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# Low energy homes and suitable construction systems

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## **How to Build a Low Energy Home -**

- 1. The current problem**
- 2. The Future Homes Standard**
- 3. The Fabric First Approach**
- 4. Construction systems**





**The Current Problem**




## The Current Problem -

1. We have a massive shortage of housing in the UK and the current housing stock is sub-standard in design and energy performance
2. The major house builders who control the delivery of new homes are focused on volume rather than quality (EPC less than C)
3. Heating and powering homes accounts for over 20% of all greenhouse gas emissions in the UK
4. The construction industry accounts for over 10% of all greenhouse gas emissions in the UK
5. Out of control energy prices

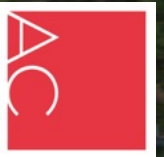






“Put simply a green or low energy home that from design, technologies and construction method uses less energy, from any source, than a traditional or average new house.”

**What do we mean by a Green Home**



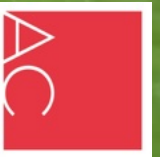


**These are examples of low energy homes-**



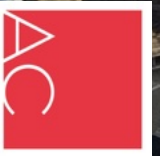


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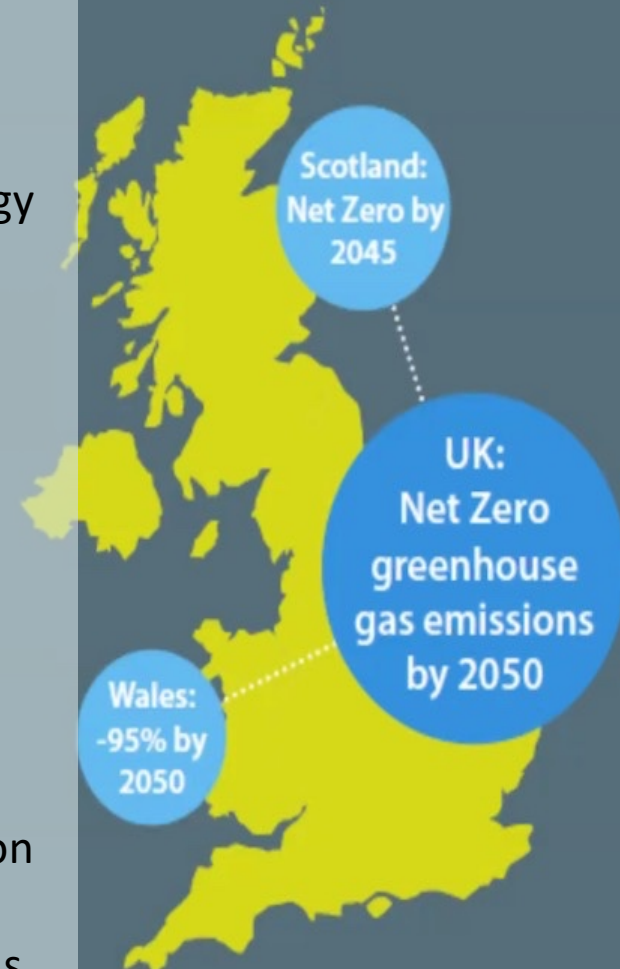
# The Future Homes Standard





## The Future Homes Standard -

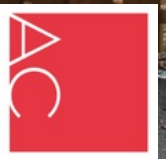
1. We need 250,000 new homes per year
2. Custom & Self build's lead the way in design and energy performance
3. Future Homes Standard 2025 –
  - A major review of the Building Regs (Part L - conservation of fuel and power, Part F – ventilation)
  - Drive towards Net Zero Carbon dwellings
  - Remove fossil fuel boilers
  - Improvement in U values
4. RIBA Climate Challenge 2030 –
  - 50% Reduction in Operational Energy & Carbon Emissions
  - 40% Reduction in Embodied Energy & Carbon Emissions
  - 40% Reduction in potable water usage
  - Low Carbon Heating no fossil fuel boilers






## The Future Homes Standard -

1. Its better for the environment, by reduced carbon emissions during construction
2. Its better for the environment, during operation due to the reduced energy demand
3. Typically 40-80% betterment in building standards than current housing stock
4. Reduced running costs over the life of the house
5. Potential for zero or positive energy bills
6. A more comfortable, healthy built environment

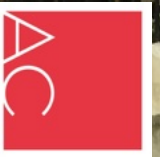






"Is a back to basics approach where you concentrate on the fabric of the building before throwing eco bling, in order to make it work."

## The Fabric First Approach





# THE KEY ELEMENTS

1. Solar Gain
2. Construction Type
3. Air Tightness
4. Limit Cold Bridging
5. Ventilation Strategy
6. Heating Systems





## SAP – Standard Assessment Procedure

### Basic Energy Performance Criteria

	England /Wales Section L	Scotland Section 6	Fabric First Targets	Passive House
Wall U-value (W/m <sup>2</sup> K)	0.18	0.17	0.15	below 0.15
Floor U-value (W/m <sup>2</sup> K)	0.13	0.15	0.15	below 0.15
Roof U-value (W/m <sup>2</sup> K)	0.13	0.11	0.15	below 0.15
Windows/openings	1.4	1.4	1.2	1.0
Air permeability	5 (m <sup>3</sup> /hr/m <sup>2</sup> at 50 Pa)	7 (m <sup>3</sup> /hr/m <sup>2</sup> at 50 Pa)	1.5 - 3 (m <sup>3</sup> /hr/m <sup>2</sup> at 50 Pa)  MVHR required	0.6 air change rate @50 Pa pressure difference  MVHR required

U – value – Measure the ease which a material or building assembly allows the heat to pass through. **The lower the U-value the better the insulation properties.**







# Construction Systems





## 1. Masonry

**Details** – brick outer skin, with cavity either full or partial fill insulation, aircrete block inner skin. Timber truss roof

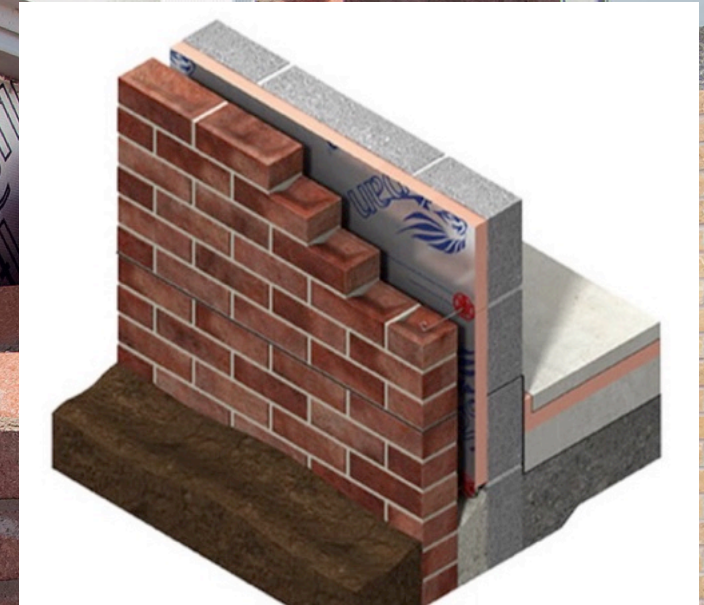
**Market share** - 46% (down from around 70%)

**Time to wind & water tight** – 20 weeks approx.  
[current market pushing to 27-30 weeks]

**Cost** – cheaper than off site alternatives

**Pros** – traditional solid and safe. No issues with building fire. Cost effective and its what most architects know. Excellent thermal mass.

**Cons** – Very slow compared to off site  
Not the preferred option for low energy homes. Thick build up





## 2. Timber frame

**Details** – timber studwork with an external OSB or plywood board nailed to it. Insulation friction fitted between the studs. OSB lined externally with a breather paper & internally with a vapour barrier.

**Market share** - 36%

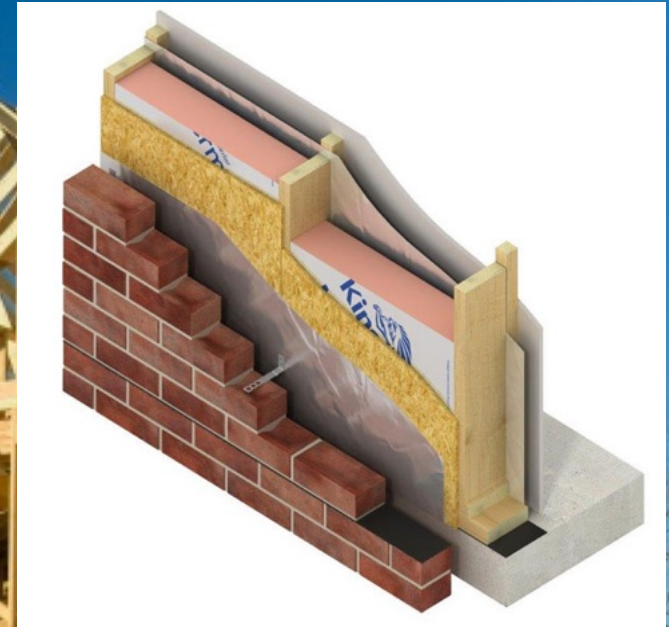
**Time to wind & water tight** – 10 weeks approx

**Cost** – open panel system cheapest, comparable to masonry

**Pros** – fast and cost effective way of building, good insulation levels. Lots of suppliers and choice.

Has been the standard choice in Scotland for many years. No issues with insurance or mortgageability.

**Cons** – Perceived fire issues, can seem lightweight. Settlement of timber can cause cracking





### 3. SIPs (Structural Insulated Panel)

**Details** – 2 skins of OSB are filled with either polyurethane (mix) or rigid polystyrene, infilled with timber to create closed panel. External breather membrane internal vapour barrier. Timber or mini SIPs structural splins. Wall & roof panels are the same.

**Market share** - 8%

**Time to wind & water tight** – 6 weeks approx

**Cost** – 10 - 15 % more expensive than timber frame

**Pros** – fast and cost effective if designed to panel sizes, excellent insulation levels. Airtight, ideal for fabric first or Passive House.

Huge spans, no roof trusses – vaulted ceilings. No issues with insurance or mortgageability.

**Cons** – Perceived fire issues, requires crane for roof. More expensive than alternatives





## 4. ICF (Insulated Concrete Form)

**Details** – Lightweight hollow interlocking blocks, usually made from polystyrene or PU insulation. Dry stacked, reinforced with steel rebar and filled with concrete (floor by floor). Lego blocks for grown-ups

**Market share** - 5%

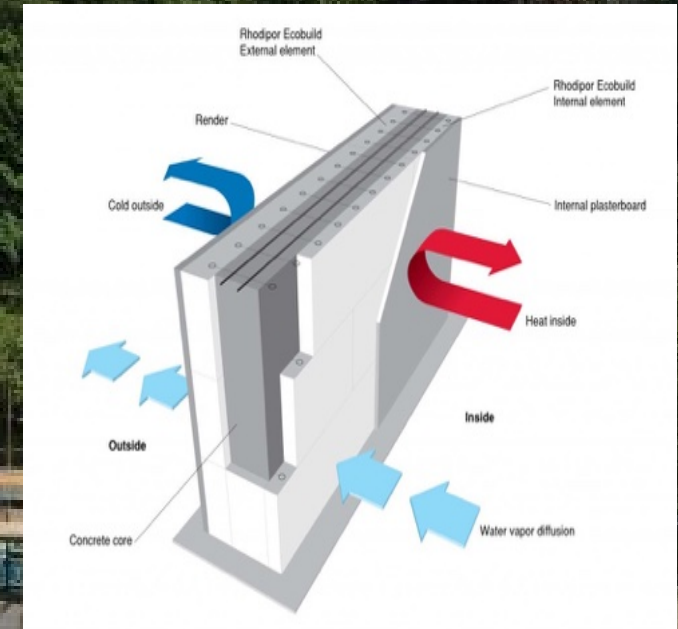
**Time to wind & water tight** – 10 weeks approx

**Cost** – 10 - 15 % more expensive than masonry.

**Pros** – fast and cost effective especially if you stack the blocks yourself. Excellent insulation levels. Airtight, ideal for fabric first and Passive House.

Ideal for basements. Rigid and solid. No issues with insurance or mortgageability.

**Cons** – The pour is critical (burst blocks), more expensive than block. Alterations, extensions can be difficult. No full house solution.





## 5. Oak Frame

**Details** – Green Oak frames are cut and shaped off site, & erected by experienced team on site. Structural frame is then encapsulated with an insulated envelope, often SIPS.

**Market share** - 3%

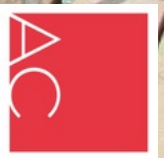
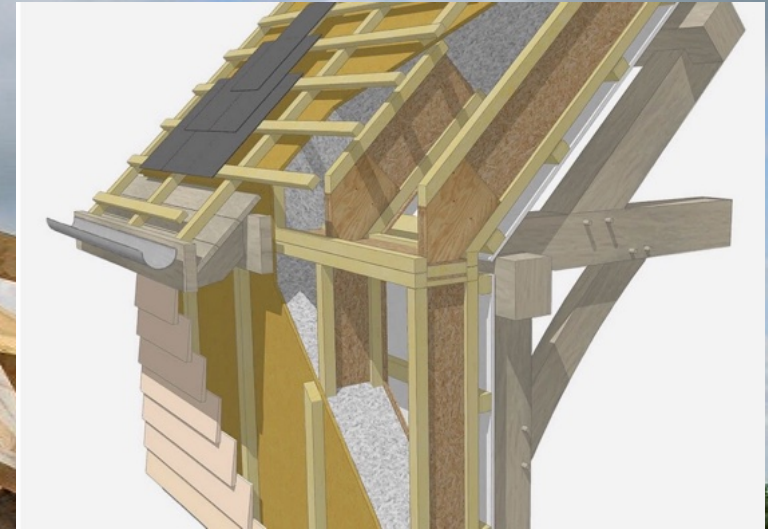
**Time to wind & water tight** – 10 weeks approx

**Cost** – The most expensive method.

**Pros** – can be relatively quick to erect kit & encapsulated. Perfect for more traditional designs. Can expose timber internally & externally. High performance given the right encapsulation.

Can use part frame in exposed areas.

**Cons** – expensive and you are doubling up on structural frame. Frame will move and shrink due to high water content, requires cleaning with Oxalic acid once erected. Specialist designers.





## 6. Solid Wood Construction

**Details –** Ecological Construction option. Solid wood modular construction method. Kit detailed offsite and arrives in small packages to site.

**Time to wind & water tight –** 12 weeks approx

**Cost –** 10 - 15% more expensive than timber frame

**Pros –** Low Carbon Footprint. Renewable raw material sustainable development. Carbon sink. Efficiency of production (processing). Natural ideal humidity.

**Cons –** Specialist design, limited providers.



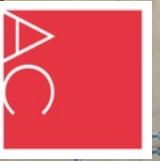


## 7. Alternatives

Straw bale

Steel frame

CLT





A photograph of a modern building with a two-story facade. The upper level is clad in light-colored vertical wood slats, while the lower level is made of red and tan bricks. A black metal balcony railing runs along the top of the wood section. A glass door is visible on the brick level. Green foliage is in the foreground.

## The main considerations

### Questions you have to ask yourself –

1. How much involvement are you having in the project?
3. What is your budget?
4. Is energy performance important to you?
5. Is speed of build a factor?





## How to Choose

1. Do your research & decide which construction method best suits your requirements – budget, speed, thermal performance etc
2. Then select and get at least 3 quotes from manufacturers of that construction method (builder or factory). Look around their factory, visit ongoing sites, speak to clients. Also check Companies House.
3. If you are using off site manufacturing, try and find a company that has everything in-house. i.e. drawings, manufacturing and site teams (not all outsourced).
4. Negotiate a fair price and agree on a fixed cost and timeframe. Make sure you go over the quote to understand all the details.
5. At the end of the day choose a company you feel comfortable with!

