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THE GREEN LIBRARY

The challenge of environmental sustainability

DIE GRÜNE BIBLIOTHEK

Ökologische Nachhaltigkeit in der Praxis

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"Environmental awareness is on the rise"
Sustainability in Danish public libraries

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“Environmental awareness is on the rise”

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Abstract: One in four Danish public libraries has a green operating policy. One in seven has taken environmental aspects into consideration in the planning of their buildings, while approximately one in six works with environmental aspects in other contexts – for instance communication. This article focuses on two Danish case studies. Firstly, on sustainability in public libraries with Albertslund Public Library and the Green Cities libraries as examples; secondly, sustainability in the construction of public libraries using Århus Public Library as a case study.

Zusammenfassung: Jede vierte Öffentliche Bibliothek in Dänemark hat eine grüne Leitlinie. Jede siebente hat in die Gebäudeplanung Umweltaspekte einbezogen, während ungefähr jede sechste in anderen Bereichen Umweltaspekte berücksichtigt, z.B. in der Kommunikation. Der Beitrag stellt zwei Beispiele aus Dänemark ins Zentrum: erstens Nachhaltigkeit in Öffentlichen Bibliotheken am Beispiel der Öffentlichen Bibliothek Albertslund und der am Netzwerk Green Cities beteiligten Bibliotheken als Fallstudien, zweitens Nachhaltigkeit beim Bau Öffentlicher Bibliotheken am Beispiel der Öffentlichen Bibliothek Århus.

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1 Introduction

Climate, environment and traffic are just some of the key elements of the debate on a greener Denmark. Others are sustainable management and operation – e.g. from waste to heating. All public institutions in Denmark – including the public libraries – are dealing with sustainability in some form today. A survey carried out by the Danish Library Association (DLA)[1] in October 2012 shows that their various efforts are more or less goal-directed.

The survey indicates that some Danish public libraries are very goal-directed in their environmental efforts. Some have worked with it for more than a decade.

1 http://db.dk/english. Accessed on 20 February 2013.

Others are on their way. And when it comes to new library buildings, environmental awareness is clearly on the rise.

This article describes the Danish situation from different angles. Firstly, the results of the Library Association's 2012 survey are discussed. Then the environmental approach by Albertslund municipality and its library are introduced. For the past 12 years, Albertslund municipality has prioritized environmental efforts.

In general, as in other countries, Danish library buildings are becoming more and more sustainable. A notable example is "Dokk1" in Århus, internationally known as "Urban Media Space".[2] This – currently Scandinavia's largest new public library construction project – is expected to open by the end of 2014 or early 2015. It is in many ways regarded as a truly model project, and also in terms of sustainable library construction as the comprehensive review of the project illustrates.

2 The focus of the Danish development

For several years the Danish library debate has mainly concentrated on the transition to the digital knowledge society and all sorts of related areas, closely followed by the structural government reform in 2007 and its implementation. The reform transformed the approximately 275 municipalities into 98 larger ones and the 14 counties into 5 regions. The result was budget cuts in a large number of municipalities as well as new activities, such as for instance Citizens' Services, at the public libraries.

As a consequence of the reform, Denmark's 98 municipalities took over new environmental tasks from the counties. To ensure that municipalities meet their obligations, it is now a legal requirement for local authorities to introduce quality management within nature and environment, securing professional quality, efficiency and consistency in order to build up confidence and satisfaction among citizens and businesses.

3 How green are the libraries?

To clarify to what extent sustainable issues are incorporated in local library operation and development, the Danish Library Association in October 2012 asked library managers in all the municipalities about their green status. This was done

2 www.urbanmediaspace.dk/en. Accessed on 26 January 2013.

in conjunction with the DLA Budget Survey for 2013. A total of 92 of the 98 municipalities responded. The question asked was:

- Does the library have a green policy?
- And if so, does it cover environmentally friendly operations or buildings?

One in four public libraries are dedicated to the topic and have specific green operating policies according to the DLA survey. One in seven say that the environment has been taken into consideration in library building design and construction, while one in six say that they work with other environmental aspects – for instance in a communication context.

The result of the survey underlines that there is room for improvement. It is surprising that so few are dedicated to greener libraries. Especially since six in ten Danish public libraries (see DLA Budget Survey 2013) are also experiencing budget cuts to some extent – and often, there are economies to be made in green operation solutions. More focus on the matter, not least in an energy context, is needed.

The environment needs to be given a higher priority on the political agendas of the municipalities as such – not least in regard to energy consumption. The same is true of the public libraries. As public institutions they should take the lead and devise greener solutions for their operations and buildings in cooperation with their respective municipalities.

4 Copenhagen Green Capital

In 2014 Copenhagen will be "Green Capital" nominated by the European Union. At the moment (January 2013) no particular activities are planned in relation to the libraries. However, Copenhagen Main Library, according to Jakob Heide Petersen its Director since 1 January 2013, will approach the event in two different ways. First of all the idea is to have public debates on ecology and sustainability as part of the library's lecture programme; secondly, there is a plan to have the main library properly evaluated in terms of sustainability and updated energy-saving measures.

5 Albertslund: Municipalities going green

Of all Denmark's municipalities, six are particularly dedicated to green visions based on a strong environmental focus and sustainability. They are known as the Green Cities. Albertslund, Ballerup and Copenhagen municipalities initiated

a green partnership in 2000, while Herning, Kolding and Alleroed joined later, Albertslund being the front runner of the six.

Albertslund municipality in the suburbs of Copenhagen with a population of approximately 30,000 is known for being a modern planned city and is characterized by its low-rise housing from the 1960s–1970s. In Denmark as well as internationally, the Albertslund municipality is famous for its green profile. Its recreational landscape with lakes and many canals has to a large degree been established by rainwater re-use. Together with the focus on the environment, two other fields – children and culture – are the top three priorities of the municipalities.

Once a year since 1992, Albertslund Public Library[3] has prepared a green action plan for consumption and sustainable management. The plan is discussed and approved by the city council. In the late 1990s it was decided to have the library formally certified to document this environmental work.

At the time, environmental certification of libraries was not on the official Danish agenda. In 1999 the local government itself was certified according to EU's EMAS[4] goals and scheme, as the first Danish public authority ever. In May 2001, the library followed suit. By the end of 2007, all central departments and institutions were certified, making Albertslund the first municipality in Denmark 100% environmentally certified.

6 The public library and the environment

It may seem meaningless to certify a library. For what is the environmental impact of an institution characterized precisely by re-use and recycling? Niels Dejgaard, the library director in Albertslund, sees it differently:

> "In many ways, it makes good sense to work with environmental management in a library context. And from a communication perspective, an obvious task is to disseminate knowledge and information about the environment and sustainability."

In relation to the mapping of the library's environmental impact, the following important factors were identified: energy and use of resources, various consumables, furniture and IT equipment, waste, building aspects, environmental information, dissemination of knowledge, and indirect environmental aspects.

Today Albertslund Library is working with a large palette of actions and activities to highlight the municipality's green profile. For instance the library of-

3 http://albertslundbibliotek.dk/. Accessed on 27 January 2013.

4 Eco-Management and Audit Scheme. www.emas.de/. Accessed on 27 January 2013.

fers an extended information service in this area through two Green Information Services, one at the main library, another at Hedemarken branch library, but in particular through an environmental portal.[5]

The site is based on the "Green City"[6] initiative, a library cooperation between Albertslund, Ballerup, Fredericia, Herning, Kolding and Copenhagen municipalities plus Malmö, the large Swedish city neighbouring Copenhagen. The site provides information on: waste, *Agenda 21* plans, sustainability, certification schemes, greenhouse, energy, consumption, pollution, food and foodstuffs, climate, environmental management systems, environmental policy and action plans, soil, water and air, products, use of resources, materials, technologies and research, transport, education and ecology, and associations and institutions.

7 The Golden Library

In 2004 Albertslund had a new main library building, replacing one from 1973. A leaking, mouldy roof, insufficient insulation and an outdated ventilation system necessitated a thorough renovation. In practice a new structure was built on the foundation of the old one, which was a typical 1970s construction with a flat roof, relatively small windows and exposed technical installations.

The ambition was to create a different building image and a library space, functionally and aesthetically living up to even the most ambitious ideas about "the future public library".

Three overall structural conditions have been prioritized in the building:
- more daylight to lending space and offices;
- improved indoor air quality, including some form of ventilation;
- consistency and clarity in the spatial layout.

The library space (3,000 m^2) was increased by approximately 100 m^2, and the open library space cleared totally of technical installations. The former detached ventilation disappeared and was replaced by a system based on natural and hybrid ventilation.

The now tombac-clad building got new, large windows allowing a view of the Town Lake to the north and park area to the south. A total of 14 roof-window elements and many skylights ensure plenty of daylight throughout the library. The

5 www.miljøbiblioteket.dk. Accessed on 26 January 2013.
6 Former *Dogma 2000*. www.greencities.dk/. Accessed on 27 January 2013.

Fig. 17.1: Albertslund Library, designed by the internationally known Danish Henning Larsen Architects. © Albertslund Library.

library is popular and well visited and its budget the second highest in Denmark, with DKK 904 per capita in 2011.

8 Dokk1 – Urban Media Space Århus

"Urban Media Space", or "Dokk1" as the project was renamed in 2012,[7] reflecting both nearby dock areas as well as culture, is part of a large and comprehensive urban development project in Århus – Denmark's second largest municipality with approximately 300,000 inhabitants and a natural catchment area of about 1.2 million.

The construction project "Urban Media Space Århus" is part of the transformation of Århus inner harbour from industrial harbour to urban space. Dokk1 will be Århus' new Main Library and Citizens' Services, and the project will have great influence on the harbour area and an active urban life. The area is conveniently situated for Århus city centre, Århus Cathedral, the pedestrian zone, and

7 www.urbanmediaspace.dk/dokk1. Accessed on 27 January 2013.

river area. Dokk1 and the car park will be completed by the end of 2014 while the waterfront spaces and the rest of the project will be completed at the end of 2015.

The project comprises:
- Dokk1 (Urban Mediaspace Århus);
- waterfront spaces;
- automatic car park below Dokk1 (1,000 parking lots);
- opening of the remaining part of Århus River;
- restructuring the infrastructure of the harbour;
- climate protection of city centre.

Fig. 17.2: Dokk1, the new main library, and the new waterfront spaces form a natural meeting point and excursion spot. © Schmidt, Hammer Lassen Architects.

Dokk1 has been under way for a long time. In 2003–2004 the city council decided to establish a new centre for culture and knowledge in the harbour area, referred to as MEDIASPACE at the time. With its approximately 20,000 m^2, it is Denmark's largest public library and replaces Mølleparken Main Library, built in 1934. The building is designed to offer library and citizens' services but also has room for external users, private IT-providers and businesses.

Following extensive preparation, involving users, politicians, professionals and local partners, a public procurement procedure in two parts took place: first a competition with a prequalification round and then a negotiated procedure. *Schmidt Hammer Lassen Architects* (who designed the "Black Diamond" Royal Library project in 1999) won the 2009 competition jointly with among others

Architect Kristine Jensen. Since then, they have been hard at work to create "The public library of the future" in Århus, in cooperation with the library itself and project manager Marie Østergård.

8.1 Sustainability

A few years ago, Århus Municipality decided to use DGBN (Deutsche Gesellschaft für Nachhaltiges Bauen)[8] principles to assess and ensure the sustainability of its new construction projects. This applies to Dokk1 (Urban Media Space), without aiming for actual formal certification. DGNB principles are a German method to ensure sustainable buildings, including certification.

The DGNB model is used internationally and works with technology, process and location added to the three classic aspects of sustainability: environmental, economic and social aspects, in order to encompass all relevant aspects of sustainability. A building's economic sustainability is weighted as high as environmental, socio-cultural and technological aspects. By taking into account the total costs in the life-cycle of the building, the operating costs can be optimized very early in the construction process.

In Denmark the Green Building Council (GBC)[9], an independent non-profit organization, is in charge of the adaptation of DGNB principles to Danish conditions, for instance in relation to the Danish Building Regulations 2010 and amendments (*Bygningsreglementet*).[10] The Building Regulations 2010 lay down the rules governing construction of buildings in Denmark. Regulation is primarily based on functional requirements and includes indoor climate, energy consumption, solar heating systems, etc. It is published by The Danish Ministry of Economic and Business Affairs, Danish Enterprise and Construction Authority.

Today, all new Danish buildings are classified according to their energy consumption. The permitted energy consumption per square metre of a building depends on the type of building. The Building Regulations provides for a so-called energy framework for new buildings, varying for different types of buildings. The

8 German Sustainable Building Certificate (GeSBC). www.dgnb.de/. Accessed 27 January 2013.

9 The Green Building Council Denmark (DK-GBC) serves as an independent overall council for eco-friendly and sustainable construction. The organization is funded through memberships and sponsorships. Any surplus is used in accordance with the association's purpose. The DK-GBC has established a Danish certification within sustainability: DGNB Denmark. www.dk-gbc.dk/english.aspx. Accessed on 26 January 2013.

10 The main scope of the Building Regulations is multi-storey domestic buildings and all forms of industrial, commercial and institutional buildings. www.erhvervsstyrelsen.dk/file/155699/BR10_ENGLISH.pdf . Accessed on 26 January 2013.

framework defines limits to the energy consumption of a newly-built house, the goal being a reduction of energy consumption (heating, ventilation, hot water, cooling and any lighting). There are two low-energy classes with energy savings of 50% and 25%, respectively.

Sustainability as such did not have a particular focus in the original architectural projects for Urban Media Space, but the projects were, however, assessed economically and functionally in relation to the possibility of upgrading the buildings subsequently. When Århus city council later decided that all new public buildings should be low-energy class 1, it was decided to upgrade the project in a dialogue with architects and consultants.

This has been done following the DGBN-principles. The Århus project formulated three areas of major importance:

- energy consumption during operation (environmental and economic aspects),
- the indoor climate of the building – users and employees (social aspect),
- the use of hazardous substances (e.g. adhesives, sealants and surface treatments) (environmental aspect).

In the following, selected efforts in relation to the three overall dimensions of these principles – environment, social aspects, and economy – are discussed. Each dimension contains a number of parameters that jointly describe the sustainability of the project.

8.2 Blue-green energy-saving concepts

Energy consumption is a central part of any discussion of sustainability. Reduced consumption is at the core of the official Danish strategy for a greener Denmark. Energy consumption during the operating phase is important, but even energy consumption in the construction phase is debated. In Århus, the aim was to minimize this as much as possible by requiring that all procurement projects follow the guidelines and advice in the publication *Gør byggepladsen energirigtig*, published by the Danish Energy Agency.[11]

Thus, the construction companies are responsible for the electricity consumption during construction: for operating cranes, for concrete works, and for dehumidification of the building. An energy-efficient site can normally reduce a contract price by 1–2%.

11 www.ens.dk/arkiv/publikationer/brochurer/goer-byggepladsen-energirigtig. Accessed on 27 January 2013.

In relation to energy consumption during the operating phase, the building is constructed as a low-energy building (level 2015). This means that there is an emphasis on compact shape and that the surface area and heat loss are reduced. Natural shadow effect is achieved by means of very accurate sizing and positioning of the levels of the building. When the sun is low in the winter, sunlight will reach the building façades, while in summer, when the sun is high, shade of the lower floors is achieved.

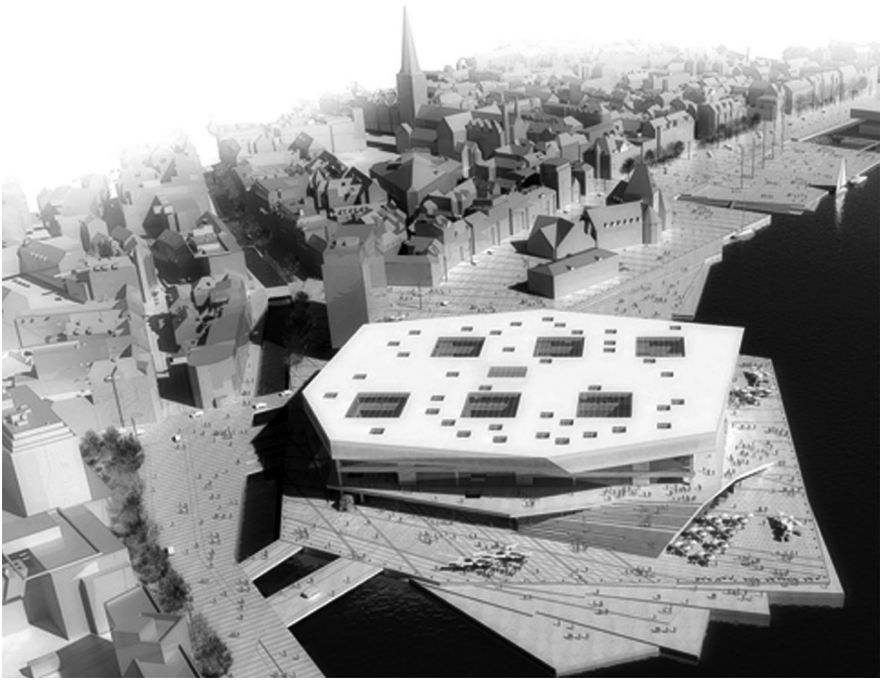

Fig. 17.3: The roof seen from above – approximately 3,000 m² solar cells will be mounted here. © Schmidt, Hammer Lassen Architects.

Two principal energy sources make the sustainability of the building world-class: the use of seawater cooling and solar-cell panels.

Seawater cooling obviously is used for cooling the building and considerably reducing energy consumption. For instance, level 3 – with offices and a server area – has cooling ceilings.

On the roof a 3,000 m² solar-cell panel will be mounted. The solar-cell panel has not been designed yet, as it is scheduled for as late as possible in the project

process to ensure that latest technology and experience are implemented. To avoid sun glare in neighbouring buildings, thorough investigations of the potential glare have been made.

It is no secret that lighting consumes massive energy. Both indoor and outdoor, emphasis is on as low energy consumption as possible, including the use of LED lights. Use of daylight control and motion sensors in all office spaces and in the outer and middle zones will minimize energy consumption when daylight is sufficient. Switches must typically be activated before the lights in rooms come on, with the exception of storage rooms, toilets, etc. with no daylight, where motion sensors will be fitted. Lights will typically be switched off automatically after a given, adjustable time in which the room/zone has not been used. The automatic underground parking lot will only have light when there are repairs and people. A car lift ensures lower fuel consumption when the vehicle is in the parking lot (accessing and exiting), which means less energy is used than if you would "drive up and down". An expected side-effect will be less vandalism of cars and a greater sense of security (social sustainability) for drivers.

8.3 In-house environment

The indoor environment for users and employees has been carefully planned in relation to energy and sustainability. The insulating power and energy performance of installations has been optimized. The thermal indoor climate has been analysed / simulated for the permissible maximum temperature and minimization of any glare from skylights.

Environmental aspects of recycling and discharge of heated seawater from the cooling process have been analyzed, using CFD calculations (Computational Fluid Dynamics). The structure of the cooling system ensures the best energy performance, Marie Østergård and the project team underline.

Areas with large varying load are accommodated by ventilation with variable air volume depending on temperature and CO_2. All ventilation systems are hooked up to the Compliance Tracking System (CTS) of buildings, used to manage and control the heating and ventilation in the building centrally. Also water and heat main gauges are hooked up so consumption can be monitored closely.

Six huge skylights in the roof, each 200 m^2, allow light to flood into the building. Together with the large glass façades, they create the special open environment and atmosphere of the building. Both building elements have called for a well thought out strategy for daylight and artificial lighting as well as shading. Special façade glass with very low heat transmission is used. The choice of glass

in the large skylights is based on energy criteria as well. For the artificial lighting, LED lighting is used to minimize energy consumption.

Fig. 17.4: Natural light is allowed to flow in through six huge skylights, down through the building's three staggered floor levels. © Schmidt, Hammer Lassen Architects.

The extensive use of glass everywhere in the building is very important for acoustics and sound. Here the indoor environment for users and staff is made pleasant in different ways. Heavy demands on reverberation in the building have been formulated, so acoustics are tolerable despite the large rooms and many sound sources. Furthermore, there are acoustics requirements for horizontal and vertical partitions to minimize noise from other activities in the building. Other acoustic challenges are met by the physical environment of the building – for example by furniture contributing further to the room's overall sound absorption. A loop system has been mounted in several places in the building.

8.4 Sustainable materials

To ensure a green and sustainable library building project, environment-friendly materials are crucial. In Århus an environmental mapping led to the following

priorities in materials. Environmental concerns and considerations are crucial when selecting materials. In addition, the requirements are:

- robust materials;
- avoid use of hazardous substances;
- natural materials for the construction that are re-usable – concrete and steel;
- materials used in the building consist primarily of concrete, steel, glass and aluminium;
- closed surfaces – advantageous in terms of dust, degassing and cleaning.

The choice of material must be documented. The main materials must be extracted and produced in sustainable working environments. PVC cannot be used in the building.

Lead- and halogen-free cables must be used. All technical installations must be installed/mounted in such a way that they can easily be replaced with future installations. In general, flexibility is the key word for the building and its furnishings.

Establishing hanging gardens with eco-friendly plantating located in conjunction with the large skylights is a special green feature with a high priority, but currently not yet guaranteed. Plants will not only be an additional experience for the users of the building, they also lower the temperature and absorb CO_2. Also under consideration is the idea of implementing sedum (widely used in green roofing) on the roof surface.

Whether these initiatives will be implemented will depend on the last part-procurements and the final budget. In January 2013, the next phase is décor and furnishing.

Environmentally friendly materials must also be used in library furniture. Furniture and other equipment have not been decided yet, as the next step is hiring a design consultant to be in charge of a process again involving users, employees and partners. Sustainability and eco-friendly materials will of course be a parameter to be incorporated in this process.

This also applies to technology and copy services. Energy efficiency is a part of the building's energy classification. It would be natural to ensure the greenest possible solutions in this next phase, when printers, servers, and other equipment are to be selected, says project manager and partnership developer Marie Østergård.

8.5 Green management

The new main library will as far as possible be based on environmental management for example in relation to cleaning, paper and material (re)-use, waste, etc. This is actually already to some extent the situation today. In the current main library, a number of routines ensure recycling/re-use in several areas. Recycling and re-use will also live up to future standard requirements in the Århus municipality – an example being waste separation. At Level 0 in the new building, space has been allocated for sorting containers, accommodating up to 9–10 different types of waste containers.

8.6 Environment and communication

Dokk1 focuses on knowledge and learning. Along with other relevant social themes, the environment and sustainability will be on the agenda – both in communication and in choice of partners and partnerships. No special focus areas in the building have yet been decided. This will all be discussed as a part of the ongoing interior decoration and layout process. The environment and sustainability are certain to be permanent or recurring themes.

In addition, the building's sustainability will be part of the future storytelling about the building itself as part of the profile of Dokk1.

8.7 Overall vision for Dokk1

- Mediaspace will become the new Main Library and Citizens' Services, which are to promote future media and municipal services to the citizens.
- Mediaspace must be an open and accessible learning environment and an environment for experiences, which provides the opportunity for activity as well as tranquility and contemplation.
- With its manifold facilities for social and association activities as well as networking, Urban Mediaspace will contribute to the promotion of democracy and community.
- A visionary and sustainable architecture must surely turn Urban Mediaspace into an icon for Århus and show a future-oriented city of innovation.

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