

Delivering Zero Carbon Homes in Rural Areas

Gina Yuzbasioglu, BRE
on behalf of the Energy Saving Trust

Lightening tour!

- Code for Sustainable Homes
- Zero carbon trajectories
- Practical implementation for deliveries
- Assistance for LAs and RSLs

Why should we care about energy efficiency and zero carbon?

- Climate change is happening
- Latest scientific evidence shows

Positive proof of global warming.



**18th
Century**

1900

1950

1970

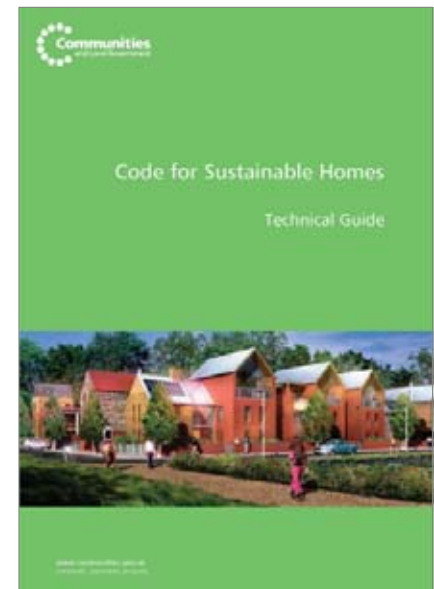
1980

1990

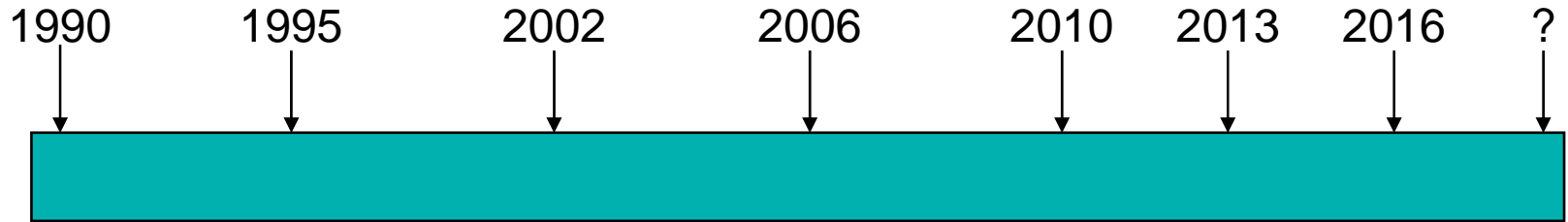
2006

Code for Sustainable Homes

- On 13 December 2006, - a new national standard for sustainable design and construction of new homes was launched
 - Concerned only with new homes



Context and timeline



1990

20% improvement over 1985 regs

Standard Assessment Procedure is accepted as an alternative way of demonstrating compliance

EcoHomes first introduced

1995

25% improvement over 1990 regs

Elemental, calculation and energy use methods

Elemental trade offs allowed

2002

20% improvement over 1995 regs

Elemental, Target U-value and Carbon Index methods

SAP required to be produced

2006

20% improvement over 2002 regs

Approved document split L1A and L1B

TER/DER assessment

Increased low-energy lighting and quality of workmanship and airtightness req.

Energy Performance Certificates

2010

25% improvement over 2006 regs

CSH level 3

2013

44% improvement over 2006 regs

CSH level 4

2016

Circa 149% improvement
CSH level 6

?

Stop press!

- Government announced on 27th Feb that rating against the Code will be mandatory from May 1st 2008

How it works

- The Code for Sustainable Homes is a set of sustainable design principles covering performance in nine categories:
 - Energy and CO₂ emissions
 - Water consumption
 - Materials
 - Surface water run-off
 - Waste
 - Pollution
 - Health & well-being
 - Management
 - Ecology

Mandatory standards

CSH Level	Min Energy performance above Regs	Daily Potable Water Consumption
1 *	10%	120
2 **	18%	120
3 ***	25%	105
4 ****	44%	105
5 *****	100%	80
6 *****	Zero Carbon	80

All Levels..

- Materials

- Surface water Run-off

- Household Waste Storage

- Site Waste Management

Assessment

- Assessors / BRE / DCLG
- Registering a housing Site
- Performing Code Assessments
 - Design Stage assessment
 - Post Construction Review
- Certifying

What is zero carbon?

- The **level 5** definition of zero carbon means that a dwelling must emit no carbon dioxide from heating/cooling, hot water, ventilation and lighting.
- The **level 6** definition calls itself 'true zero carbon'. It is zero carbon in use or with occupancy. It requires provision of renewable energy for all the level 5 requirements mentioned above and in addition takes into account energy use from cooking and all appliances

Challenges and Debates

- What denotes a true zero carbon source of energy ?
- On-site renewable generation or private wire off-site generation
- Cannot be approached in isolation, sustainable lifestyles / sustainable communities are important

How the Code relates to Planning

- Integration into planning guidelines
- Potential replacement for 10% renewables requirements?
- Promotes sustainable development – not ‘quick fixes’
- Technical guidance available from the best practice programme

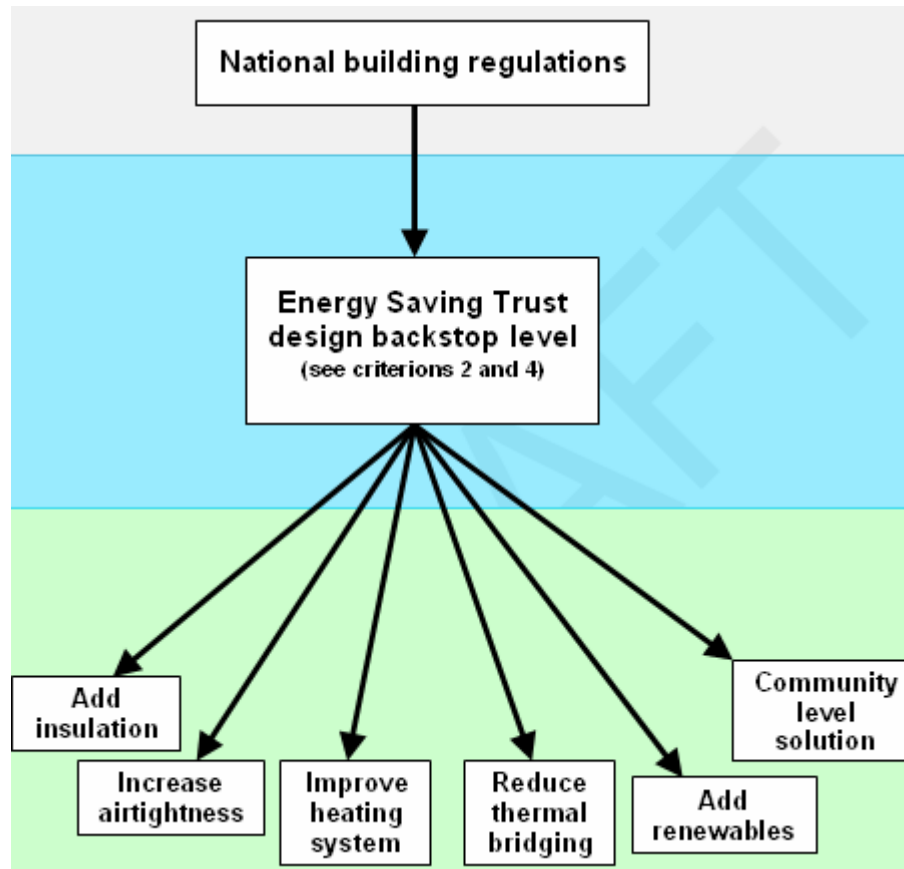


- A suite of three publications, designed to guide the design process
- For developers, specifiers & architects
- Give detailed technical guidance on ENE1, plus extensive scenario modelling to illustrate compliance strategies

Energy hierarchy

- Deal with the fabric envelope first
 - Insulation
 - Air-tightness
 - Thermal bridging
- Then add renewables

The process



Worth saying twice!

- Fabric first
- Then renewables

Why?

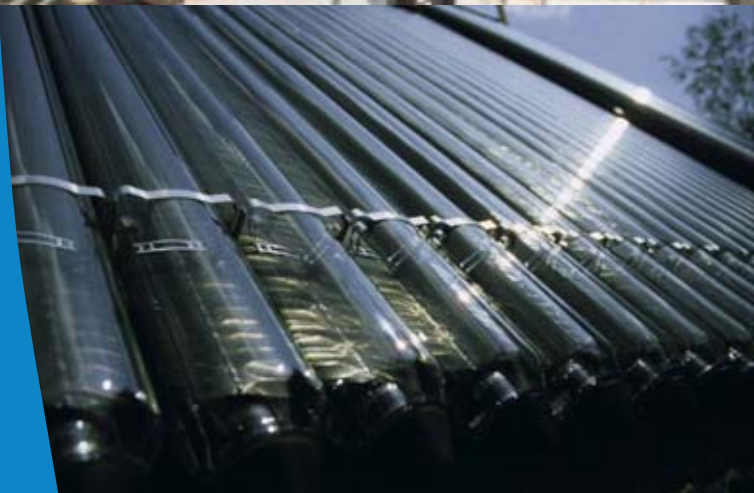
- 3 reasons
- Future-proofing
- It's the cheaper option
- It reduces waste of valuable resources (manufacturing, maintenance, battery storage, etc.)

Design backstops

Aspect		National building regulations	Energy Saving Trust Code level 4 guidance	Energy Saving Trust Code level 5+6 guidance
Opaque elements W/m ² .K (area weight ed average)	Roof	0.25	0.13	0.13
	Walls	0.35	0.20	0.15
	Exposed floors	0.25	0.20	0.15
Windows and doors W/m ² .K (area weighted average)		2.2	Windows must achieve a BFRC rating in band B or better. Doors should achieve U-values better than 1.5 if glazed, or 1.0 if solid.	Windows must achieve a BFRC rating in band A or better. Doors should achieve U-values better than 1.5 if glazed, or 1.0 if solid.
Air permeability		10	3	3
Thermal bridging		Accredited construction details (y=0.08)	Energy Saving Trust Enhanced construction details (y=0.04)	Energy Saving Trust Enhanced construction details (y=0.04)

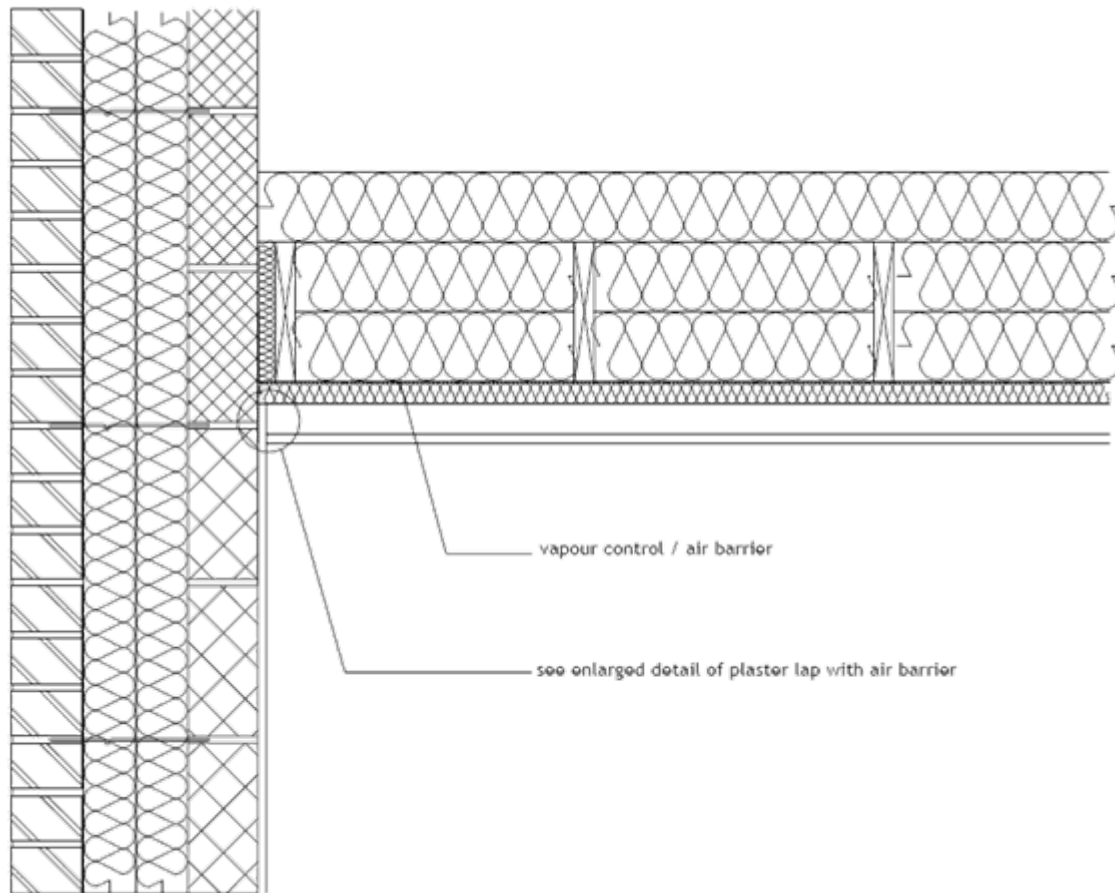
Low & zero carbon technologies

- Solar hot water, heat pumps, PVs etc.



EST enhanced construction details

- A standard set of “off the shelf” details
- Reduce thermal bridging to half current levels
- Industry consultation and agreement
- Released this April via EST website



Masonry Version 01 - 150mm Full Fill

- Use EST Enhanced Details for the 3 key junctions
- Use standard Accredited Details for the rest
- $Y=0.04 >$ twice as good as Accredited Details alone

Appendix Q

- A mechanism to incorporate innovative new technologies directly into SAP
- Provides a level playing field
- Simple spreadsheet based calculation to find savings
- A key tool for achieving Code compliance



Special Features (SAP Appendix Q)

Officially sanctioned data only

Description:

	kWh/year	Fuel
Energy saved or generated:	<input type="text" value="350"/>	<input type="text" value="Standard tariff"/>
Additional energy used:	<input type="text" value="0"/>	<input type="text" value="Standard tariff"/>

SAP 2005 = A 109 (108.77) DER = -14.76 kg/n

Enter the resulting CO ₂ emission per m ² here:	<input type="text"/>	Box 012
Energy saved (kWh), to be entered in box (95)	Box 013	<input type="text" value="0"/>
Additional energy consumed (kWh), to be entered in box (96)	Box 014	<input type="text" value="0"/>
Step 5 : Re-enter 0.00 into SAP calculator as the air permeability at 50 Pa		
Enter 0 in box (95) and 0 in box (96)		
For box (95) and box (96) the fuel is electricity		
The CO ₂ emissions from the SAP calculation now incorporate savings from the tested MVHR unit		

Step 1: Improve insulation – for Code level 3

Walls	from 0.30	to 0.25	W/m ² K
Roof	from 0.16	to 0.13	W/m ² K
Floor	from 0.22	to 0.20	W/m ² K
Windows	from 1.8	to 1.5	W/m ² K
Doors	from 2.0	to 1.0	W/m ² K

Step 2: Improve Airtightness

- Building regulations target of 7
- Dropping to an airtightness of 3 is equivalent to doubling the thickness of insulation in the walls
- Significant cost savings over further insulation
- Realistic target

Part L 2010	5
Holland	6
Sweden	3
Germany	1.8 to 3.8
Super E (Canada)	1.5

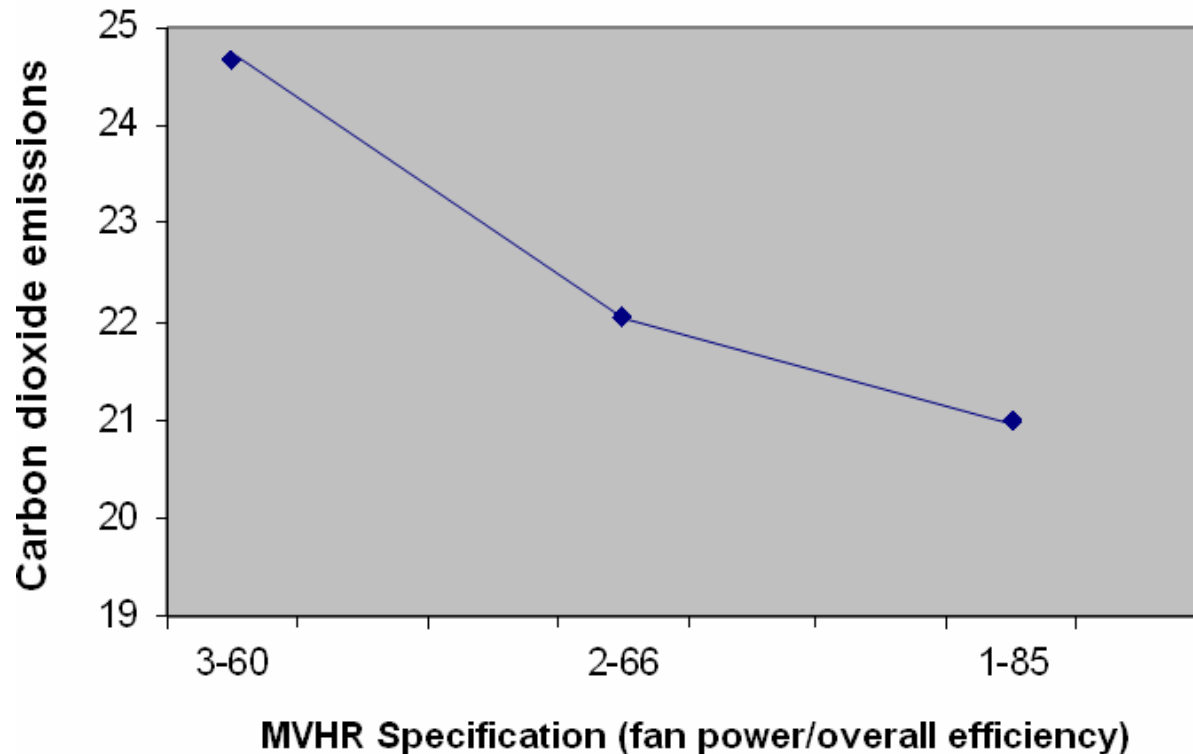
Airtightness

- Realistic levels of airtightness
- Achieve HLP requirements
- Dedicated guidance available

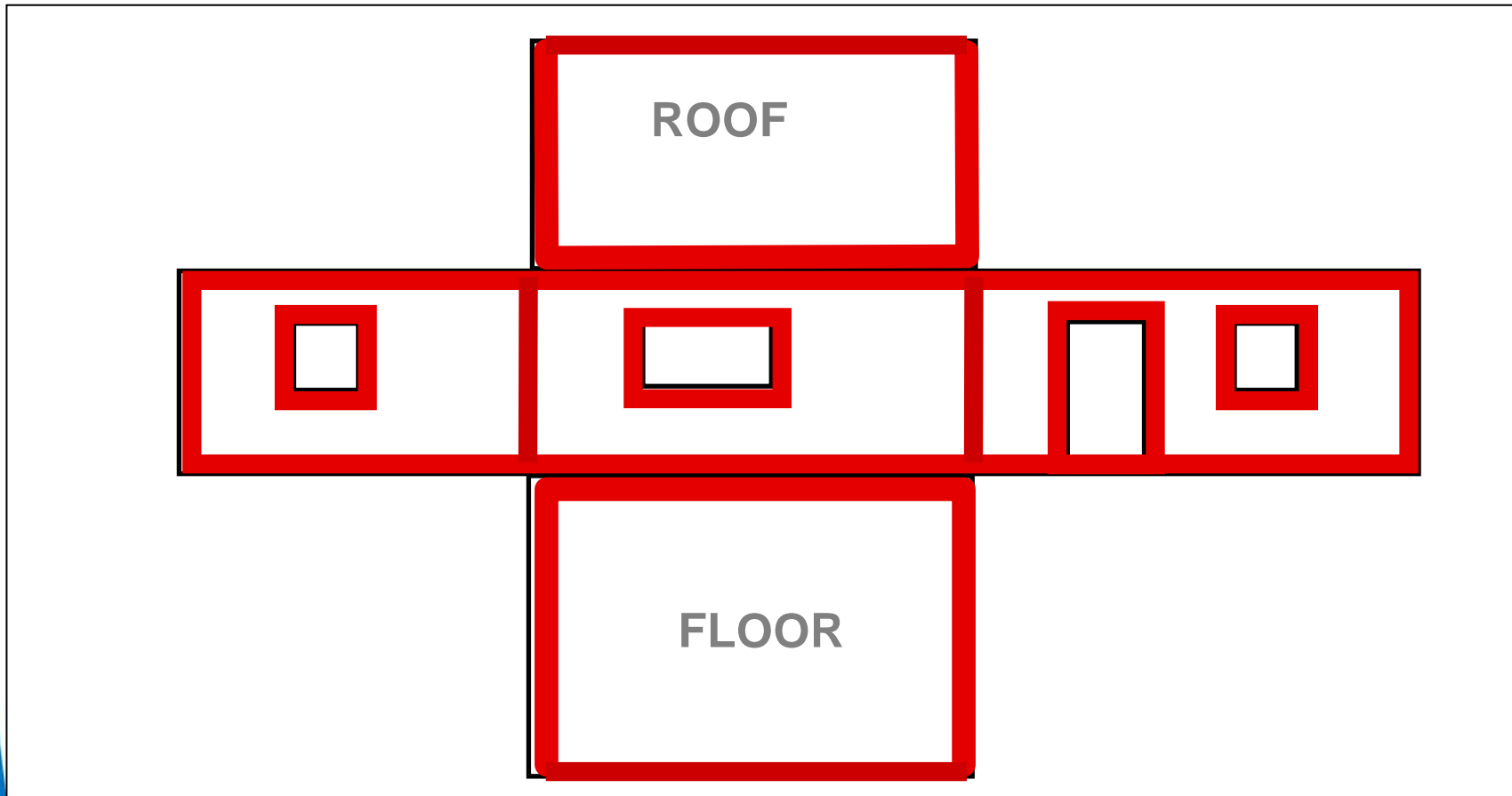


Step 3: Introduce Heat Recovery

Improvements in U-values against MVHR specification
(at airtightness $3\text{m}^3/\text{hr}/\text{m}^2$)



Step 4: Reduce thermal bridging



Going forward – 2013 – Passivhaus?

- European voluntary standard, between CSH Level 4 - 5
- **www.Passivhaus.org.uk** managed by BRE
- Typical U-values 0.15 (opaque), 0.8 (windows)
- Airtight - 1.0 m³/m²hr @ 50Pa
- Efficient MVHR (80%)
- Minimal thermal bridging
- Attention to solar layout
- 15kWh/m²yr space heating demand
- 120kWh/m²yr total primary energy use
- Usually a 'post-heater' is sufficient, with solar DHW

Which one is the Passivhaus?



Passivhaus is an energy standard, not a design style



Just one country girl's opinion



www.energysavingtrust.org.uk/housing

- Hockerton Housing Association



Assess your advantages and disadvantages

- When planning a site take an integrated approach from the VERY beginning
- Start thinking about zero carbon with a blank canvas – or even better before you choose the site

What do you have in rural areas?



Solar Fields

- Relatively New Concept
- First Scheme 1988
- Around 20 schemes
 - Scandinavia
- No Fuel Cost
- Huge space requirement
- Local Solar Resource

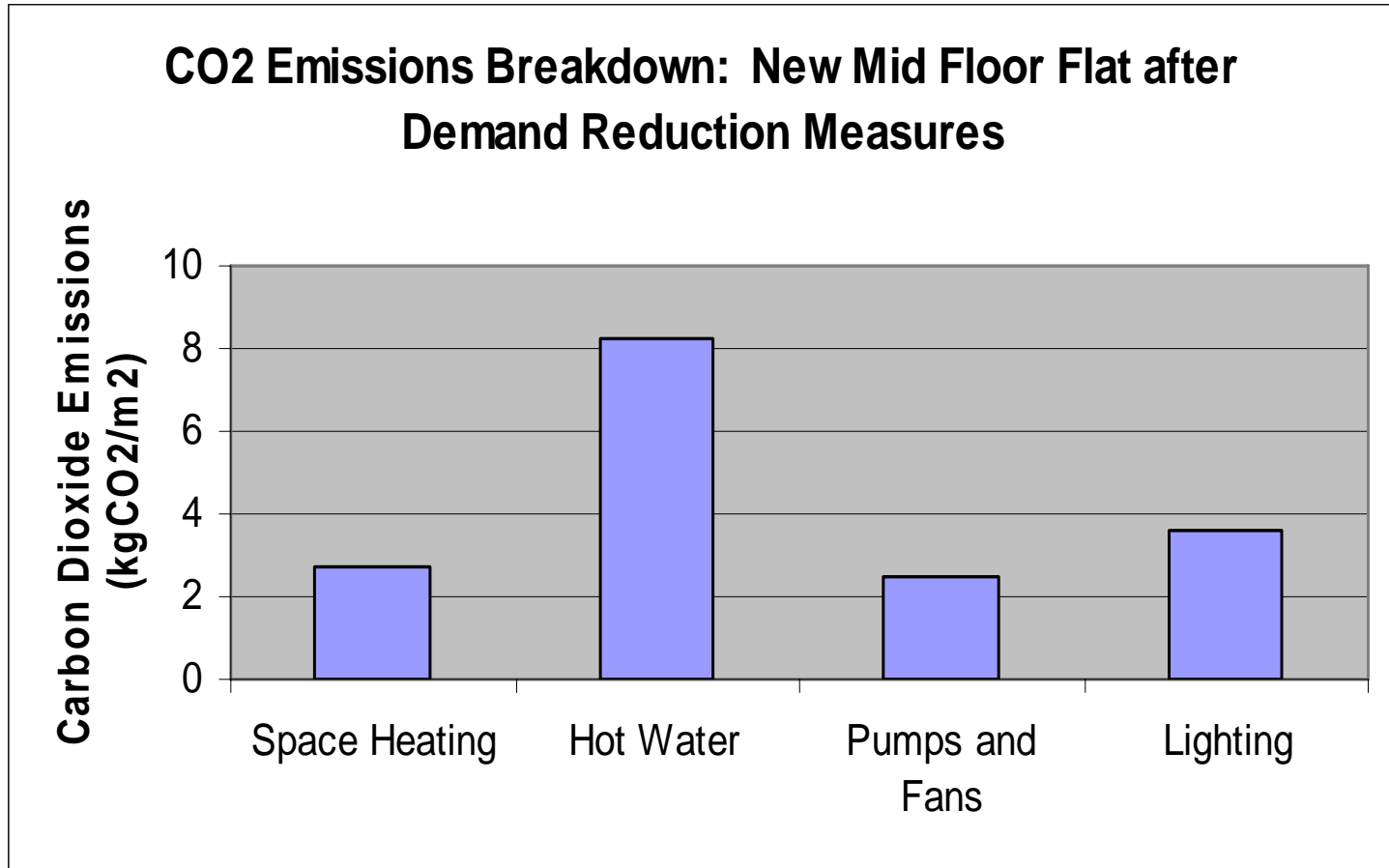


Picture source: ARCON/ESTIF

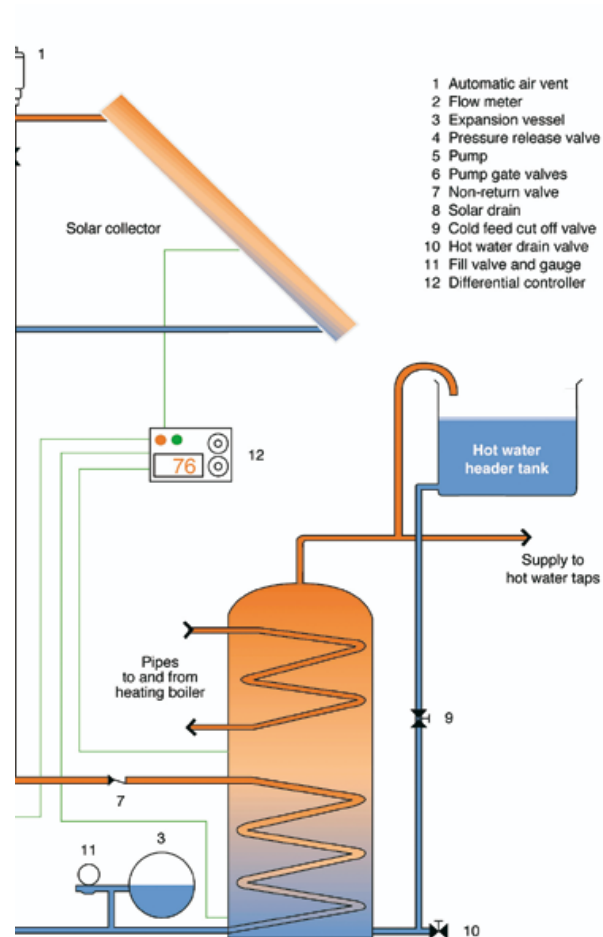
Understanding the limitations of district heating

- Understanding the heat load of future housing
 - no heat load > no need for district heating
- Alternative fuels and technologies
- The effect of density on the capital costs
- Short pipework runs are cost-effective. Long runs (low density sites) are not

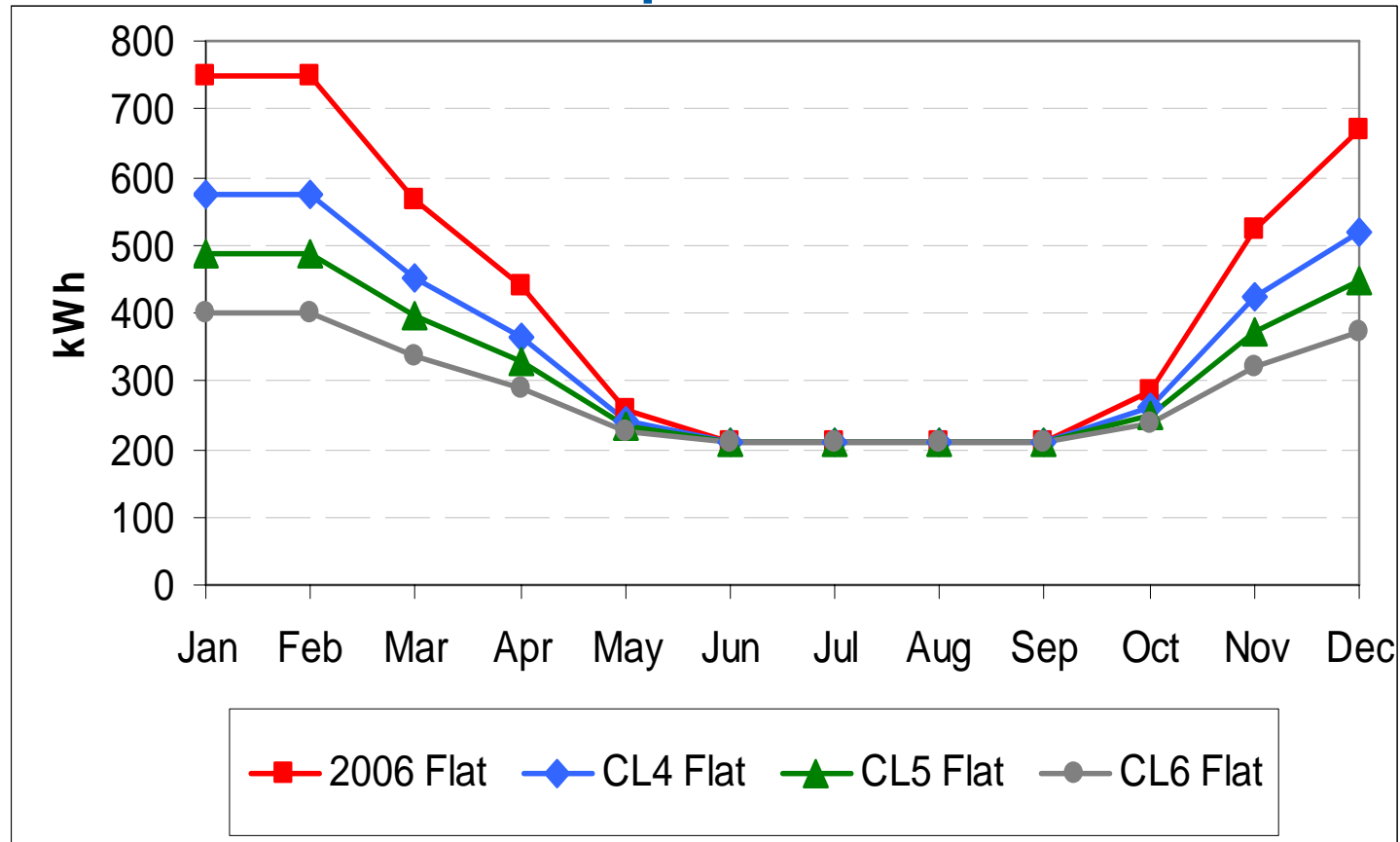
Flat after Demand Reduction Measures



Solar thermal hot water systems



The Changing Shape of heat demand profiles



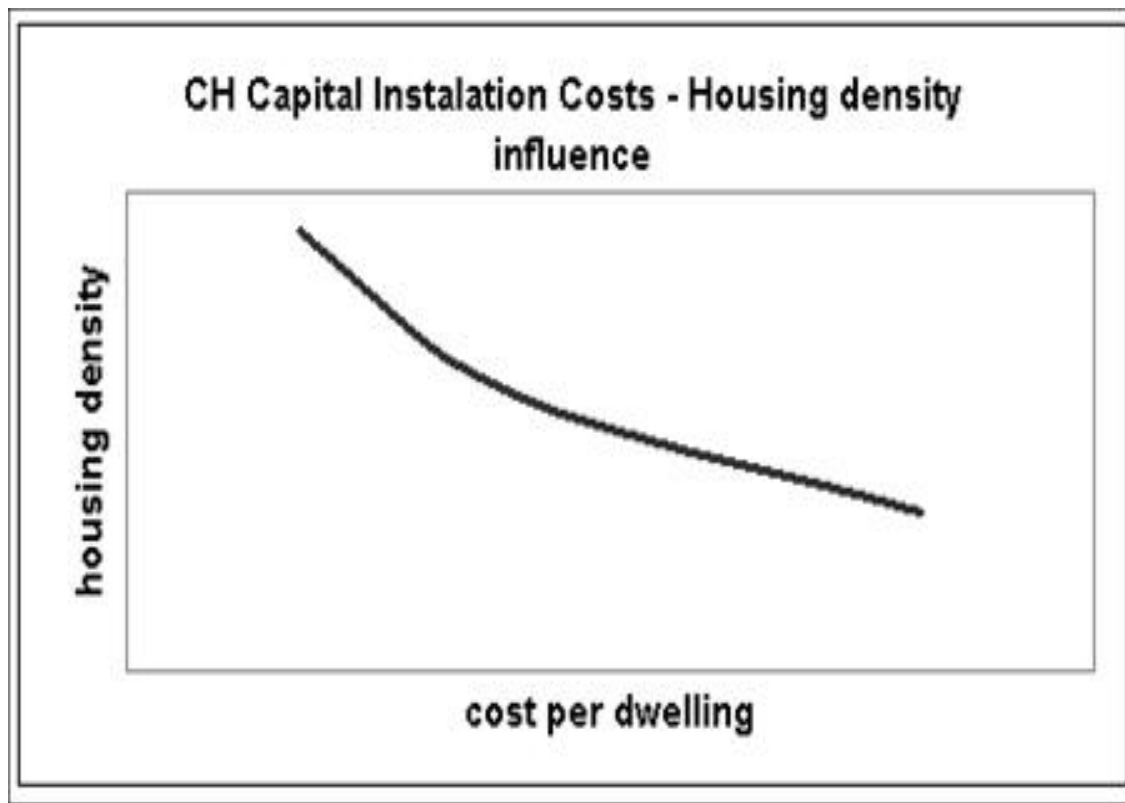
Wood Gas CHP being trialled in Wick

- New wood gasification technology
- Jenbacher gas engine
- How will it perform?
 - Only time will tell



BUT... Heat Networks are capital intensive

- Capital Cost depends on density
 - The higher the density the better



And

- You must have a balanced load
 - Leisure facilities
 - Hospitals
 - Care homes

District Heating for New Houses

- Scandinavian Countries have led on this
- Some examples in UK
 - Heol Gelynen
- Possible with Higher Costs
- Zero carbon the objective
 - wouldn't consider otherwise
- Building Integrated can be expensive



What about wind power?

- Good supply at times of high heat load means worth thinking about ground source heat pumps which are powered by electricity
- Can be the most cost effective way of powering (and maybe heating) a site

Small scale wind turbines

Good wind speed

Little turbulence

Little visual impact

Low noise

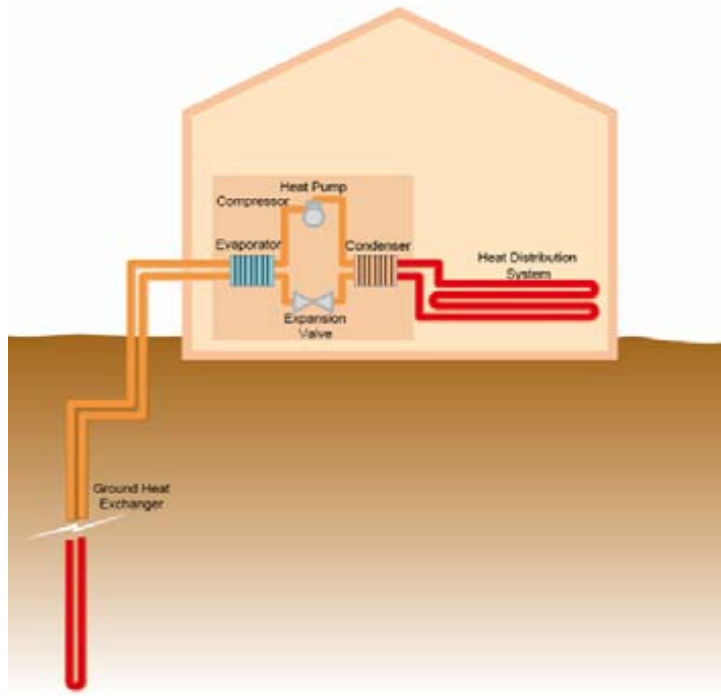
CE70 Renewable
energy sources
in rural environments





1,2,3,5,8,13,21,34





Community approach

- Look beyond your immediate housing needs
- Partnerships – CHP with hospitals etc., site development close by, ESCOs
- Think about transport issues, buses, minibuses, car sharing schemes
- Change hearts and minds
- Look at examples of transition towns (Totnes)
- Hold community workshops
- Doctors' waiting rooms – leaflets, magazines

To summarise

- Assess your advantages
- Assess your disadvantages
- Work with your individual circumstances
- Energy efficiency before renewables
- Choose a renewable strategy appropriate to your site
- An integrated approach/partnerships
- Build strong communities

Where can we find examples of zero carbon?

- Carbon Challenge – 10 sites, 2 released
 - Hanham Hall Bristol
 - Peterborough
- New Build Outreach
- EST Guidance

Newbuild Outreach programme

- Target audience of house builders & developers of new build housing
 - Strategic & Technical Support
 - Monitoring & Evaluation Support
 - Marketing & Promotion Support
 - Honest Broker/Supply Chain & Product Development
- Developers can access a maximum of 2 services on real projects
- Current partners include InSpace, Berkeley Homes and Osborne (Raven Housing Trust)

Advice/training

Free training events:

- Air tightness workshops
- Part L for beginners
- Sustainable energy for planners
- Supporting local training events
- Working in partnership with industry

EST and the Innovation Park

- The Innovation Park at BRE in Watford is a showcase for innovative technologies and demonstration buildings
- Technical assistance provided through EST meant that Osborne Homes could achieve a 40% improvement over Part L1a 2006 building regulations
- EST has since provided support for three other developers on the site Kingspan, EcoTech, Stewart Milne
- The EST information posters on the site inform visitors of best practice guidance and the principles, technologies and approaches which can be used in minimising the impact of new housing on climate change



Refurbishment Outreach and consultancy

- Houses already built today will make up 2/3 housing stock in 2050
- An essential element of the UK's CO₂ reduction strategy
- A fragmented industry – private/social/domestic stakeholders

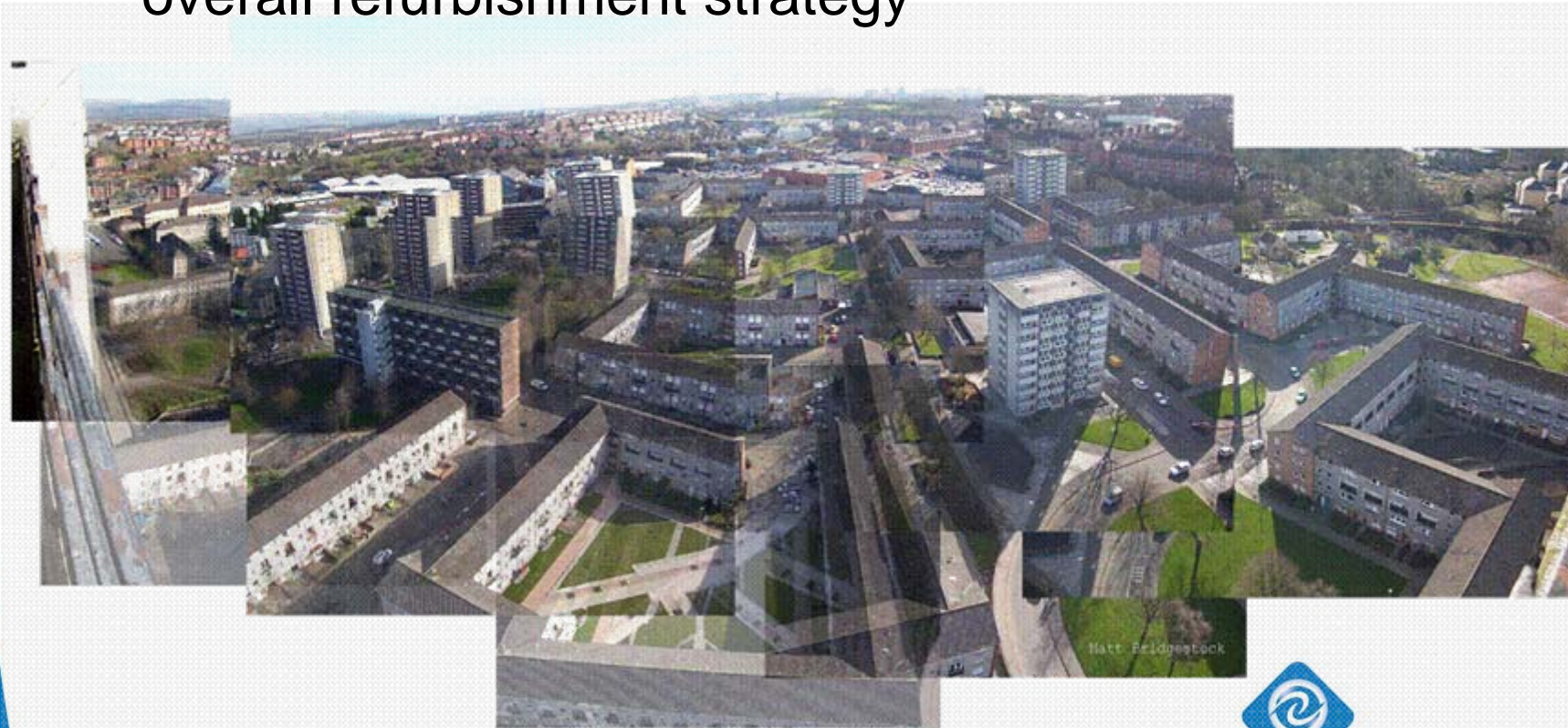
BRE Stable block

- ‘Hard to treat’ Victorian build with a wide selection of common problems
- Partnership with 9 other stakeholders
- EST working with partners to deliver three exemplar refurbishments to Code level 3 (previously best practice standard)



Cube Housing Association Glasgow

- 2000 social dwellings in a very deprived area
- EST working with stakeholders helping to deliver an overall refurbishment strategy



Mears Group

social housing maintenance

- Maintains ~20% of the UK's social housing stock
- Partnership with Travis Perkins
- Best practice working with partners to deliver flexible, real world costed eco refurbishment packages

EST currently offers

- Practical guides
 - 90+ publications freely available as hardcopy/download pdf



- Practical because industry involved and feedback through consultation process
- Recently developed new guidance for Code Levels 3, 4, 5&6

EST currently offers

- Website and online tools
 - Housing tool and whole house boiler sizing wizard
 - New website coming end February – will enable easier navigation and interaction
 - All publications accessible via website



- Helpline – **0845 120 7799**
 - All enquiries, technical or otherwise, are answered within three working days

Refurbishment Outreach

- Houses already built today will make up 2/3 housing stock in 2050
- An essential element of the UK's CO₂ reduction strategy
- A fragmented industry – private/social/domestic stakeholders

Assistance for Local Authorities

- practical help enquiry line on **0870 241 2089**
- Free enquiries service – 3 day response
- Up to 3 days in-house consultancy including presentations
- Top tips



energy saving trust™

www.energysavingtrust.org.uk