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ENVS 662-660
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10/23/07

Jubilee Campus, University of Nottingham – United Kingdom

Introduction:

The Jubilee Campus of the University of Nottingham, which opened in 1999, successfully combines an impressive number of green features. The overall design concept achieves goals of sustainability and eco-efficiency, while simultaneously creating a vibrant social and academic environment. Perhaps most impressive of all is the fact that the project was accomplished at costs competitive with traditional building practices, coming in at $105 per square foot. (Buchanan)

The first of many green features is that the campus was built on a former industrial site. In this previous incarnation, the landscape that is now the Jubilee Campus was almost entirely covered by identical concrete warehouse buildings. The architects were extremely conscious of restoring nature and biodiversity to the former brownfield site. At the same time, the designers were conscious of the need to create a campus that would be a logical bridge from the town center on one side, to the more suburban-style neighborhoods on the other side of campus. The campus buildings are therefore closest to the town center, while the constructed lake, wetlands, and trees border the suburban homes. Since the campus borders the town center, it is easily accessible via public transportation.

The project set several environmental goals. These included reducing carbon emissions on the order of 70%, restoring biodiversity, creating a model of sustainable design and industrial redevelopment, and raising awareness about environmental and sustainability issues. In addition, the University wanted the project to be carried out quickly, efficiently, and at a minimum cost.

The project featured close collaboration between architects and engineers, a fact evidenced by the all-encompassing, fully integrated design elements. The architectural firm was Michael Hopkins Architects, and the chief engineers were Ove Arup Consultants. Partial funding for the project was obtained through an E.U. THERMIE grant. The campus includes buildings for the School of Education, the School of

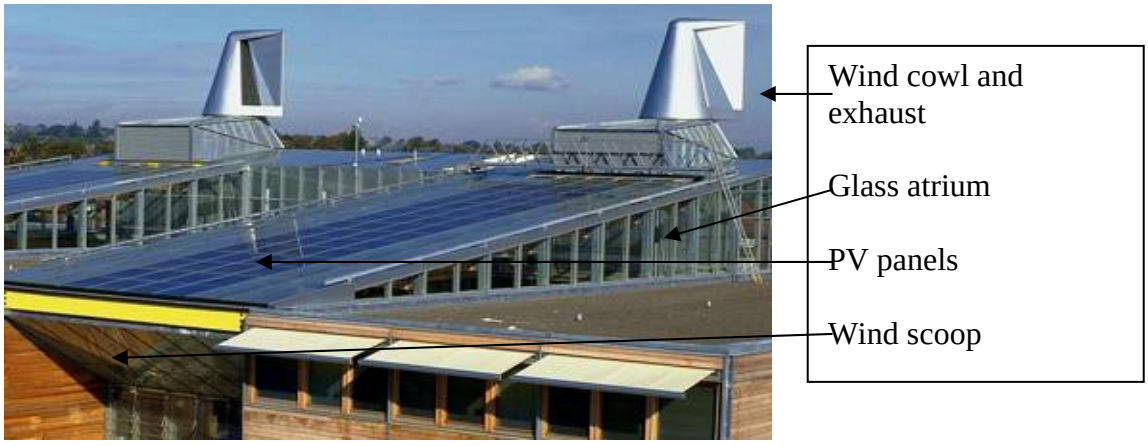
Computer Science and Information Technology, and the Nottingham University Business School.

Key Design Elements:

The most important and innovative green element of the Jubilee campus design is the wind driven mechanical ventilation system. This extremely efficient system takes local climate conditions such as prevailing wind and temperature into account, creating a heating and cooling mechanism that lets the landscape do the work, rather than fighting to subdue nature.

Air for the ventilation system is drawn in by the scoop-shaped fronts of the glass atria between buildings. The air is circulated through the buildings and out the back through the stairwells. At the back of the buildings are rooms filled with trees and plants, capped by rotating wind cowls. Fresh air is cooled and purified by the plants. Circulation is maintained by air pressure generated by the cowls. The process is mostly powered by the prevailing wind.

The atria also act as a thermal buffer, collecting solar energy and preventing heat loss in the winter. In the winter, a combined heat and power (CHP) unit preheats incoming air and allows it to rise and circulate through the buildings via displacement ventilation. In the summer, PV cells integrated with some of the glass panes in the atria provide shade and generate electricity to help give extra power to the ventilation system. The buildings are thus designed to take advantage of the moderate temperatures and cloudy, windy conditions prevalent at the location for most of the year. The design also takes advantage of the fact that days when wind speeds are lower and temperatures are warmer also tend to be sunny.



www.nottingham.ac.uk/about/campuses/jubilee.php

What makes the Jubilee Campus truly “green,” apart from using mostly renewable energy to drive the ventilation system, is the fact that the design includes the surrounding landscape as part of the whole. The design explicitly called for increasing the amount of green spaces on the campus, and set a goal of encouraging biodiversity.

The landscaping is integral to the design of the buildings, particularly the wind driven ventilation system. The edge of campus is buffered from the suburban housing next to it by a strip of tall trees and a constructed berm planted with shrubbery. Next to the trees and shrubs, the designers engineered what used to be a stream into a small lake. The prevailing wind blows through the trees and over the lake, which cools and filters the air that then flows through the ventilation system. Reed beds and constructed wetlands surround part of the lake to purify stormwater runoff. The lake functions as a stormwater retention basin. Graywater is collected from the buildings and routed through the wetlands for natural filtration and purification. The lake and wetlands were designed to encourage a variety of wildlife habitats.

In addition to its functional uses, the lake features a grassy arcade that connects the glass atria between academic buildings, together forming the social hub of the campus. The glass atria contribute to the overall green design even beyond their energy contributions. There are plants and trees within the atria, as well as abundant natural light enhanced by light reflectors. The reflectors help bounce the light into the rooms within the academic buildings, reducing the need for electric lighting. The atria are used to house public spaces such as a cafeteria and a series of auditoria in the library building. This uniquely shaped building is situated on a small island that projects into the lake.

The academic buildings feature planted roofs, with low-growing alpine plants such as moss and lichen. This helps reduce and purify stormwater runoff, as well as serving to insulate the buildings. The academic buildings are also equipped with dry compost toilets and a graywater purification system, as mentioned earlier.

Another important energy saving feature of the campus is the light and motion sensors installed to reduce wasted electric lighting. In fact, none of the rooms in the academic buildings have manual light switches. Electric lights are turned on only when natural light levels dip too low. Motion sensors know not to keep an empty room lit.

The designers made a number of materials choices to achieve lower embodied energy and less pollution from manufacturing. They chose cedar wood from sustainably managed forests for the cladding on a number of buildings. In situ concrete was used when possible, with the added benefit of the concrete's temperature stabilizing effects. Insulation made from recycled paper was used in the walls of some of the buildings.

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Performance Evaluation and Conclusions:

One of the conditions of the THERMIE grant that helped fund the project was that precise data would be collected about the performance of the system regarding internal temperatures, as well as water, electricity, and gas consumption. This data is not yet available to the general public, but will certainly serve as an important set of information for future projects. Regardless of whether or not all the efficiency goals are met, the project's goals of raising awareness, providing learning opportunities, and demonstrating that viable sustainable design can be done without high costs have already been met.

Some data has been made available about the performance of the building integrated PV panels. The PV system utilizes mono-crystalline square cells integrated

between panes of glass in the atria. The designers used 9 different module arrangements to meet the specific shading and energy needs of the different areas in which they were installed. This shows the attention to specifics and adaptation to circumstances that is typical of this project. Rather than force something to work the same way everywhere, the designers sought to create the right design for the right situation. In total, the system can generate approximately 60 kW of electricity. Actual yearly output has proven to be about 51 MWH per year, which has proven to be enough to meet the needs of the electric fans. (http://www.iea-pvps.org/cases/gbr_01.htm) The buildings have shown lighting energy savings of 384,000 kWh per year, and total energy savings of 3,056 million kWh per year. The carbon dioxide reduction goals have been achieved, with a reduction of about 980,000 kg per year. (www.energyglobe.info) The project also met goals of quick, efficient, cost-effective construction.

Some of the green features incorporated in the project are perhaps not as green as they appear on the surface. For example, the cedar cladding came from sustainably managed forests in Canada, which means they had to travel a great distance to get to the U.K. This product was chosen for its low cost. Also, there is some question as to whether or not recycled paper is appropriate as insulation, since it sometimes can off-gas chemicals or require treatment to prevent mold.

The project has been successful in restoring green spaces to the site, and raising biodiversity to some degree by providing habitat where there was none before. The green rooftops have proven to be more effective than traditional insulation. Still, they are somewhat bland and underused. They could be improved with increased plant diversity, better access, or the integration of some sort of food crops. The lakeside arcade could be made more diverse than the current grass monoculture. The campus is planning to build a model eco-village in the near future. It will be interesting to see what innovations are incorporated into the design of this new project.

The Jubilee Campus has received a number of prestigious awards. These include the Millennium Marque Award for Environmental Excellence, the British Construction Industry Building Project of the Year, the RIBA Journal Sustainability Award, and the runner-up prize for the 2005 Energy Globe Award. (www.nottingham.ac.uk) These awards are a testament to the successful, innovative green design of the project.

Sources:

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