Eco-house Oxford

Project Basics

Location: Oxford, UK
Latitude/Longitude: 51°N, 1°W, 40 m above sea level
Building Type: Residential
Square Footage/Stories: 2,552 ft²; 2,750 ft² including porch and sunspace/ 3 stories, 6 bedrooms
Completion date: construction took about 18 months; completed Mar 1995
Client: Sue Roaf
DesignTeam: Sue Roaf and David Woods

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Exterior Photo

Background and Context

The Eco-House Oxford was the first low-energy house in the United Kingdom with a fully integrated photovoltaic roof and is one of the lowest energy houses in Britain. It has reduced CO_2 emissions from 6,500 kg CO_2 per annum for a regular house of the same size to only 148 kg CO_2 per annum for the Eco-House Oxford. It was built in a traditional manner with traditional materials and did not cost any more than any other house of its size.

The Eco-House Oxford was built to make a point. It would evaluate the potential for photovoltaics to contribute to domestic and industrial energy supplies and demonstrate how solar energy can replace much of the damaging electricity and gas supplies in a residence. Many companies helped out with the construction and costs of this project. “There was a tremendous sense that this was a really important development and everyone who was asked for help, without fail, responded.” (Partnerships).

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Interior Photo

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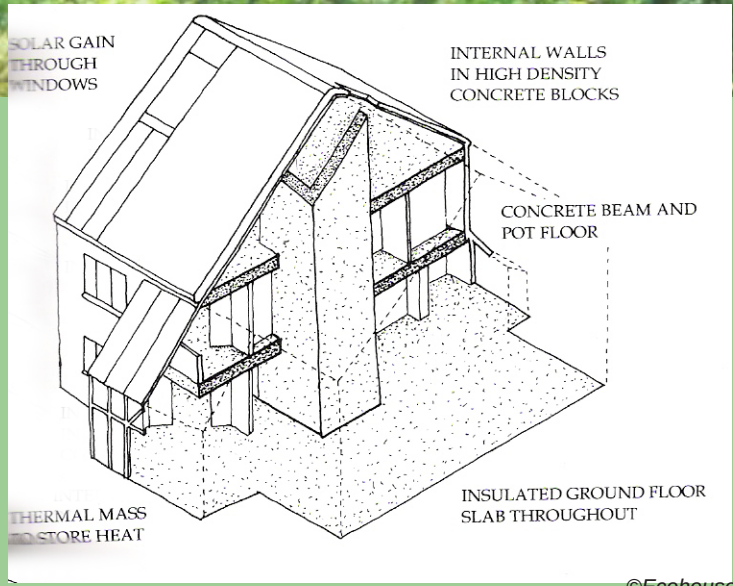
Design Intent and Validation

Sue Roaf has studied ecohouses all over the world. She has written two books on the subject. She looked at the site characteristics and materials to design the best use for this climate to achieve a low-energy house.



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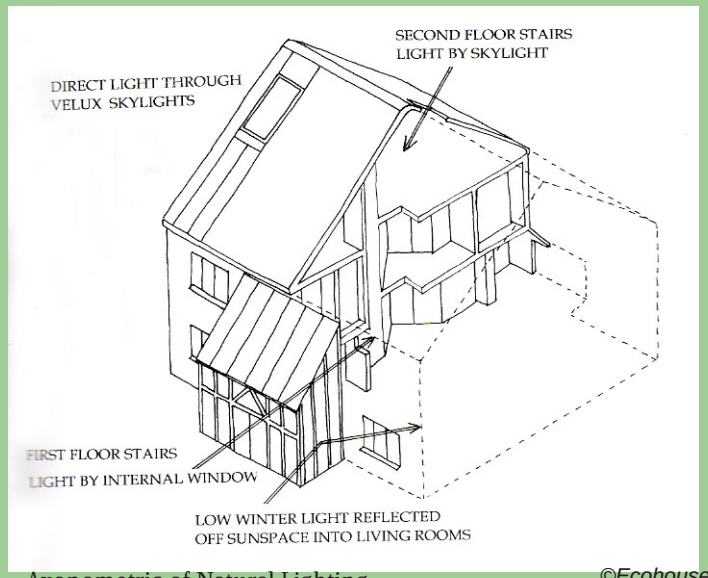
Axonometric of Materials

Wood-Burning Stove



Axonometric of Natural Lighting

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Key Design Strategies

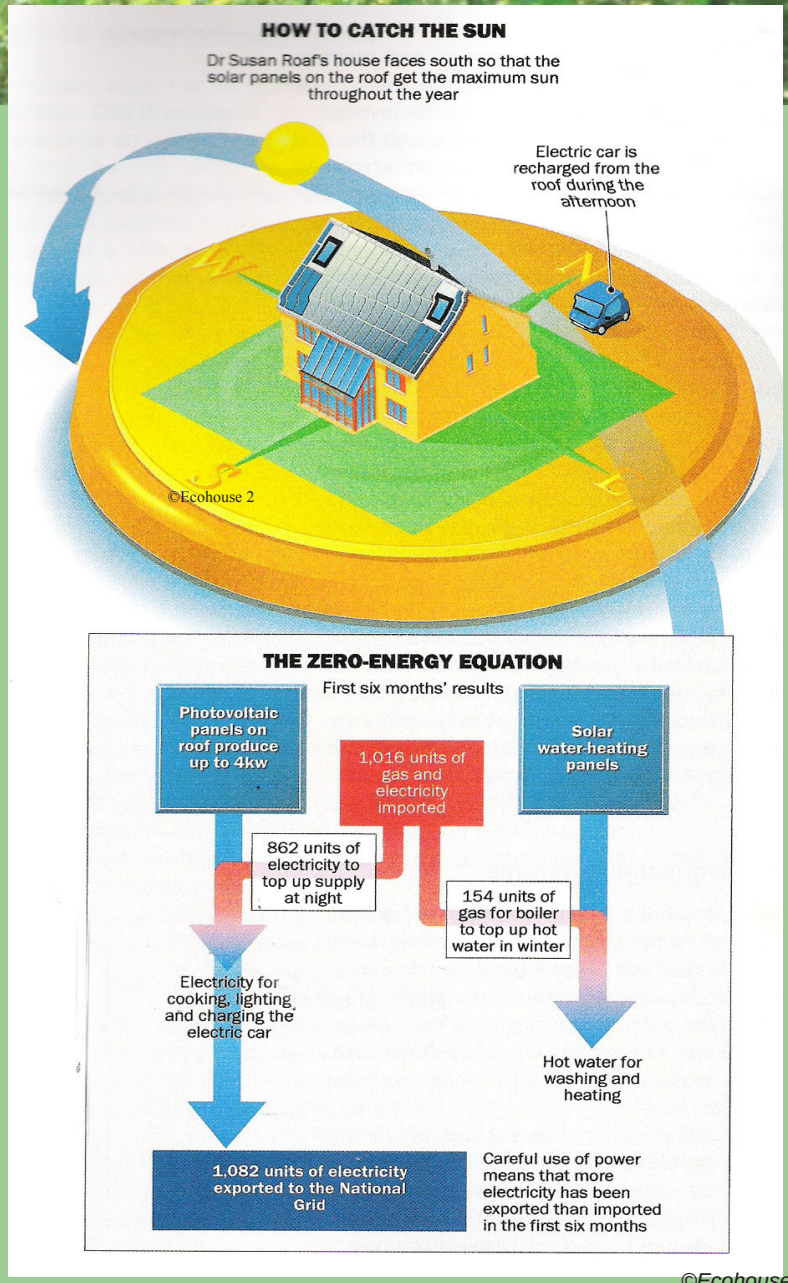
The Eco-House Oxford uses a variety of strategies to adapt the low-energy technology to the temperate climate.

Photovoltaics. There are 48 photovoltaic modules arranged in 4 vertical rows mounted on a built-up aluminum frame screwed on the roof. Oxford only receives about 4.0 peak hours of sun in the summer and 0.6 hours in the winter. During summer months there are surpluses, predicted to be around 12 Kwh per day, that are exported to the local electricity station or stored for use at night. The company pays 0.02p for each KW. Then in the winter, when there is not enough energy, electricity is imported from the power station and Sue pays 0.6p for this.

Solar hot water. On the roof alongside the photovoltaics are 5m² solar hot water panels connected to a 300-litre tank to supplement the energy demand for hot water.

High levels of insulation and high thermal mass. These prevent heat gain and loss, therefore reducing the need for outside heating and cooling systems.

Windows. Triple-glazing to prevent thermal transference except in the sun room which is only double-glazed.



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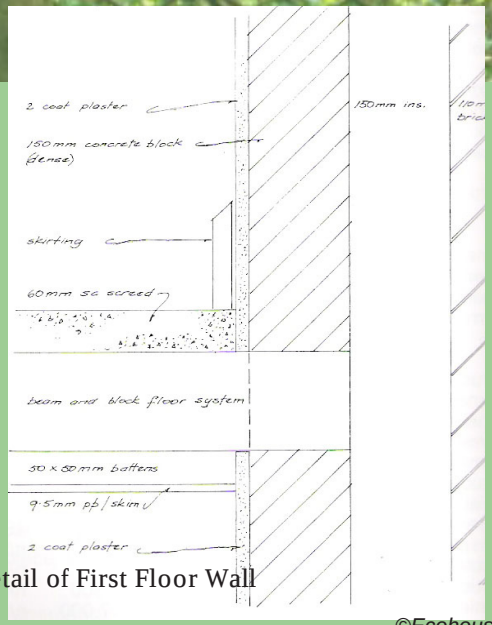
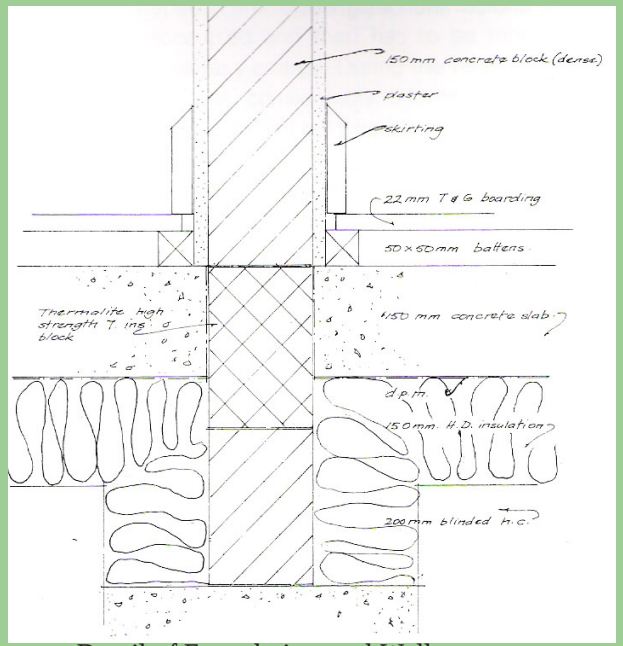
Orientation. The house is oriented roughly east–west with a south-facing rear elevation which provides good solar access. Heating costs are minimized through the use of passive solar gain.

Materials. Materials were chosen carefully for transport energy, durability, and heat storage. They used traditional materials and construction techniques. For example, the ground floor is 15mm floating timber on 60mm screed over 150mm concrete slabs on 150mm polystyrene floor insulation.

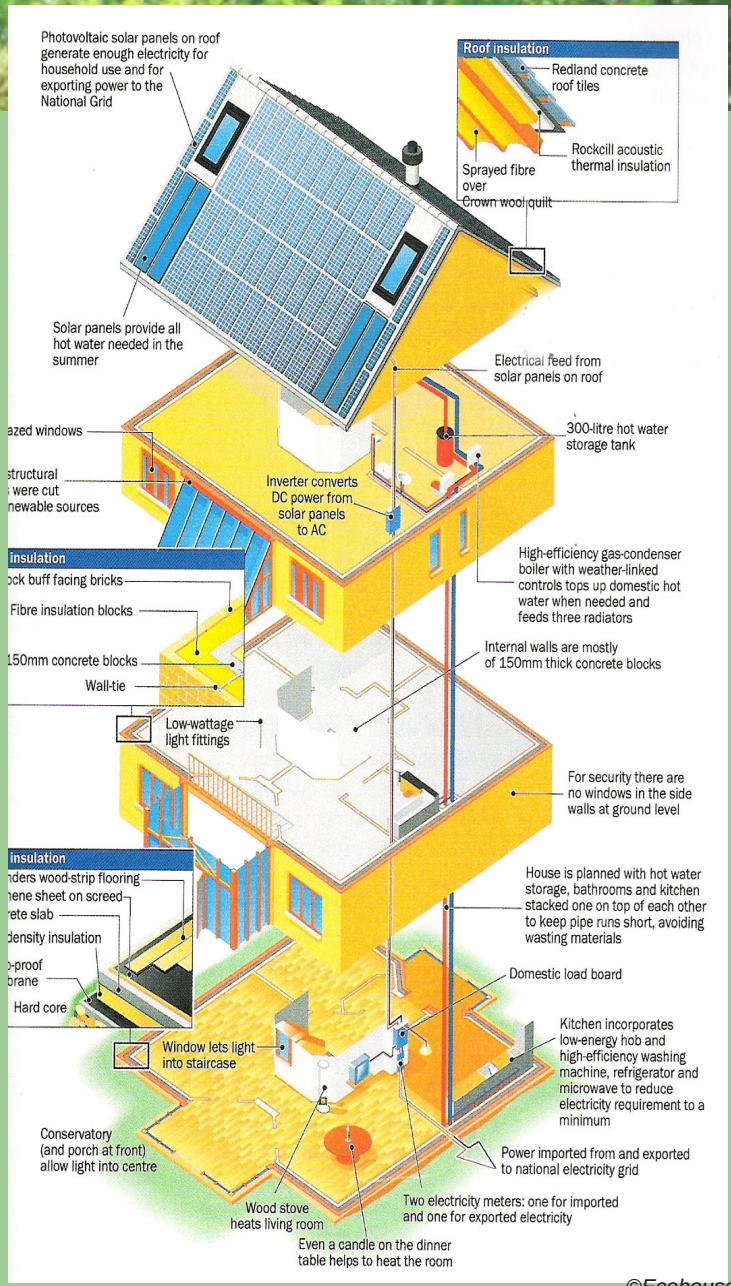
No mechanical ventilation system. However, there is no condensation = the air and wall temperatures usual same rooms arranged round a central core incorporating a service



Detail of First Floor Wall



Detail of Foundation and Wall



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Performance Studies

There are many performance studies of the Eco-House Oxford in Sue Roaf's book, Ecohouse 2: A Design Guide.

Thermal Transmittance
*U-value = thermal transmittance through 1m² area of given structure divided by temperature difference between the environmental temperature on either side of structure.

Element	U-Value (W m-²)	Description
Walls	0.22	Brick Block
Floor	0.19	150 mm Insulation
Roof	0.14	250 mm Insulation
Windows	1.30	Triple-Glazed

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Performance Summarized
*All costs in pounds

Type	kWh m-² a-¹	Electric Cost	Gas Cost	Total Cost	CO2 emissions (kg)	Construction Cost (per m²)
OXFORD ECO-HOUSE	26	8	44	52	148	720
TYPICAL HOUSE	90	180	476	566	6500	720
SAVINGS	64	172	432	514	5360	0 EXTRA

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Map and Transportation Options

Megabus.com
£1–5
Leaves from Victoria, Buckingham Palace
Arrives Gloucester Green, Oxford
Times throughout the day

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Further Information

<http://www.ecobusinesslinks.com/ecohouse_showcases.htm>

<http://www.pilkington.com/resources/projectsummariesforweb.doc>

<http://www.tve.org/ho/doc.cfm?aid>

References

Partnerships Central. “Oxford Ecohouse.” Energy Portal. <http://partnershipscentral.org/mainpages/realportal/displayobject.php?object_id=3>

Roaf, Sue. “Ecohouse in India and Wales.” Architecture Week. 21 January 2004: E1.1
<http://www.architectureweek.com/2004/0121/environment_1-1.html>

Roaf, Sue. Ecohouse 2: A Design Guide. Amsterdam: Architectural Press, 2003.

Case Study by Kyndell Madsen, Spring 2006