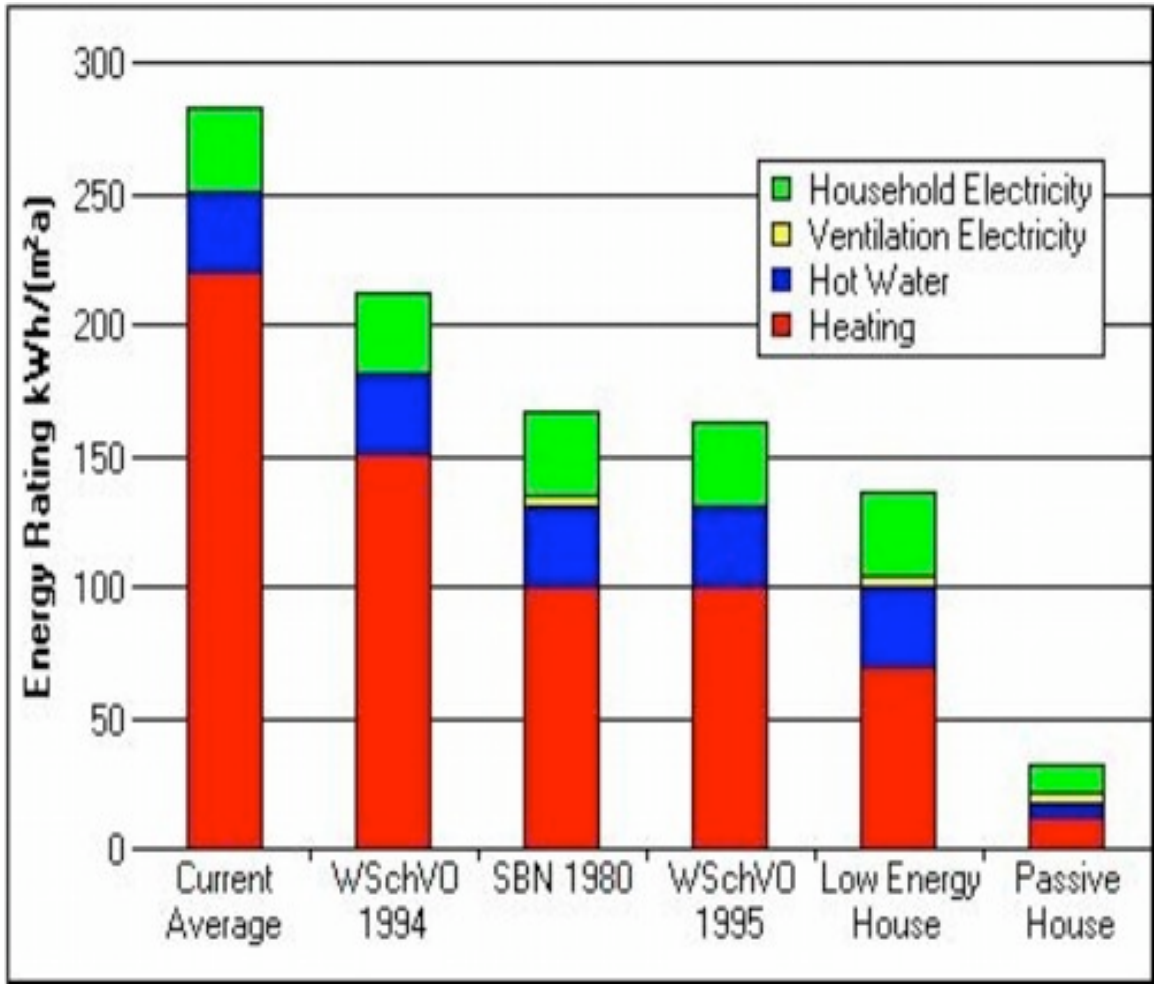
Passive House

What is it and why use it

CIR HEAT Conference 2009
http://www.hvm-uk.com

A peak into a passive future or ……

Conventional Low Energy **Passive House**



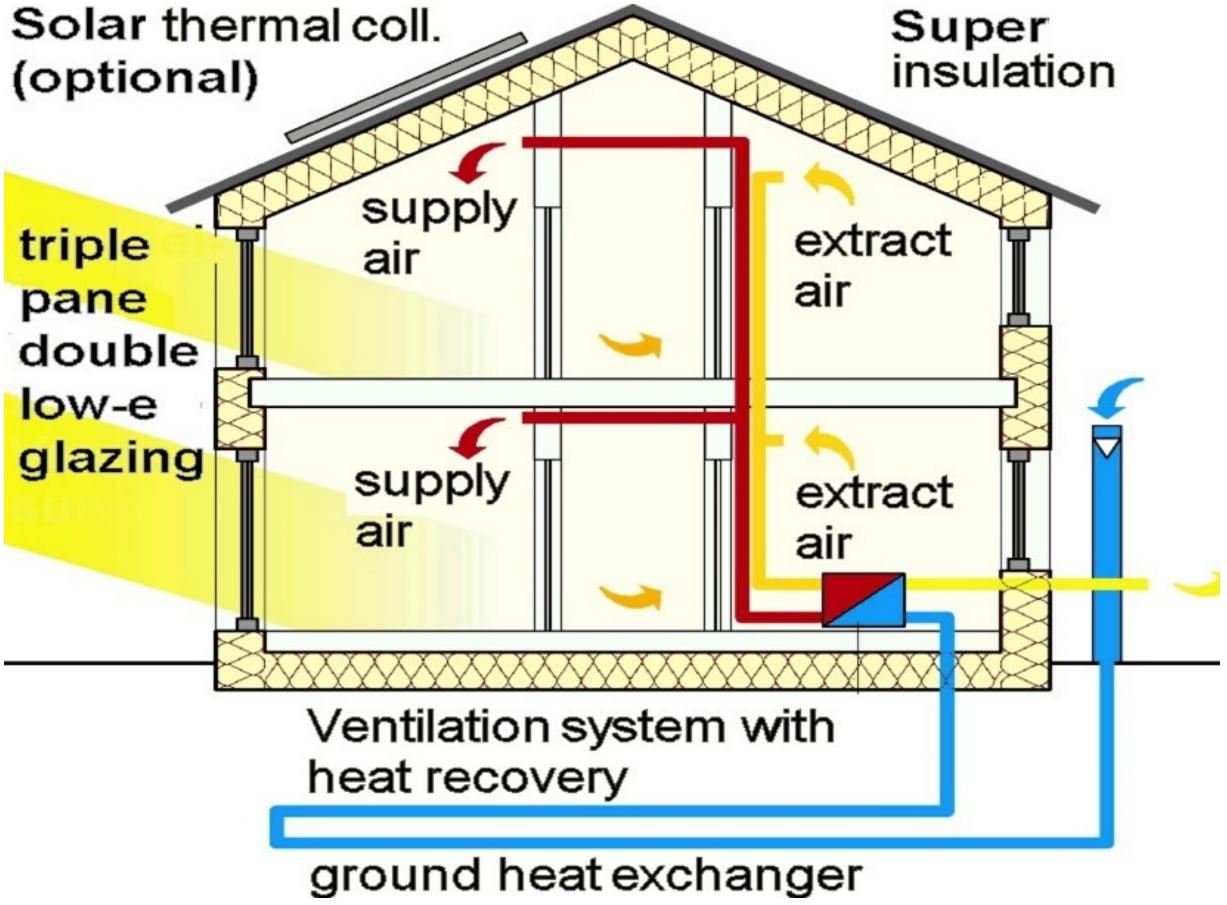
Passive House - where it came from

- Passive house concept since 1990
- Started in Scandinavia and Germany with low energy homes, Developed by an Architect and a Physicist
- Major changes in theory "challenging the norm"
- 7000 certified and 20000 uncertified homes since during last 20 years
- Now applied to other commercial projects
- Lessons for both new build and refurbishment
- Adoption of CEPHEUS and PHPP standards across Europe trailed on 16 projects
- New EU directive anticipated for passive from 2012-13
- Low Carbon, Low Energy Passive style towns established or planned in China, Austria, Sweden, Abu Dhabi and the UK

Passive Needs

- U-Values of fabric of 0.15 W/m2/K, greater for doors and windows
- Total energy demand 120kW/h(M2a) max
- Space Heating demand 15kW/h(M2a) max
- This is currently 65% more efficient than current standards
- Whole house contribution from all elements of the house including appliances and people.
- Can be constructed from any material but favours some types.
- Future contribution to "Zero Carbon" to include embodied energy
- NAO/HCA new build standard 25% to "innovative" specification

Passive Style



Typical components in Passive House

Exceptional uninterrupted thermal insulation of the whole building shell, including

Foundation

Walls

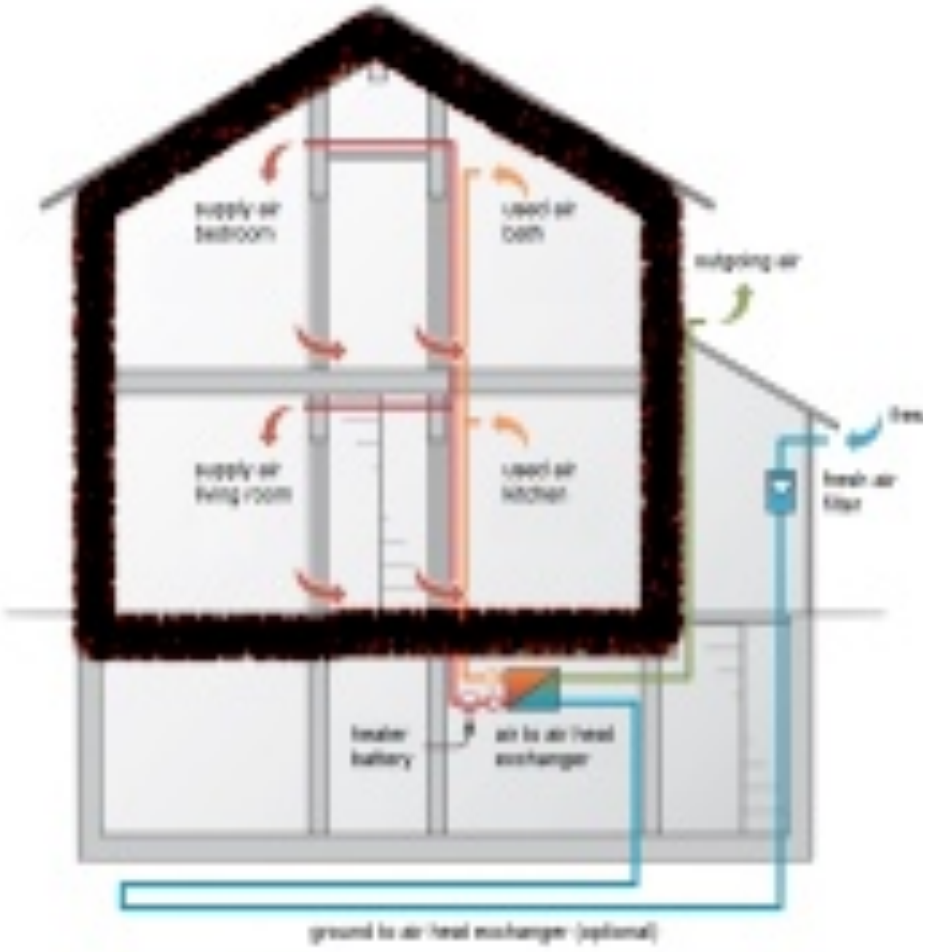
Roof

Floors

Windows

Doors.

Thermos flask approach, for both cold and warm climate conditions



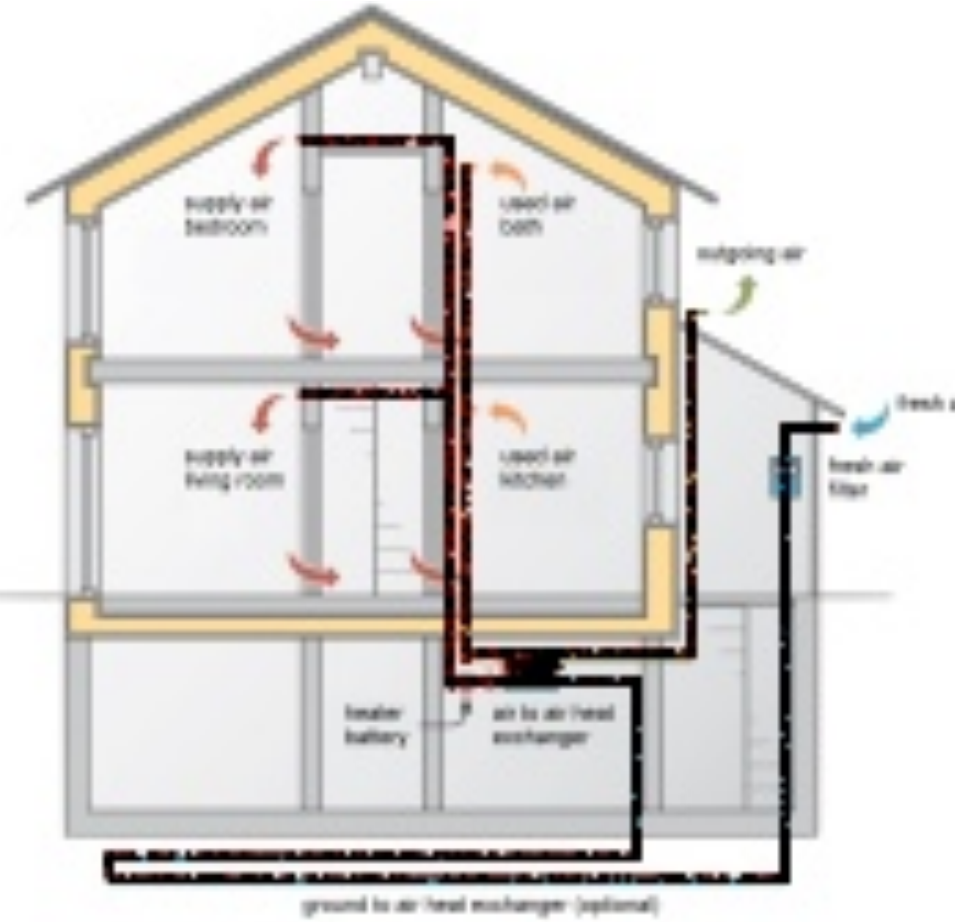
Typical components in an Active Passive House

Mechanical ventilation system with heat recovery provides clean and healthy air around the clock, eliminating the need to "air" the house manually.

Reduces bacteria spores, mould.

Improves air quality [improves air for Asthma sufferers etc]

Possible to develop a true passive house without MVHR is a greater challenge in colder climates

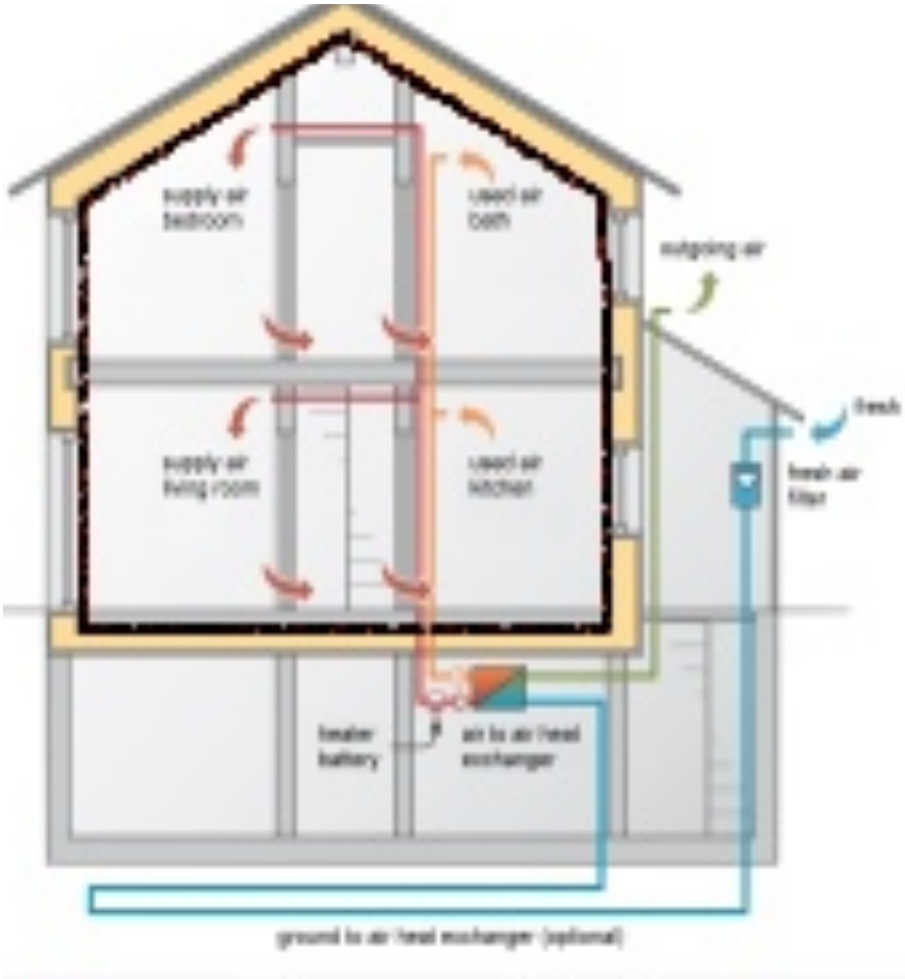


Typical components in Passive House

Draft-proof building via a vapour barrier with no air leakage between inside and outside.

Leakage causes draft and heat Transfer, alongside condensation within walls leading to mould and other damage to the structure.

Thermal bridging can be an issue on some designs where the building shell is not included with the foundation design



Typical components in Passive House

Building design according to solar gain principles:

Site specific, Orientation

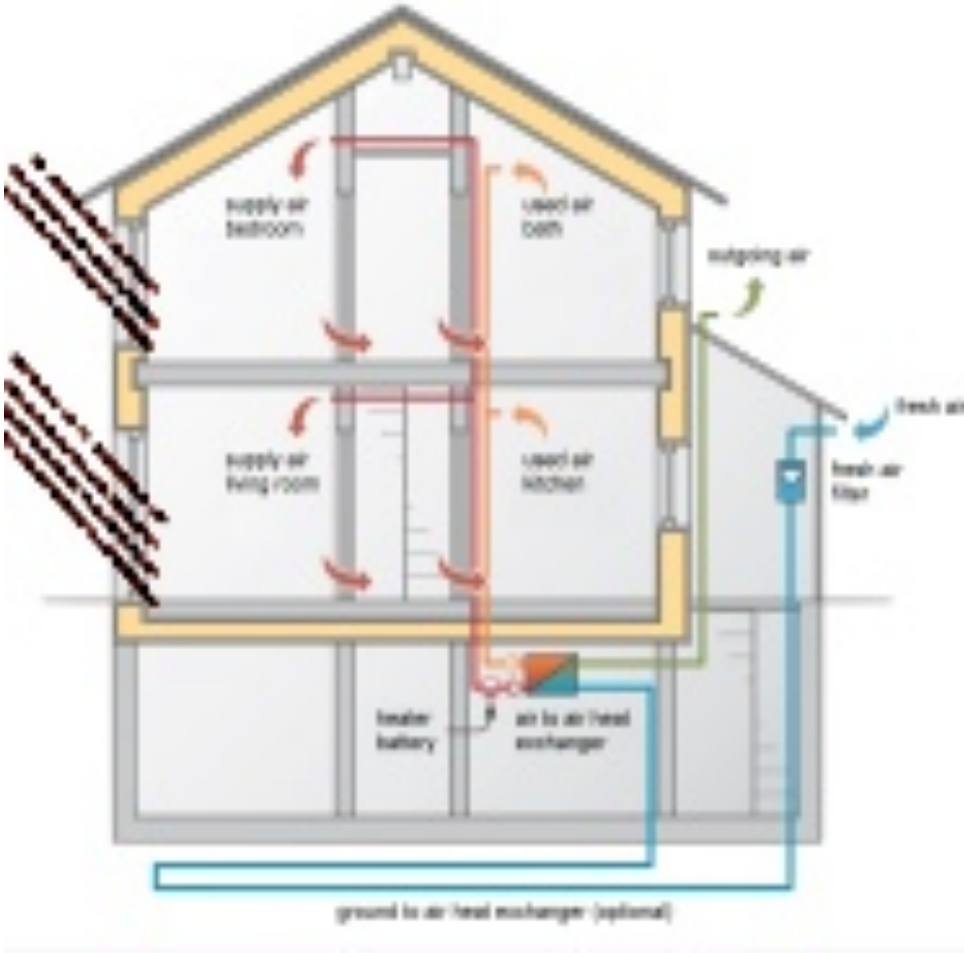
Large windows, south and west facing for cool climates north and east for warm.

Simple design

Preferably no dormers

Whole house heating

Open plan "family oriented" space, balanced heating.



The Passive House

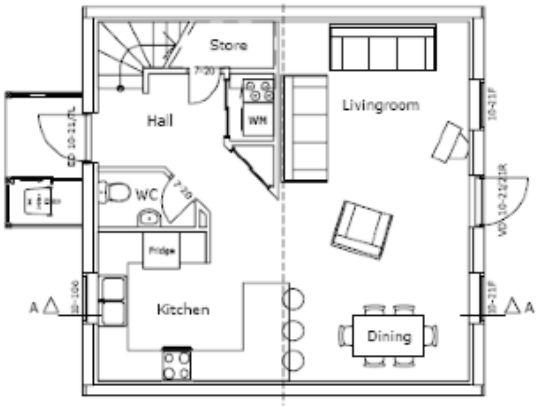
Made mostly of wood – eco-friendly and eco-nomical

The first fully offsite-manufactured Passive House in the world was built to Swedish standards in Ireland in 2002, in just 25 days!

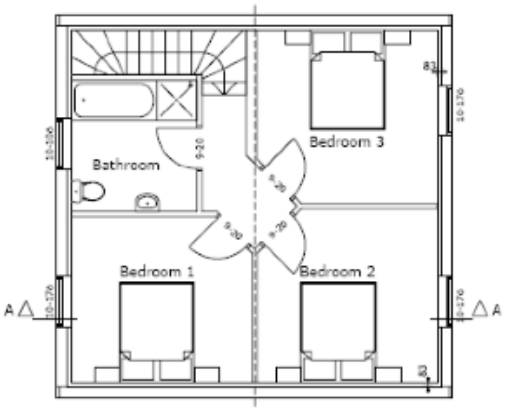
Simple do's and don'ts

- To get the best you can take a whole development approach, engage an entire team from the outset, align with the same ethos
- Decide to design Passive from the start its easier to rethink at design stage than to try and build in after
- Your suppliers are often the best source of help and knowledge
- Look out for conflicting data, i.e. window orientation and light requirements
- Be site specific, not all your homes can face south
- Eliminate complex designs, simplicity is key to balancing the house and balancing the cost
- Link wet areas, kitchen, bath and WC,
- Plan shortest pipe runs and insulate all pipes hot and cold including foul waste
- Use open plan where possible, without room specific heating to improve house flow and space for able and disabled residents

3 BR (90m2)



Ground Floor



First Floor

Ground floor: Entrance, recycle bins, kitchen, guest toilet, storage cupboard, dining and living rooms

First floor: three bedrooms, bathroom

Entrance View

Rear View

Simple do's and don'ts

- Design from the inside out use standard sizes i.e. tile so no waste of component or time
- Mix solar, heat recovery, PV, ground and air source to achieve best results
- Focus on thermal stability not thermal mass
- Build speed, if traditional type think of element exposure which can lock in moisture, building needs to be watertight as quickly as possible. Preference is towards offsite and panels.
- Don't forget the house starts with the foundation so make it thermal , and if building with timber panellised construction then load is much less, so simple ring beam can be used without sub-structure in most cases.
- Ensure the homes are designed for the able and disabled (Lifetime)
- Include a utility room / cpd for heat recovery and wet appliances i.e. washing machine, dryer etc. Appliances should be AA rated.

Terrace of 3 88m2 with upstairs converted,
Floorarea 88+50 = 138m2/unit
Passive specification, peakheat <15W/m2 (1.8kW/unit)
Super Passive specification, peakheat <10W/m2 (1.3kW/unit)

Simple do's and don'ts

- Homes can be finished externally in a variety of ways, sliced brick, timber, weather boarding , render etc but most do not need more than render to finish and other cladding is for decoration only.
- Build to a sustainable and environmentally friendly method check materials for energy consumption pre, during and post construction
- Time of construction, if small infill sites quicker erection means less disruption for existing residents and may be easier to get planning permission. Also allows quicker sales or rental stream
- Look at wall thickness, what is most beneficial to achieve the correct levels you need, does a particular material increase your footprint and or increase your window size.
- A 15kWh passive wall can be as thin as 215mm and a 10kWh can be as thin as 335mm.

NAO and the Callcutt Review

The recent NOA report "Homebuilding: Measuring Construction Performance" recommends that performance measures should be comprehensive and cover

- **business efficiency**
- **quality of the building**
- **environmental performance and,**
- **customer satisfaction**
- **This is a theme also emphasised by the Callcutt Review of House Building Delivery.**

So in conclusion, why do it

- It reduces energy consumption
- It reduces carbon consumption , pre, build and post.
- It can make use of more sustainable and effective materials
- It speeds up housing delivery
- It enables high standards of "liveability"
- It reduces resource consumption
- It will deliver new green jobs
- And if you use the offsite method then it is increasingly regarded as a means of improving quality, reducing time spent on site, improving on-site safety and overcoming skills shortages in the construction of housing.

- Oh, and did I say that it costs no more than traditional masonry construction

Day 1: Preparing to apply under-floor insulation

Day 4: Prefabricated panels are lowered into place

Day 6: Installing roof insulation

Day 55: Complete; No defects

The Scale of the Refurbishment Challenge

21 million	The number of homes that exist today will still be with us in 2050
7 million	The government target for whole house conversions to be treated by 2020 and all 26m by 2030. **(=13,000/week)**
£160	The amount spent per household on energy efficiency since 2002(EEC/CERT).
£1,534	The average amount spent per household on alterations, improvements & repairs in 2008
£1,239	The average amount spent on energy in 2008
£22,750	The average spent on refurbishment by Generation Homes project aiming at 60% reduction
£150,000	The amount the Technology Strategy Board has recently budgeted per house for its *Retrofit for the Future* challenge.

energy technologies institute