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Housing for eternity - sustainable solutions and mistakes to avoid. The role of library buildings in preservation

The Almedalen Library –an energy low-cost solution

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Libraries all over the world comprise several factors that justify their existence. They can be learning-centres, information providers, cultural institutions, guardians of a cultural heritage as well as architecturally exciting monuments that together with museums, religious centres and other significant buildings make up an important part of a city's profile. Behind the façade, a library is always a storage space for library materials and a working place for both personnel and patrons. To be able to effectively fill its function as a safe storage space for information it is necessary to surround the collections with technical systems which protect the material from damage and chemical breakdown that otherwise would make the materials inaccessible in a near or distant future. Preservation is therefore a core issue for those libraries that need to preserve information for the future. National libraries, but also university libraries, as well as a huge number of special libraries have this responsibility. Today digitization is a powerful tool for making collections accessible without having to touch the originals, but still, huge collections must be given the best conditions available in order to save them for the future. IFLA has always promoted good standards in preservation for library collections and the typical IFLA-tool for encouraging sound practise is to publish guidelines. One such publication is the IFLA Principles for the Care and Handling of Library

Materials. Crucial factors for a successful protection of a library collection, are for example, proper care and handling, practical conservation treatments and digitization, or other means of duplicating. A disaster plan is of course essential, and, the perhaps most effective means of slowing down the chemical deterioration is storage of materials that are to be kept for the future, in climatically controlled stacks. Many recommendations are given as to the different parameters of temperature and relative humidity, for example in the above-mentioned IFLA recommendations. Chemical breakdown is considered to double per every 10 degrees C (18 F), and low temperature storage is therefore recommended. High levels of humidity can cause mould in both the high and the low temperature range so this also has to be kept under control. In dry climates desiccation can cause significant distortion in certain materials such as vellum. To give recommendations for an ideal storage climate may at first seem to be an easy task. However, the climatic differences in different countries make it difficult to give general advice. The IFLA *Guidelines* acknowledge these difficulties by stating "*In general, library materials should be stored and used in stable conditions which are not too hot, too dry and not too damp*". Furthermore, the guidelines state that it is unrealistic to maintain a building or stack temperature at one setting throughout the year, especially in countries with extreme temperature variations, without incurring huge costs.

In Sweden, we have fairly long and cold winters with temperatures ranging between approximately minus 25°C in the winter and 25°C during summer. The long winters decrease the water content of the air, making it difficult to maintain a suitable climate for library collections without moisturizing the air to a level where condensation may cause serious problems to the structure of library buildings. Moisturizing is also costly and therefore often seen as a problem, which should be avoided. However, materials such as parchment and leather can be damaged by the extreme dryness of the air.

In a tropical climate on the other hand, it is the excessive heat and dampness that poses a threat to collections and huge sums of money have to be spent on air-conditioning to prevent the decay to library collections which is caused by mould and heat.

Modern technology has provided us with excellent systems to cope with excessive dryness, heat, dampness and cold for the benefit of preserving our collections, but so far, too little attention has been paid to the issue of the energy costs necessary for keeping the systems active. On the contrary, library buildings are still being built in a manner and in an architectural style, that necessitates highly sophisticated HVAC systems to counteract the problems connected to moisture and dampness or with the heat accumulating in sun-lit façades or façades with immense glass areas or other heat-retaining structures which pull in the heat from sun-irradiation. The real threat to library collections in the future may be when one cannot afford to pay the huge energy costs necessary for keeping the counter-balancing HVAC-systems active.

The aim of this paper is to raise the issue of the importance of low-cost solutions for the climatic control of library collections as rising energy costs can pose a threat to the long-term preservation in conventional buildings. Before going on to describe an alternative energy low-cost library – the Almedalen Library – some fundamental facts of what can be expected from future energy systems have to be presented.

The issue of global energy supplies is an extremely complex issue, in our minds linked to headlines on the oil-crisis, nuclear waste, global warming etc. One may think that our use of energy mainly depends on political decisions and multi-lateral agreements, but if we look beyond these often conflict-ridden issues, we find that other initiatives are being taken, which aim to give evidence as to the physics of energy supplies.

One such initiative is the ASPO, *The Association for the Study of Peak Oil*. The mission of ASPO is to make scientific analyses of the global oil production to estimate when peak production is reached. When this has happened globally, further growth of supply is over and the prices of the hydrocarbons will rise dramatically, and, following the rules of supply and demand, prices on other types of energy such as electricity, will most probably also rise. To make this fact clear to politicians is a prerequisite for planning future societies and therefore, as we use energy, it should also be an important issue for libraries. As a good storage climate may have to consume a lot of energy in a conventional building, the issue of energy is especially important to those involved in preservation.

If we take a look at the history of oil consumption, the relatively short period we have used oil, app. 100 years, is a period that coincides with the industrial boom of modern society – one sign of the importance of this energy source. Many countries however have already reached their peak of oil production, the USA for example peaked already around 1970 and since then has to rely more and more on imports.

At the ASPO Conference in Paris 2003, its president, Kjell Aleklett, Professor of Physics at the Uppsala University, Sweden, tried to visualize the known facts about global oil production with the help of 20 bottles representing the 2 trillion barrels of oil, which the planet earth contained by the late 19th century. 11 bottles have already been used and 5 bottles are in the Middle–East region. Out of the remaining 4 bottles spread all over the planet, only 2 bottles represent the yet unexplored global oil reserves. The effects of the dwindling oil resources may perhaps best be summarized by a quotation from the June 2004 issue of the National Geographic Magazine "*We're at the beginning of the end of cheap oil"*.

Energy and libraries

During the heat wave in Europe in the summer of 2003, technical systems were strained to the breaking point in libraries and other institutions in the cultural heritage sector, which are dependent on an even preservation climate for the safeguarding of their collections. Buildings such as the Museum of Modern art in Vienna, with its black basalt stone façade, and the Bibliothèque Nationale in Paris with its glass towers, both had problems keeping the temperature within reasonable levels. The cost problems with air conditioning, which is much less common in Europe than in for example the USA, gave rise to a debate on the high costs of energy for air conditioning. Within the European Commission Fifth Framework for Research, which was completed in Nov 2004, the issues of buildings and sustainable energy solutions were addressed within the EUBART-project or the **EU**ropean **B**io-climatic **A**rchitecture with integrated Renewables and **R**eal-**T**ime user feedback. The project consisted of 8 partners out of which one was the newly built Almedalen Library in Visby, Sweden, located on the island of Gotland in the Baltic Sea.

The combined owners of the library, the municipality of Visby and the University college of Gotland, have tried to make the library a flagship of sustainable architecture and high environmental ambitions. This relatively small library is situated in a park near the sea and the library occupies app. 4000 square meters with an additional 1400 square meters for staff and teaching. Its innovative energy system contains the following elements:

- A highly insulated envelope.
- Effective solar shading which uses natural elements such as trees and roof overhangs as well as shading by louvres run by photovoltaic cells.
- A low rate of natural air infiltration.

- An exposed internal concrete construction, which retains the heat.
- An efficient low-pressure mechanical ventilation system.
- An electrically powered heat pump for heating via the air and thermostatically controlled perimeter radiators. Seawater is the source of heat for the heat pump by means of a water-to-seawater heat exchanger. During summer the seawater heat exchanger cools the building, making further air conditioning and refrigerating unnecessary. The heat pump is driven by solar energy and for the sake of its better environmental performance, employs propane as its heat pump medium.
- Excess energy can be exported to adjacent buildings.
- The energy is 100% renewable.
- Compact fluorescent lighting, occupancy sensors and sun-shading devices are also used to improve energy efficiency.

The results of a recent evaluation of the performance of the building shows that the library uses a total of 92 kWh per square meter and year, of treated floor area. The net energy requirement for heating the building is 52 kWh per square meter/year where the seawater heat pump uses only 19 kWh/m2/year of the total electricity needed. This adds up to a neat 36% energy use, compared to a conventional building. These extremely good values are the results of both the passive systems such as the exposed concrete construction as well as the refined technical systems out of which the heat pump is perhaps the most important contribution to the overall results.

The heat pump system uses the stored ground energy from the sea during winter and it returns any excess heat during summer. The use of energy from the ground by the help of the heat pump boosts the available energy and provides a highly cost-effective solution for both heating and cooling. The seawater is used for the Almedalen Library but the principle for collecting energy from the ground is not limited to seawater. Energy is quite effectively stored in the ground and can be used in many ways both for cooling and heating.

The Almedalen library is interesting as a sustainable energy solution for a library. When energy prices will boom in a not so far future a library like the Almedalen can continue operations for a stable climate all year round, which may not be the case for those buildings which rely heavily on conventional heating and cooling. Here we might even expect that the control systems so necessary for a stable preservation climate simply have to be turned off, because they will be too expensive to keep in operation.

Library architects and library officers responsible for building design need to take into account that the technical systems of a library need to be integrated with the construction of the building and not amended in a secondary planning stage as a compensation to the drawbacks of the more bold architectural designs such as huge south-facing glass facades. These drawbacks are abnormal heat gains as well as losses, which in a not so distant future can be expected to be too expensive for a library budget to bear.

The Almedalen library is a relatively small non-monumental library in a country with relatively long and cold winters and short temperate summers. However, its energy concept may serve as a model for sustainable library buildings as it uses the ground (and ultimately the sun) as its energy source for both heating and cooling.