NATURAL POWER OFFICES, CASTLE DOUGLAS

CASE STUDY

sust.

THE LIGHTHOUSE ON SUSTAINABILITY

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Client	Forrest Estates, Castle Douglas
Architect	Neil Sutherland
Consulting Engineer	AF Cruden Associates Ltd
Contractors and specialist suppilers	Carpenter Oak & Woodland
Main Contractor	Colin Bosworth and Carpenter Oak & Woodland (timber frame)
Completion	2001

INTRODUCTION

The Forrest Estate is one of the largest private woodlands in Scotland. It is owned by Fred Olsen Limited, also the proprietor of the the Natural Power Company. In developing an office building for Natural Power, the company used timber sourced from its own grounds, in the Forrest Estate, allowing the company to meet is objectives for diversification and expansion of operations.

In 1999 an architect was commission was to build a comfortable, healthy and bright office space of around 360 metres square. The facility should accommodate up to 18 workers, and be based on hot desking design for complete flexibility. Timber was selected from the client's forest, cut using a portable sawmill and air-dried on location around 16 weeks before construction started.

The building has low embodied energy in both construction and use. It is completely free of external infrastructure support using local hydropower, ground water from a bore hole and draining to a sceptic tank.

SUSTAINABLE DESIGN FEATURES

Heating and insulation

• Underfloor heating powered by Estate's own hydro scheme installed in 1983
• High levels of insulation (225 mm cellulose fibre throughout)
• Passive solar orientation and large thermal storage potential through the use of concrete blockwork partitions and a concrete floor slab
• Solar hot water panels
• Double glazing using low-emissivity glass
• Natural daylighting and ventilation with glare control from generous overhangs
• Earth sheltered – to reduce heat loss from exposure

Materials selection

• All timber, with minor exceptions, sourced in Scotland with two thirds coming from client's estate
• Appropriate use of specific timbers to avoid the use of chemicals
• Large section of heartwood Douglas Fir for principle timber frame with exposed post and trusses
• European Larch for soleplates and counter battens
• Green Oak for exposed Balcony and escape stair (60 minutes structural integrity for fire)
• Less durable Norway Spruce was used for floor joists and framing
• The staircase was locally fabricated using Oak and Sycamore
• Scottish Sycamore and other Scottish hardwoods were used for other internal finishes
• Locally quarried stone for car park base
• Sawmill waste used for path materials and mulch
• Use of recycled materials, such as Warmcell insulation
• Sustainable materials: 150mm turf roof – stripped from site and adjacent hill
• Water and drainage: use of ground water from nearby bore hole
• Use of sceptic tank

Site layout
The building is set on a hillock a little back from trees and laid out on a East – West orientation to maximise solar gain along the heavily glazed south face. The office is earth sheltered and built into the hill at the east providing level access tthe first floor. The elevated position allows for foul water to drain naturally to the sceptic tank.

Costs
The total cost of the development, including infrastructure provision, was £320,000, which was considered comparable with standard office construction costs. The building uses 70% less energy than an equivalent sized conventional building.

Contractor issues
The project was managed by the chartered surveyor, who acted on behalf of the client. The frame was built and erected by Carpenter Oak and Woodland Limited. a timber frame specialist. Other materials were sourced by the architect. A local builder provided the labour required.

SUSTAINABLE DESIGN FEATURES

Consultation

Experience of sustainable design

Archtiect Neil Sutherland was commissioned for his specialist environmental design knowledge and experience. The practice is particularly concerned with developing an appropriately robust, versatile and sustainable modern building tradition for the Highlands and rural Scotland.

The practice has experience of incorporating a number of sustainable design elements. These include the elimination of chemical treatments through appropriate materials selection and designs; use of local timber, earth sheltered features including retaining walls and grass roofs; and reduced energy use both in embodied energy and energy use. However, this was Sutherland's first office design.

Implementation of sustainable development policy within the client organisation

Both client and tenant are directly involved in renewables energy systems. For the Forrest Estate, early investment in hydropower schemes was followed by diversification into continuous cover commercial forest management and new planting intiatives where native species are grown as opposed to raising livestock. Two wind turbines wil be constructed and a biomass combined heat and power system introduced to power further development including tourist accommodation and a renewables interpretation centre.

The location of the office development has created work locally through harvesting the timber. The office itself also provides high value jobs in the area. Many employees cycle to work and a car share scheme has also been set up.

Relationship between client and architect

The client had a total commitment to meeting its aims for sustainable design and was very knowledgeable about sustainable features. The architect was selected for his experience in designing in timber and his 'Norwegian' style approach to producing simple but elegant designs.

Business case for sustainable development

For Forest Estates, there is commercial rational is using own-grown building materials. The 'organic' nature of the building is consistent with the ethos of other local businesses, which includes an organic farms.
For Natural Power, the building provided an identifiable company image for a business promoting renewables. One of the aims of the building was that it should show that renewables are sound business sense, costing little more to use and brining long term cost benefits.

What barriers were encountered and how were they overcome

Dumfries and Galloway Council were very supportive of the sustainable approach being taken by Forrest Estates They liked the modernity of the design; that it was consistent with their company image as 'The Natural Place'; and that it brought new jobs into the area, some of which are high-value. The main concern about the building is that is could become a 'stranded asset' should Natural Power move out.

Building Control were concerned about the timber fire escape and had initially requested a metal structure to be built. Howeve, assured that the timber used had at least 60 minute fire resistance, the feature was accepted.

Recommendations to others seeking to adopt a similar approach

The lead consultant should be selected for experience if integrating, directing and co-ordinating the project beyond a set drawings and specification to ensure that the integrity of the design is maintained throughout construction.

CONCLUSIONS

The project demonstrated how rural buildings can achieve a high degree of sustainability by being built of appropriate local materials. The client achieved its objective of supporting a building design that was sustainable and capable for replication by others. The building provides a good promotional footing for the occupant and is a sound and solid base for further sustainable activities.

The procurement method used helped to reduce the overall costs to the client by removing risk from the contractor. Contractors often lack the knowledge and experience of implementing a sustainable design, which is often offset through an increase in the tender price.

LESSONS LEARNT

The client invested in a full feasibility study to investigate a number of possible sites and to examine the various options for sustainable design to be critically examined. It was felt that this feasibility study was a useful reference point during the construction period and served to remind participants of the aims of the design set out at the start of the project.

The architect was closely involved in the construction work, taking on a range of roles from sourcing and transporting timber from the Highlands, sourcing other materials and providing a costing service. This was to all intents and purposes an example of 'partnering' in the construction process, with open book accounting used instead of competitive tender. The architect proposed that one advantage of this approach is to avoid the need for a quantity surveyor, who may not understand the life-cycle approach to costing for sustainable design features.

This approach allows the architect to remain close to the design during the construction process, thereby reducing the extent to which the contractor can provide his own interpretation of the design. One disadvantage of the open tender process is the lack of cost certainty for the client, though careful budget control can provide a cheaper solution to the risk sharing process. As a result of experience on this project, the architect is now developing more sophisticated spreadsheet based budgeting systems.

The client is planning to extend the office to provide space for additional workers. The client has observed that they are now able to source materials at cheaper prices. This is possible because the usual suppliers are now willing and able to source these alternative materials with confidence, having seen their use proved in this building.

In terms of material use, it was noted that sources need to be carefully checked – slate brought in from Wales and apparently 'Welsh' turned out to be imported from Spain. The client will not use this material in the building extension. It was hoped to use locally grown wool for insulation, however, treatment costs proved too expensive. Water-based paints rather than organics were also used treduce costs.

The intended use of ridge glazing was substituted for standard velux roof lights to allow cost saving and increased ventilation.

The Forrest Estate is one of the largest private woodlands in Scotland. It, and the Natural Power Company, tenant of the building are ultimately owned by Fred Olsen Ltd. By providing an office for Natural Power, and using their own grown and seasoned timber, Forrest Estates were able to meet diversification aims. The estate began using hydropower in 1983.

Sustainable features:
Use of timber grown by client in two-thirds of building
High insulation levels
Lobby spaces
Passive solar orientation
Extensive use of natural light
Solar hot water panels
Natural, user controlled ventilation
Selection of materials treduce use of chemicals
Earth sheltered features
Turf roof
Underfloor heating
Thermal mass floor
Power from clients hydroscheme

Sust.: The Lighthouse on Sustainability aims to raise awareness of sustainable design in architecture. It was devised by The Lighthouse: Scotland's Centre for Architecture, Design and the City on behalf of the Scottish Executive. It is funded by the Sustainable Action Fund.

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