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THE GREEN LIBRARY

The challenge of environmental sustainability

DIE GRÜNE BIBLIOTHEK

Ökologische Nachhaltigkeit in der Praxis

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Landmark with green credentials

Brighton's "Jubilee Library"

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Abstract: In 1998 Brighton's city council decided to build a new library. The library was designed using a public-private partnership model and the public was involved in the planning. It became in many ways a sustainable building, and since its inauguration in 2005 the library has received more than a dozen awards for it. The library was also well accepted by the citizens. The increase in usage, as well as technical innovations led to some adjustments to the construction. The library continuously evaluates its consumption in order to improve. Seven years later a critical look at the energy consumption and feedback from the building occupants show how well the edifice actually performs according to calculations.

Zusammenfassung: 1998 entschloss sich die Stadt Brighton zum Bau einer neuen Bibliothek. Die Realisierung erfolgte nach dem Public Private Partnership-Modell, und die Öffentlichkeit wurde an der Planung beteiligt. Es entstand ein in vielerlei Hinsicht nachhaltiges Gebäude, wofür die Bibliothek bereits mehr als ein Dutzend Preise erhielt. Die Bibliothek wurde von der Bevölkerung gut angenommen. Der hohe Zuwachs an Nutzern sowie technische Neuerungen machten einige Anpassungen am Bau nötig. Die Bibliothek evaluiert kontinuierlich ihre Verbrauchswerte, um diese stetig zu verbessern. Sieben Jahre nach dem Bezug wirft dieser Beitrag einen kritischen Blick auf den Energieverbrauch. Ein Feedback der Gebäudenutzer zeigt, inwieweit das Gebäude heute die bei der planerischen Kalkulation bezifferten Ziele erreicht.

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1 Introduction

Since its inauguration in 2005, Brighton's "Jubilee Library",¹ situated in the centre of the popular British seaside resort, has been showered with more than a dozen

¹ www.brighton-hove-rpml.org.uk/libraries/sites/jubilee/pages/home.aspx. Accessed on 16 January 2013.

awards and prizes. The construction was not only lauded for its spectacular design, but also for its sustainability credentials. Seven years after opening, a look at energy consumption and feedback from the building occupants provide an indication of how well the building actually performs according to calculations.

2 The design

Over the years, Brighton's fortunes changed from slow economic decline in the 1970s to a strong regenerative upturn in the 1990s. With private capital moving in, the residential areas along the sea-front were remodelled in order to attract visitors; new cafés, restaurants and designer shops were set up, and soon Brighton became a haven and inspiration for artists, writers, film-makers and architects. But the city quarter called North Lanes, situated between the railway station and the Royal Pavilion, a major tourist attraction, barely profited from the upturn. The city council then took the initiative and in 1998 voted for a regeneration scheme that included funding the project through a public-private partnership fund. The contract was part of a £60 million regeneration scheme centring on a new library, with social housing flats, private flats, hotels, shops, offices, cafés and restaurants completing the venture, thus transforming a derelict site into a vibrant space for contemporary urban living. Construction of the new library building, designed jointly by the architectural firms *Bennetts Associates and Lomax, Cassidy & Edwards*, began in May 2003 and was completed in November 2004. The building, costing about £14 million, opened its doors to patrons in March 2005.

In the course of the planning process, the developers and architects reached a consensus that the library be created as an architectural showcase with unique features that reflect the community's involvement in reshaping Brighton's inner city. Thus they engaged in consultations with local business people and amenity groups as well as the general public. Feedback from questionnaires and discussions were used to evaluate certain elements of the proposals, which finally led to a high level of approval from city planners, local residents, businesses and conservation groups.

The library's design integrates a sophisticated sustainable approach to the building fabric with the demands of a public space in a lively urban setting (Dove 2006). The building makes good use of the natural energy provided by the south coast setting, specifically sunshine and wind. In winter, the sun's energy is gathered through the south facing front glazed wall, while in summer the built-in solar shading reduces glare and solar gain. Heat generated by equipment and people inside the building is harnessed and re-used. Energy use is minimized

as the library was built with a solid, heavy structure thus holding a high “thermal mass”. The concrete floors were laced with hollow tubes in a design called ThermoDeck®. Heat is stored in the floors and walls, being released slowly into surrounding areas as part of a low-energy release ventilation and heating system. Instead of air conditioning, natural ventilation enhanced by sea breezes refresh the atmosphere inside and cools the building. Five-metre-high wind towers on the roof, designed to add to the flamboyance of the city skyline, use the breeze to draw excess heat from the floors below during the summer months. The operation of the wind towers is automatic and handled by the Building Management System (BMS).



Fig. 19.1: Jubilee Windtower. © Brighton Jubilee Library.

Furthermore, using daylight was a key element of the design, both in terms of the quality of the interior environment and in relation to the reduction of environmental impact and energy consumption. Daylight streams in from the front windows and from skylights placed around the main halls. Artificial lights respond automatically to daylight sensors. Finally, water use is minimized by collecting and re-using rainwater for toilet flushing.

The library’s interior is designed as a simple rectangular plan on three floors. The ground and upper floor library halls are lofty spaces constructed from two rows of vaulted elements supported on tall columns. Three single-height, flexible

perimeter spaces wrap around these central areas in a U-shape on three sides, intended as gallery spaces overlooking the floors below.

Since opening in early March 2005, the library has won 14 awards, among which are the Prime Minister's "Better Public Buildings" award, the Royal Institute of British Architects (RIBA) Regional Award, the British Construction Industry Building Award and the Chartered Institute of Library and Information Professionals (CILIP) Public Libraries Group Award.

3 Assessment and adjustments

The settling-in period was used by the staff to monitor the functions and to view the public's acceptance of the new building. The attractive design and the positive media coverage made citizens aware of the expanded library services, which led to a considerable increase in its use. Within two years, the occupancy level rose to nearly one million customers per annum, a welcome increase which however necessitated a readjustment process not uncommon to new constructions. Variations in human behaviour can affect the actual building performance compared to the modelled building performance. One of the first alterations introduced in the Jubilee Library was the addition of more PCs in order to keep up with consumer demand for internet services.² The additional heat emanating from people and computers had a major effect on the temperature measured on the top floor of the building, a development which ultimately led to the decision to install supplementary air conditioning units which in turn caused an unwelcome rise in energy consumption.

A cost-saving measure introduced by the Brighton city council led to unforeseen problems for the library. When the city administration closed many public conveniences in the downtown area of Brighton, people started using the library's facilities instead. The effect is that the building gets used as much for its toilets as for its contents! Faced with this development, the library management took a proactive stance and refurbished the library's toilets. They installed sensor urinals in the male toilets and sensor taps and soap dispensers throughout the building, thus achieving a more hygienic environment. The grey-water collection which flushes all toilets is considered a very successful feature of the new building.

As to lighting, the building's light-sensor system ensures a reduction of electrical power used during the day, and the library operates on reduced lux in order to keep the electricity consumption at a low level. Furthermore, as new technolo-

² The information and data on usage patterns were supplied by the staff of the Jubilee Library, whom I would like to thank for their cooperation.

gies become available, a process of changing the light fittings over to LED was introduced. The entire set of lights had originally been fitted with low-energy bulbs, but their life-cycle is shorter than that of LEDs. Because of the building's high ceilings, "cherry pickers" (high lifting platforms) are called in regularly. The operators were instructed to change lamps in the library's main space, a time-consuming and expensive exercise indeed. Once LED lighting is put in place throughout the building, a considerable cost reduction will be assured. Furthermore, a voltage optimizer will be installed. Although the investment in this equipment is considerable, a decreased energy bill serves as an attractive inducement, especially as the break-even point will be reached within three years.

Situated on the southern coast of England, Brighton enjoys quite a number of sunny days per year. As the building is not overshadowed by any tall building in its vicinity, thought has been given to installing solar panels on its roof. Although the three tall wind towers shade a good deal of the roof's surface area, the experts consulted on the matter advised that the installation was still a viable option.

Temperature control of the building caused some headaches, especially in the height of summer. Experience has shown that the passive ventilation system does not provide a stable, constant internal summer temperature throughout the day or from day to day. The amount of cooling energy depends on the drop of temperature during the night hours. When the library opens its doors, the store of "coolth" dissipates at different rates depending on the external weather, the amount of heat created by occupants, internal lights as well as equipment such as photocopiers or PCs. On busy days, when the overnight temperatures have been warm, with large numbers of visitors using equipment, internal temperatures will as usual rise faster than on quiet days with little equipment use.

Though air cooling equipment is provided as part of the system, it is not intended to control internal temperature in the same way as a traditional air conditioning system. Internal temperatures are allowed to rise according to the effects of the variables influencing them (external weather and solar gain, occupancy and equipment use). The library's cooling plant is switched on only when the rise in temperature exceeds the set upper limit. This operating mode results in significant reductions in the electricity consumption of the building compared to traditional air conditioning systems.

The temperature regulation was adjusted according to the following variables: during the winter season, the building is kept at 21°C (variables ± 1.5 degrees); during the summer months, the average temperature was set at 25°C. For the toilets, a slightly different arrangement was laid down: 18°C in winter and 26.5°C in summer.

Though the English south coast is known for its moderate summer temperatures, during the past years daily external temperatures often rose above the

design criteria of 26°C in summer and sometimes even exceeded 30°C. Likewise, night temperatures do not regularly fall to levels measured three or four decades ago. Consequently, the amount of cool air streaming into the building and stored in the “ThermoDeck” floors is often less than calculated. This confronts the building management with a very demanding situation in maintaining the preset temperature inside the building. In order to improve the performance of the construction, the length of the night-cooling stage was extended from 4 am to 7 am making use of lower temperatures during that time span. According to the original design,



Fig. 19.2: Brighton Jubilee Library from outside. © Bennetts Associates Architects.

only the wind towers open during the overnight cooling phase. Aiming for more cooling capacity, the programme was changed to open all windows during the night cooling stage. Furthermore, all windows are kept open for some time after 8 am to bring in the cool morning breezes.

As to heating, gas consumption is limited to the winter months when the system turns into the “winter mode” beginning in October. The library has been able to operate throughout each summer without using any gas.

4 Outlook

Since the start of operation, the building’s energy consumption has been monitored by a Brighton-based firm. For every month a report sheet is produced listing the electricity and gas consumption as well as the water supply. The data are aggregated to annual and multi-annual tables. Excessive usage patterns are pointed out and accounted for, and targets for the current year agreed upon. The technical staff has established a procedure aimed at achieving a technically feasible reduction of energy consumption (for 2012, the overall reduction was set at 1%). Although the library has not formally conducted a post-occupancy evaluation, its staff is geared to addressing performance problems and, wherever feasible, opts for reducing the environmental footprint of the building. This stance is in accordance with government regulations enforced since October 2008 which require large public buildings in the UK to post a “Display Energy Certificate” (DEC). The Jubilee Library, hailed as an award-winning landmark and praised for its sustainability values, prides itself on adhering to its green credentials.

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