildings have been identified in Halland and a new inventory points out over 10000 objects. The inventory concerns the housing and service sector as well as industry and others. Similar results will most likely appear in the other regions too. At the same time as the buildings and objects are protected they must be given reasonable running costs. There is a demand for a model/guidance on how energy efficiency can be managed without negative impact on the cultural and historical values in our heritage.

Our officially protected monuments are quite well managed and energy efficiency is of minor interest considering their high historical and cultural values. Preserving the past for the future is not a risk but an obligation. But how about all these buildings at risk not so ancient, not so distinctly characterised still so important for the overall experience of a block, a neighbourhood or a region? They serve as time-documents of a city history and as cultural layers of its development. Are these values protected when the energy experts come to do their job according to the Directive 2002/91/EG on Energy Performance? There is a lot to discuss and investigate and to do within the complex set of problems that holds in between energy efficiency and preservation perspective. From these both perspectives a kind of double core emerges and the main questions in EEPOCH are:

–Will intangible values in our built cultural heritage be lost in favour of measurable and tangible energy efficiency actions?

–Is there a risk that too big cautiousness in our built cultural heritage makes actual efficiency potential not being realised?

Is it possible to explore this dual core, which is the combination of preserved built heritage and energy conservation on the one hand, performed in a way both conservation officers and energy counsellors can accept on the other hand and is this exemplified in the Halland Model?

3 METHODS, ACCOMPLISHMENT AND EXPECTED RESULTS

EEPOCH as a project will explore a dual core, which is the combination of preserved built heritage and energy conservation on the one hand, performed in a way both conservation officers and energy counsellors can accept on the other hand, all exemplified in The Halland Model where objects for case studies are chosen. Within the project generic research on the objects energy performance and preserved values will be carried out for cross-case conclusions. This requires both technical and analytical means and methods.

Evaluating the energy performance can be carried out in linear empirical research grounded in theory of positivism making use of deductive implications as is usual in natural science. However in order to handle the duality of the research question Yin's method for case studies (Yin 2009) in applied social research is more adequate and will be chosen. In this evaluation workshops will be performed together with responsible energy managers in eight local energy and real estate companies owned by the municipalities in the County of Halland. The project will gain from their great experience and knowledge on energy matters and they will in turn get access to the work and results from the project and to the group of experts linked to it. Ten experts from the two sectors technology and the humanities, representing both practice and academy are carefully chosen and they will participate in the workshops. This accomplishment holds both interdisciplinarity and transdisciplinarity within.

Descriptive method for analyzing the objects cultural values emanates from the humanities and the history and from development of architecture, sociology, society and technology. Authenticity, patina, continuity, symbolic value, rarity and other qualities (Unnerbäck 2002) will be considered as well. In a way this can be related to philosophies of (post)structuralism (Lübcke ed. 1988) in evaluating the qualities and values in the sense of meaning and understanding of them. As Schleiermacher defined hermeneutics as the art of avoiding misunderstanding general hermeneutics including interpretation of built form and both written and verbal information will be used in the project. In the assessment an interpretive-historical approach (Groat et al. 2002) is needed when archival data and interviews with involved conservation officers and craftsmen will be analyzed which implies qualitative research. Inspectors of built heritage will be invited to the workshops concerning this part for valuable contribution. These stances and mix of approach and method regard the state of the objects and discernment or judgement on their values.

The second part of EEPOCH will examine the point of common in the involved disciplines within the Halland Model. And the possible synergetic effects of an interdisciplinary perspective in relation to each case for understanding of holistic views on built environment. Finding out how this has been obtained by the teams requires an investigation of roles and organisation on the one hand and methods and actual execution on the other hand and will be carried out in the next phase of the project.

A continued cooperative work, including as many disciplines and practitioners as possible or demanded in each case together with carefully planned and prepared increase of efficiency can lower environmental impact and make our built cultural heritage useful for the future creating attractive environments with low running costs. EEPOCH shall provide the models for managing of energy performance without diminishing cultural values in our built heritage. The expected output with EEPOCH is providing the models for managing through case studies based on the outcome of the Halland Model. The hypothesis is also that the model can be implemented in other projects for demonstration thus contributing to society as a whole. This research project is connected to the National Energy Agency's ”Save and Preserve” programme along with other projects that will form an important component to bring additional quality and contribute to necessary development of knowledge.

4 CASE STUDY NO1, DROTTNING KRISTINA 2, HALMSTAD

4.1 *The Object: Fattighuset, Drottning Kristina 2 in Halmstad*

The first case study is ”Fattighuset” (the Poor-house) or the old fire-station at Lilla Torg (the small market) in the municipality of Halmstad. The real estate’s name is Drottning Kristina 2 in the parish of S:t Nicolai. The municipal real estate company Industristaden AB is the owner. The main building was raised in 1859 and 1879. The back wing was built up 1891 and altered in 1901. Total area heated to +10˚C or more amounts to 1062 m^2. The real estate is part of Halmstad old town forming an environment with great values to preserve and protect. An inventory was made from antiquarian and technical perspective and the buildings were measured out and all damages were documented in 1994-1995. All collected original material is being kept at Kulturmiljö Hallands archives at the address Bastionsgatan 3 except for those kept at the town hall.

”Fattighuset” is a corner house at Köpmansgatan and Lilla Torg by the markets southwest part. The buildings have two stories and are of red burnt 1 ½-stone handmade bricks of second-rate on a foundation of granite. Partitions are of wood and slabs. All tiers of beams in floors are wooden. The brickwork is cross-bond mason with lime mortar and an exterior cornice. There are entrances on the north facade towards the market and to the east into the yard. The regular placed four-bayed wooden windows have cross mullions and plate covered window-sills. “Fattighuset” has span-roof and broad-axed Swedish roof-truss with boarding and red-painted plated roof. When the conservation was carried out the earlier garrets were replaced with roof-windows and 175 mm of insulation was added. Two mason chimneys are astride the ridge and the roof towards the market has a hip roof. A lift has been installed. In the attic there is a room for the mechanical ventilation and on ground floor in the oldest part of the building is the boiler room where the exchanger for district heating is placed. The original plan is almost fully preserved. The exterior as well as the interior have many old doors, windows, stairs, floor and roof cornices and more of old date preserved.

4.2 *History*

In 1847 Sweden had its’ first complete Poor Law saying that every parish and town should take care of those who lacked ability to do so by themselves. The plans for “Fattighuset” in Halmstad are drawn by Hans Strömberg who was head architect in the city of Gothenburg at the time. The first back wing was torn down in 1891 to make place for a new one with cells for the insane and with studies. The object worked as a poor house for 42 years and after the extension on the north façade in 1879 there was room for about 40 needing people and room for offices, staff’s living etc. In 1901 this activity moved to new premises. The fire brigade took over. A hose-tower and coach-house was built up with Sven Gratz plans. The main house was reconstructed for offices and the back wing for giving the fire-men a gymnasium. The fire department moved in 1903. The tiled stoves seen in plans from 1901 are gone in plans dated 1934 when a new heating system with water-distributed heat and a boiler was installed. The later alterations are small like garret-windows in the attic 1946 and 1952, altered disposition of rooms, new kitchen and bathrooms. From 1977 when the fire department moved out some local associations and unions moved in and stayed to 1986. After that the buildings were vacant until the conservation work started in 1996. Today “Fattighuset” is hired out to shopkeepers and offices.

4.3 *Cultural values*

”Fattighuset is one of the city’s few preserved buildings from the 19th century and as such it is a historic document of this era. It’s representing the changes due to the liberal politics’ emergence and breakthrough in Sweden during the latter part of the 1800s. The public’s role in society grew and taking care of the poor is one good example of this.” (Landsantikvarien 1995)

The buildings are constructed with locally specific materials, worked and handled by skilled craftsmen and are well preserved in materials, original forms and expressive exterior. The very vivid brick-facades have many nuances due to the second rate quality. This character also mirrors the society’s view on the pursued activities in the buildings at the late 1800s. The floor plans are almost intact and are of the general character which can hold different activities within and by this possesses a high architectural quality marking good art of building. Further on the buildings as documents and symbols are important parts of the societal development and social history in Halmstad. Fattighuset together with the fire-station and the cinema forms an extremely characteristic quality in facades facing north and as such constitutes an inalienable part of the framework or settings around Lilla Torg. Fattighuset has classification 1 in the city's preservation plan: Building of great cultural and historical values with exterior that cannot be altered.

4.4 *Energy efficiency*

Knowledge on the buildings energy consumption is a condition for running and maintain buildings in an energy efficient way. Measured figures are naturally what to use but these figures don't always match the calculated. These differences could be of value showing that the building is maintained very well but could also indicate that actions could be taken and show what can be improved. Measured figures and manually calculated demand will be accounted for. Halland is in climate zone III according to the Swedish regulations (Boverket 2009b).

Use of district heating is 186 MWh/year. The district heating system in Halmstad amounts to 88 % of renewable energy sources. For Sweden as a whole it was 71 % in 2008. Average electricity use based on the latest four years is 90.4 MWh/year of which 60.7 MWh/year is related to the tenants' activities and leaves 29.7 MWh/year for running the building. This part includes running of two minor machines for air conditioning in the summer. These are installed in the attic floor. Average use of water in the four latest years is $600m^3$/year. Key figures for district heating is 176 kWh/m^2, year and for electricity 28 kWh/m^2, year. The table shows comparison of key figures for total energy use in similar buildings.

Fattighuset, Drottning Kristina 2	204 kWh/m^2, year
Energy calculation, type code 826, statistic interval*	144-200 kWh/m^2, year
Other figures in offices**	140-240 kWh/m^2, year
The National Energy Agency's STIL-study, average figure***	202 kWh/m^2, year

*Boverket 2010. ** http://www.byggabodialogen.se/ ***Energimyndigheten 2007.

The buildings have water distributed heating with radiators. The main building has mechanical continuous exhaust ventilation with variable frequency control but no heat recovery. Fresh air is supplied by vents in the brick wall. The back wing has mainly natural ventilation and mechanical exhaust ventilation which can be turned on if demanded.

When preparing for the manual calculations eight different books and guides have been used: Adalberth 2008, Adamson et al. 1986, Anderlind et al. 2006, Boverket 2009a, Boverket 2009b, Elmroth 2009, Petersson 2009 and Wärme 1991. Calculating thermal bridges and the heat accumulating capacity of the brick walls and to determine the outdoor temperature one have to use Ψ-values. These values for massive constructions like brick walls are not to be found in the books or the guides. This could depend on the guides intended use for new constructions and new massive brick constructions are rare in Sweden today. Computer software has not yet been tested. The Ψ-values for massive constructions might be available there. Nor the heat loss through thermal bridge on the negative side neither the positive compensation through the wall's heat accumulating capacity will be referred to in the manually performed calculations. For determining the outdoor temperature (winter) the figure -17˚C is chosen and it is the limit which SMHI, Swedish Meteorological and Hydrological Institute, uses for measuring degree days. A normal year in Halmstad the degree days are 3194. Measuring the indoor temperature in thirteen different places gave the mean value +20.5˚C which gives a difference or Δt=37.5˚C.

Construction	Material	U-value*	Construction	Material	U-value*
Walls	Brick	1.8 W/m^2 ˚C	Doors	Wood/glass	2.7/4.5 W/m^2 ˚C
Window I	Wood 2-panes	3.0 W/m^2 ˚C	Roof I	Wood	0.154 W/m^2 ˚C
Window II	Wood 1-pane	4.5 W/m^2 ˚C	Roof II	Wood	0.287 W/m^2 ˚C
Window III	Wood 1+1-panes	2.7 W/m^2 ˚C	Tier of beams	Wood	0.255 W/m^2 ˚C
Roof-window	Wood/aluminium	1.4 W/m^2 ˚C	Boiler-room floor	Concrete	0.425 W/m^2 ˚C

* U-values tell how much heat that is transmitted from the warm side to the cold side in a construction.

U-value for the brick wall is calculated on actual temperature of the walls' surface and indoor and outdoor temperature on the occasion when IR camera was used. The other U-values are calculated by the book with λ-values for heat conductivity for calculating the heat resistance, R, and with the special transition resistance R_{si} and R_{se}. All other applicable corrections have been made for moisture, for constructive and general corrections and finally some U-values e.g. for windows are taken from the books and guides.

Measured wall surface is 632 m^2, floor surface to the ground 388 m^2, roof surface 534 m^2, window surface 100 m^2 and door surface 33 m^2. By multiplying U-value by surface and by degree days the transmission losses through the envelope amounts to about 136 MWh/year. Using exchanged air volume per hour, the air's density and heat capacitivity, flow and degree days the heat losses through ventilation amounts to about 47 MWh/year. Fresh water coming in to the house usually holds about +8˚C and it takes 1.16 kWh to raise the temperature of 1 m^3 water 1˚C. You have to heat the hot tap water to +60˚C to avoid Legionella bacteria and by multiplying you get a demand for hot tap water about 12 MWh/year. In total 195 MWh/year. Contributing surplus heat from people and electrical equipment amounts to 21.6 MWh/year (3600 kWh+18000 kWh) which gives a calculated bought district heating of 173.4 MWh/year. This is about 13 MWh less than actually bought district heating. Using the IR, infrared, camera gave some possible answers. It was e.g. obvious that lack of draught preventers causes huge heat losses through windows and doors. In addition the problems that tenants and landlord have registered could give an explanation to this difference.

The tenants experience mainly emanates from comfort issues. It is cold during winter especially in areas near the fresh air vents and around windows and doors. The temperature on the walls on the inside by the fresh air vents was measured to +9˚C and simultaneously the temperature outdoor were measured to 0˚C. The windows are not air-tight causing draught in addition to the cold draught from the glass itself meeting the heated indoor air. During the summer the offices at the attic floor is overheated.

From the landlords view the buildings general condition, economy and applicability are the main issues. They mean they have high costs for heating and possibility for letting out on hire is connected to floor plan solutions and indoor comfort. There is also a problem with the foundation and a dehumidifier with continuous measuring and control was installed by Anticimex. Fungus growth in the stone foundation occurred in the beginning of 2001 and was then excavated and a dehumidifier from CorroVenta AB was installed.

5 FRAMEWORK

5.1 *Energy Efficiency a Global Problem and a Tradition in Sweden*

Sweden's total energy use is almost 400 TWh/year (of total supply 600 TWh) and about 36 % is used in the residential and service sector (Energimyndigheten 2009). This sector has an enormous impact on our environment and climate and in an EU-perspective the supply of imported fossil fuels is a problem. The need of import is about 50 % today and will have increased to 70 % in 2030 if actions are not taken (European Commission 2007). This isn't sustainable. Many directives have been formed due to this fact.

In several regional, national and international studies on energy efficiency the potential is estimated to at least 10 % of electricity use (Sveriges kommuner och Landsting 2006) and 20 to 50 % savings of total energy use (European Commission 2007) if installations and constructional measures are considered i.e. heating/cooling, ventilation and insulation. On European basis the tertiary and service sectors are consuming 40 % of the total energy use. For economists a buildings lifecycle is 40 years. During this time span about 85 % of the total energy use (Adalberth 2000) and 50 % of the total costs is within the managing phase. In EU level according to the 2005 IEA summit energy efficiency is considered a key action while it decreases energy demand and its' environmental impact as well as creating new jobs. It's seen as a path to social, financial and environmental sustainability. A slow pace of erecting new constructions in Sweden, about 1-2 % per year, points out the existing constructions and buildings as the big potential. What this implies for the building itself or the inhabitants are rarely mentioned.

When the Oil crises occurred 1973 the issue on energy supply became topical in many countries. The Swedish building regulation from 1967, SBN 67, were valid for building demands in

Sweden at that time. The demands were low and equivalent to about 60 mm insulation in walls and 100 mm in roofs or attics and double glazing was required when erecting new buildings (Adamson et al. 1986). Soon an increased energy costs due to the oil crises was mirrored in the regulations. The demand on insulation doubled and the window area was limited to 15 % of the floor area. For bigger buildings heat recovery for ventilation systems was demanded.

The government bill 1977/78:76 Energisparplan för befintlig bebyggelse (Plan for energy saving in the existing building stock) principally implied an objective for 25 % energy savings within ten years. Subsidies for added insulation of facades and having energy counsellors in all municipalities were introduced. All municipalities had to make energy plans and later on by PBA, the Planning and Building Act (Boverket 1987) to include energy management in all development plans. In 1984 a special legislation for houses heated with electricity came up (Byggforskningsrådet 1987). Economic means were put into research and development of renewable energy sources and techniques.

Today our Swedish legislation is based on functions. With BBR 2008 we got a limitation of energy use; from maximum 110 kWh/m^2, year in the south climate to maximum 150 kWh/m^2, year in our north zone and in addition a mean U-value 0.50 W/m^2, K for dwellings. Higher numbers, +20 %, can be accepted if this demand “is not possible to obtain due to cultural and historical motivated limitations” (Boverket 2008).

Through the years a number of bills, regulations, reports and subsidiaries have been delivered and their common sign is lack of holistic view and the one sided consideration of buildings as real capital handled by economic rules and assessments. The energy issues have slowly but consequently been pushed forward, although in uneven steps. During the last ten years with the new focus on environment and climate issues other sides have been enlightened but even then from an economic perspective which the Stern report (Stern 2006) shows, as one example.

In 1999 the Swedish government decided on 15 Environmental Objectives and in 2005 a 16th objective was added (Environmental Objectives Council 2009). Many of them are strictly related to our energy use and its environmental impact. The objectives have been adapted to county level with action-plans in all of Sweden. Sweden has a long tradition of energy balancing, resulting in energy- and environmental counsellors in every municipality in 2008 and over 44 % renewables in the national energy system which is more than in any other EU country. The Swedish government’s objective for 2020 is 50 % renewables (Energimyndigheten 2009).

5.2 *The tradition of conservation in Sweden*

In Europe during the 19th century a restoration method based on absolute architectural style had developed as were the trend for new buildings. An opinion against this evolved in the beginning of the 20th century. Crave for genuine and authentic experiences and materials along with national and historical influences characterized the Swedish movement that came to build the base for our stable tradition. The architects Sigurd Curman (1879-1966), Erik Lundberg (1895-1969) and Ove Hidemark (1931) are the main representatives of our 20th century tradition and all three of them were also historians. Other similarities are teaching and publishing theories on restoration and history of architecture. All this have been described by Victor Edman in 1999.

Professor Curman was 1903-1905 studying conservation work in Italy, Germany and France and got in contact with “restauro storico” (Robertsson 2002) emanating from Camillo Boito (1836-1914). For Curman method had to balance rules and freedom of action and furthermore emphasize patina as the ornament keeping the buildings ambience and telling the national history and path of development. Part of this restoration concept was a revival of old materials and methods which were reinvented by skilled craftsmen at the construction sites. Curman and his generation managed to combine the antiquarian and architectural perspectives with creation of a new profession: The restorer as scientist and aesthete. This was mediated to Lundberg.

Erik Lundberg’s contribution to the new tradition was his aesthetical approach allowing new artefacts as e.g. designed lighting to elucidate spatial properties and layers in historic environments but principally it was his approach on historical and architectural development and design. He emphasized the historical continuity with all layers, the architecture experienced by senses and history as a living past in a creative process unifying the past, present and future. The Swedish modernism of the 1930s wanted a break with tradition and old and new clearly parted using modern material in restoration. Lundberg was positive but vindicated the importance of tradition and historic perspective. He developed a holistic view including understanding of the buildings gestalt, movement and expression, the skill of the shaping, crafting hands and the primary properties of the materials in use. As a teacher and author Lundberg had a great influence. One of his students was Ove Hidemark.

Hidemark continued the tradition from both Curman and Lundberg with empirical accuracy, emphasizing an objects patina and the historical approach which he developed. His analyzing of strict measuring resulted in a “technical and historical reading” (Hidemark 1978) using the building as the source of knowledge. On European level Cesare Brandi’s (1906-1988) theories on restoration “restauro critico” was predominant and formed base for the Venice Charter formulated in 1964 (Robertsson 2002). With its’ 16 articles it viewed the building as a historic document where transparency and exposure of its history and restoration dominated. This principle though could sometimes be apprehended as lack of both technical and psychological credibility. Some Swedish architects performed restoration according to this and were criticized. On one level fragments were exposed on behalf of the experience of the whole and modern materials were used on behalf of the buildings identity. In this contemporary context Hidemark developed a respect for the buildings’ identity, material, techniques, cultural layers, authenticity and patina resulting in his “Charta Minor”, a minimized level of intervention in old buildings using repairable and hence durable materials. Hidemark sees the old building as the abstract concept of time materialized and preservation as mastering the beauty of ageing. Hidemarks thoughts on restoration are material and immaterial. The physical properties are defined by empirical science and the spiritual are to be found in the buildings identity, its’ memory.

The Swedish tradition aims at a harmonious combination with the artistic and scientific criteria. Curman, Lundberg and Hidemark have been leading authorities in relation to architectural and historical values as well as excellence in construction, materials and technique, forming unity and balance. All three have opposed rigid doctrinal attitudes. They have had the will to see time as an unbroken tradition with a binding rather than dividing effect. The building itself is the main source of knowledge and must determine the measures taken.

This tradition though must be seen connected to a societal perspective where our stock of buildings radically altered during the 20th century. As in other countries the cities’ population increased causing a big housing shortage. Most dwellings were small and lacked sanitary facilities. Investigations on these issues succeeded one another from 1920 and onward. Everyone should have a ”God bostad” (Good dwelling) which also gave name to the standards that in course of time was brought forward. Sweden parted from other countries by not promoting social housing or low-cost housing but giving favourable governmental loans to and demanding high standard in all new dwellings (Caldenby ed. 1998).

Sweden had poor housing conditions in the beginning of the 1950s. This originated a row of political decisions and new physical planning. The reconstruction of the cities seemed to be the only answer. New constructions were emphasized before renovation due to the costs. The government had forced the construction industry to develop new economic and rational methods and with the decision to build one million dwellings in ten years pushed them even further thus giving the construction industry a very strong position. Most old towns in the Swedish cities’ centres were demolished leaving the towns without identity or historic roots. The strong opinion against the 1950s and 1960s demolition of old cityscapes turned the heritage sector and preservation towards continuous settlements and whole environments. Old built environments were revalued as important and useful. Traditional materials and techniques were seen as healthy and ecological contrary of modern. Hidemark criticized the construction industry for their short term thinking. Step by step a new perspective evolved. New conceptions like cautious reconstruction and cautious city renewal came in use in universities and among architects (Caldenby ed. 1998).

These issues were discussed on European level as well and great manifestations as the congress in Amsterdam took place 1975. Antiquarian preservation was connected to environmental preservation and cultural survival. The Granada Convention passed in the European Council in 1985. The member states committed to take action on legislation, public supervision, planning, education and research aiming on conservation, protection and maintenance of built heritage. Sweden signed on. Within a few years this resulted in new laws. A new view on built heritage and conservation was formed. From a societal viewpoint care for our built heritage must permeate all sectors of society and be seen and handled as an integrated part of the regular planning.

Today we make use of integrated conservation and refer to five important laws and regulations in Sweden of which two will be mentioned here. According to the Planning and Building Act, Chapter 3, section 10, "Alterations to a building shall be made cautiously, with regard to the building's characteristic features and with its constructional, historical, cultural, environmental and artistic values sustained." (Boverket 1987) We also have the Heritage Conservation Act which contains the basic regulations for protection of Sweden's heritage, including buildings, ancient remains, archaeological finds, ecclesiastical monuments and specified artefacts (Riksantikvarieämbetet 1988). The Heritage Conservation Act serves as the core legislation for preserving Sweden's historic environment.

6 RESULTS AND CONCLUSIONS SO FAR

The conservation work in Fattighuset has been performed with great consequence along the line of Swedish tradition. At actual work the uses of traditional or original materials and techniques have been advocated and any incision or alterations were designed reversible. Some of the doors were made with old ones as prototype with great adaptation as a result. New floor cornices have been adjusted to measures from old ones. Radiators have been replaced by new ones in old style. Some small movements in the construction had caused small damages registered in the inventory 1994 and these are apparent at ocular inspection but the moving seems to have stopped. The exterior have many time-layers all adjusted to the original facade showing high authenticity and patina. The gymnasium also owns a great patina and authenticity still having the climbing ropes hanging from the ceiling and gymnasium ribs on the wall. The broad-axed roof-truss with rafters and tie-beams in the attic are exposed and untouched.

The buildings' important part in the environment of the old town and their high architectural values has been preserved. Documentary and symbolic values from societal perspectives and social history are still there for the future. Much of the intangible and tangible cultural values are preserved. Is it on the energy efficiency's expense? The estimate must be that Fattighuset is getting on well in comparison with similar buildings' energy use but it could have been much better. If the computer aided energy balance shows the same results as the manually calculated there are still actions to be taken for improvement of the energy efficiency and indoor climate. Possible measures: Heat recovery in the ventilation system could be installed and mechanical supply air could be added. Much would have been gained by this with the energy use and the tenants' problems partly solved. Air leakage from windows and fresh air vents must be dealt with from both the tenants' and the landlord's point of view. Added insulation of the interior side might cause problem but could be possible if the dew-point of the walls' construction is calculated and the type and thickness of insulation is adjusted to it and carefully chosen. All this must be taken under consideration of an Inspector of Built Heritage, an Energy Counsellor, an Architect and a Construction Engineer together. But right now in this particular case the Halland Model didn't manage to go quite all the way on the energy path.

All together the cultural and historic values have to a very great extent been preserved at the same time as the buildings had an altered use. The technical and comfort issues remaining should be possible to solve with continuously preserved cultural values.

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