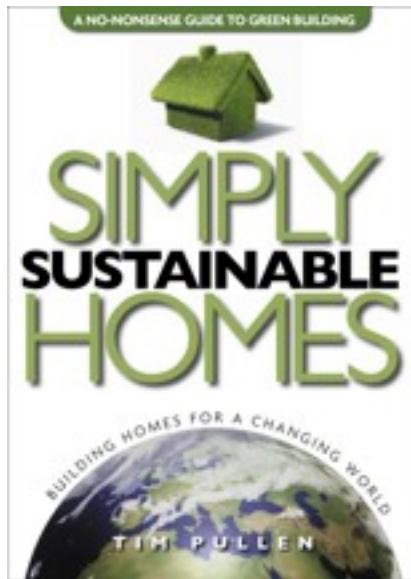




Principals of Energy Efficient House Design



Tim Pullen

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- 1. Materials & Construction** — Durable, renewable materials & high insulation levels
- 2. The Plot** – Considering the resource value of the land you are building on.
- 3. ENERGY USE** — Putting energy use at the centre of the design process = **£'s** and security

Using Sustainable Materials



**Re-used, Recycled,
Renewable**



Function of design



**Consider why they are
being used**



Orientation



The north-facing Kingspan
Lighthouse

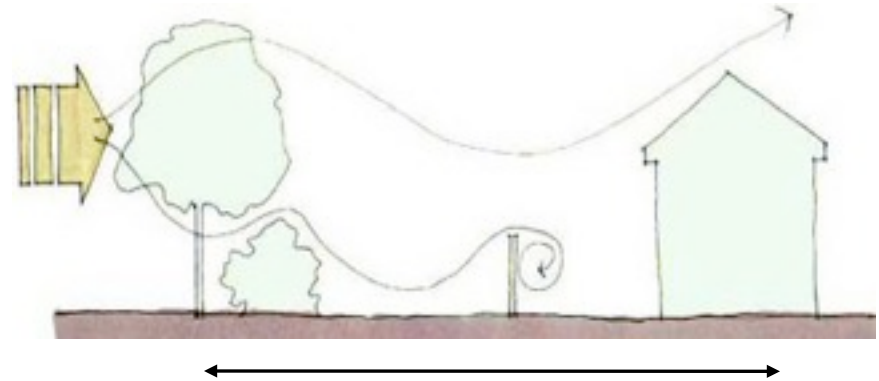


The south-facing Super E house

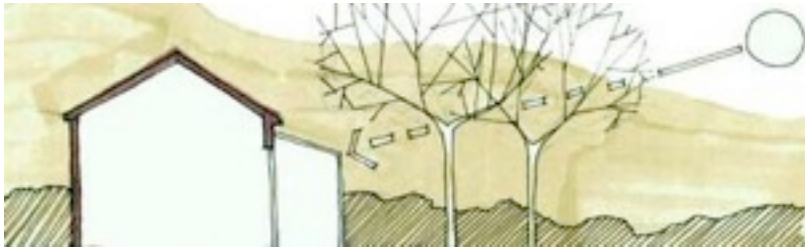
Site Conditions

A shelter belt will reduce heat loss and weather attrition

WINDY SITE



SUNNY SITE



Close planted deciduous trees provide summer shading

Shelter belt max 3X height of house from the house



OPTION 1 – Mass and Glass

Maximum glazing + Maximum thermal mass = Maximum solar gain



Option 2 – Light & Tight

Very good insulation potential

Very good air-tightness potential

Move the bricks and get the tea-cosy effect

Standard Timber Frame Wall

140 x 38mm Vac Vac Treated C.L.S Studs at 600mm Centres with 9mm OSB 3 Sheathing, providing a strong and economical to insulate structure.

*Plasterboard

*V.C.L.
Vapour Control Layer

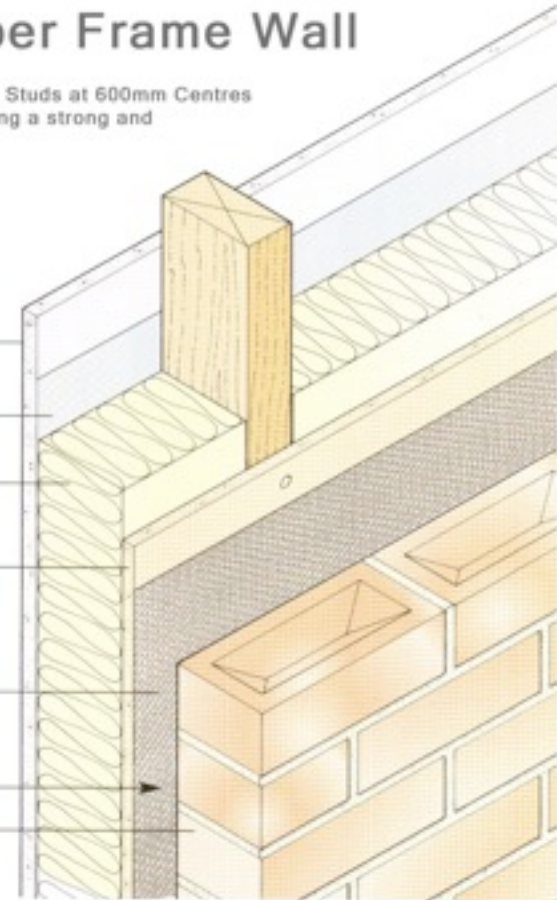
*Thermal Insulation

OSB 3 Sheathing

Breather Membrane
"Tyvek House Wrap"

Drained and Vented Cavity

*Outer Leaf of Masonry

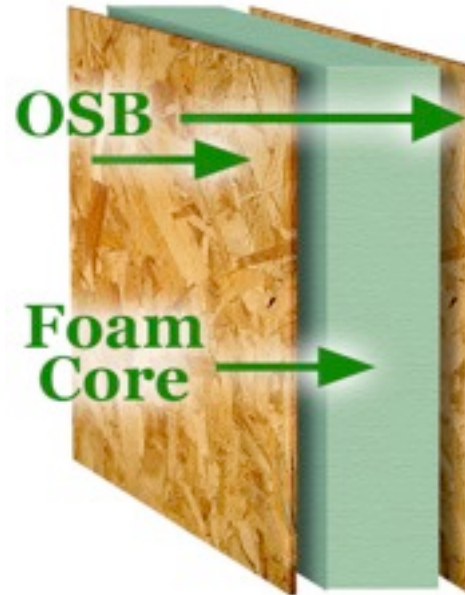


* Supplied by others

Construction Method



Option 3 - SIPS



**Maximum insulation + Maximum air tightness =
Minimum heat loss**

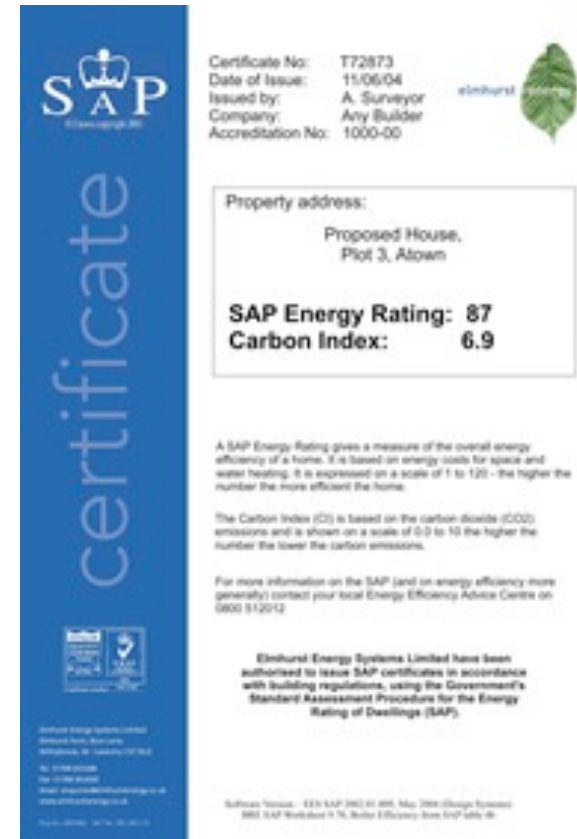
Will need a ventilation system



Put Energy At The Centre

Traditional Approach to Design:

1. Design house
2. Getting planning consent
3. Do SAP calculation
4. Get Building Regs approval
5. Build house
6. Find out what it **ACTUALLY** cost to run



The image shows a vertical SAP Energy Rating Certificate. On the left, a blue vertical bar contains the SAP logo at the top, the word 'certificate' written vertically, and the Building Regulations logo at the bottom. To the right of the bar, the certificate details are as follows:

Certificate No: T72873
Date of Issue: 15/06/04
Issued by: A. Surveyor
Company: Any Builder
Accreditation No: 1000-00

Property address:
Proposed House,
Plot 3, Alton

SAP Energy Rating: 87
Carbon Index: 6.9

A SAP Energy Rating gives a measure of the overall energy efficiency of a home. It is based on energy needs for space and water heating. It is expressed on a scale of 1 to 100 - the higher the number the more efficient the home.

The Carbon Index (CI) is based on the carbon dioxide (CO₂) emissions and is shown on a scale of 0.0 to 10 the higher the number the lower the carbon emissions.

For more information on the SAP (and on energy efficiency more generally) contact your local Energy Efficiency Advice Centre on 0800 512012

Elmhurst Energy Systems Limited have been authorized to issue SAP certificates in accordance with building regulations, using the Government's Standard Assessment Procedure for the Energy Rating of Dwellings (SAP).

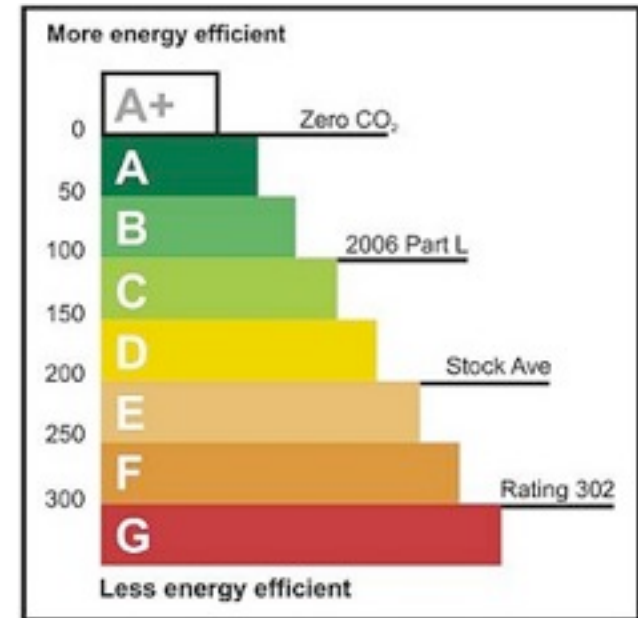
Software Version: EES-SAP (M) 01.009, Max 2000 (Energy Returned)
SAP 2009 (M) 01.009, Max 2000 (Energy Returned)

Building Regs compliant house has space heating demand of 55kWh/m²/year

Put Energy At The Centre

Sustainable Approach to Design:

1. Set out primary design criteria
2. Decide on acceptable energy demand – 15kWh, 25kWh, whatever suits.
3. Design house
4. Calculate what it will **ACTUALLY** cost to run
5. Get planning consent & Building Regs approval
6. Build house



The average rating is anticipated to be C to D

Insulation & Air Tightness

Construction Method	Average Energy consumption	Typical Insulation levels	Air Tightness	Annual heating cost for 200m ² house
2010 Building Regs	55kWh/m ²	Loft = 270mm mineral wool Walls = 70mm polyurethane Floor = 75mm EPS Windows = U-value 1.8	10m ³ /hr	£543
OMS – SIPS	25kWh/m ² to 45kWh/m ²	Loft = 350mm mineral wool Walls = 140mm polyurethane Floor = 100mm EPS Windows = U-value 1.8	7m ³ /hr	£247 to £445
Passivhaus	<15kWh/m ²	Loft = 450mm mineral wool Walls = 280mm polyurethane Floor = 110mm polyurethane Windows = U-value 0.8	<1m ³ /hr	£148 (!!)

10% heat loss through windows & doors

Triple glazing adds 15% to 20% to price and reduces heat loss by less than 5%



Typical U values:



The U value of single clear glass is 5.4

With ordinary double glazing this is improved to 2.6

With Low-E glass the U value is reduced to 1.8

If argon gas is used to fill the air gap, the U value will reduce to 1.6

Secondary double glazing less than £100 per window – reduces U-value from 5.0 to 2.6W/m²

Using Renewable Energy

The sustainable home will want renewable energy

**Energy design =
knowing what you need**



**Feed-in Tariff =
commercial viability**

Good design = minimum demand = minimum investment

Renewable Energy

Solar panels – not necessarily south-facing roof

Biomass – find a supply of fuel first

Heat pumps need big gardens

Wind seldom works in urban locations



Principals of Energy Efficient House Design

Energy as a design criterion

Energy security adds value

Sustainable materials feed in to design

Design as a circular rather than linear process

The site is a resource

Incorporate the value of the site into the house you build on it

More Information

The Association of Environment Conscious Building –
www.aecb.net

The Green Register –
www.greenregister.org



Simply Sustainable Homes

Tim Pullen, Ovolo Books,

