Module 7

Achieving climate change mitigation and adaptation in small scale development

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Housekeeping

- Fire alarms
- Assembly points
- Toilets

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Aims and agenda

- Aim of the course is to provide an understanding of...

"...the principles of sustainable and climate adapted design and retrofitting as it applies to small scale development"

1. Designing sustainability
2. Challenges with small scale developments
3. Code for Sustainable Homes
4. Assessing developments
5. Refurbishments
6. Sources of further information

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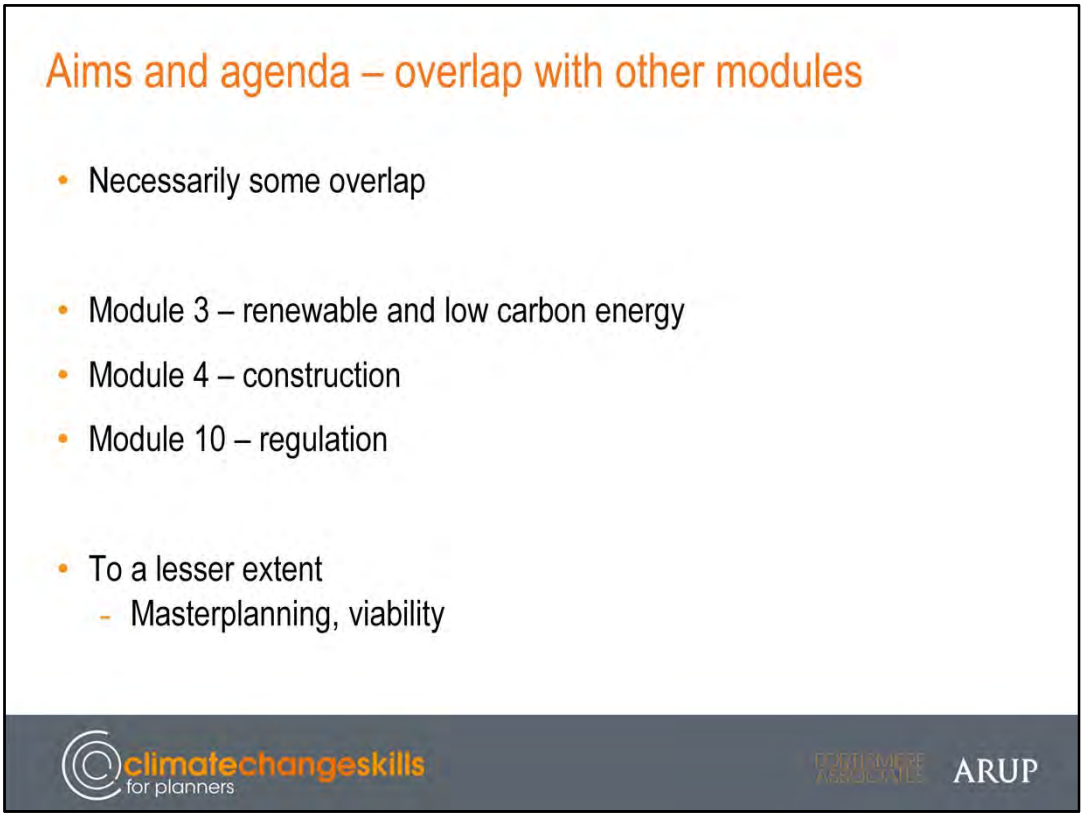

What we're not going to cover in too much depth as it's in elsewhere.

Will cover some of these aspects but will focus specifically on small scale developments

Quick opening discussion

- What are your experiences of implementing climate change planning policies for smaller applications
- What questions do you hope the module will answer?

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Session 1

Designing Sustainability

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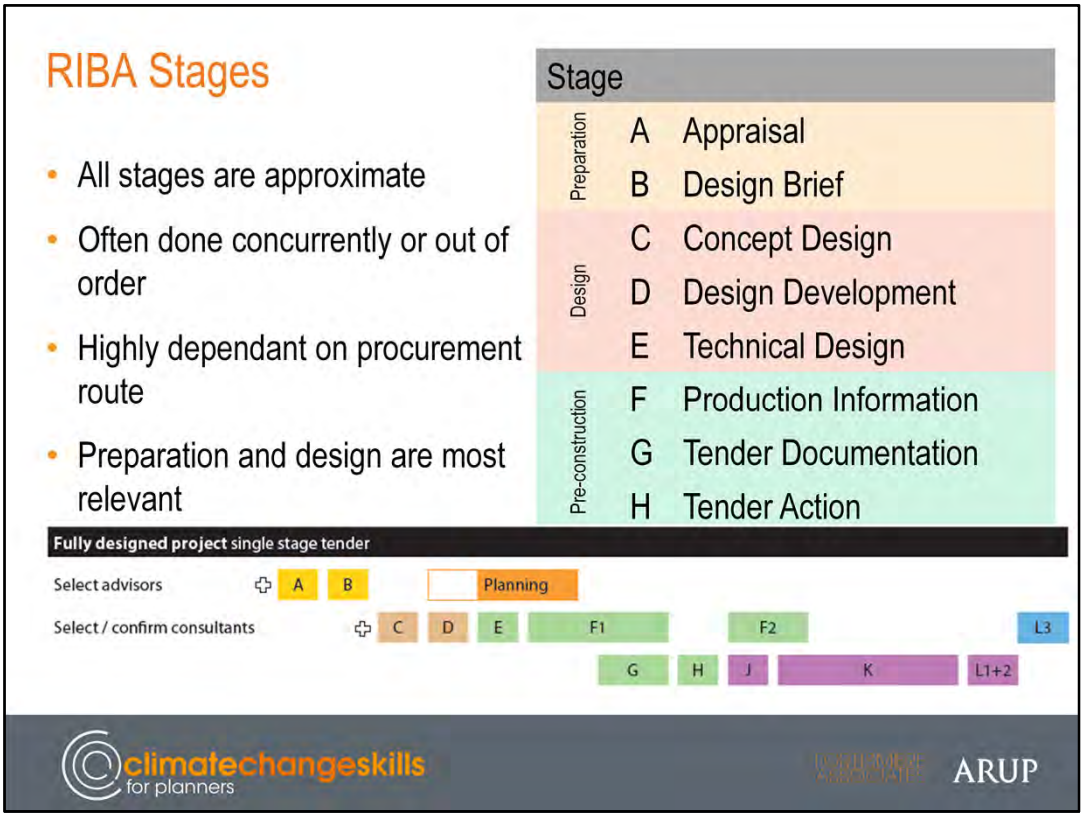
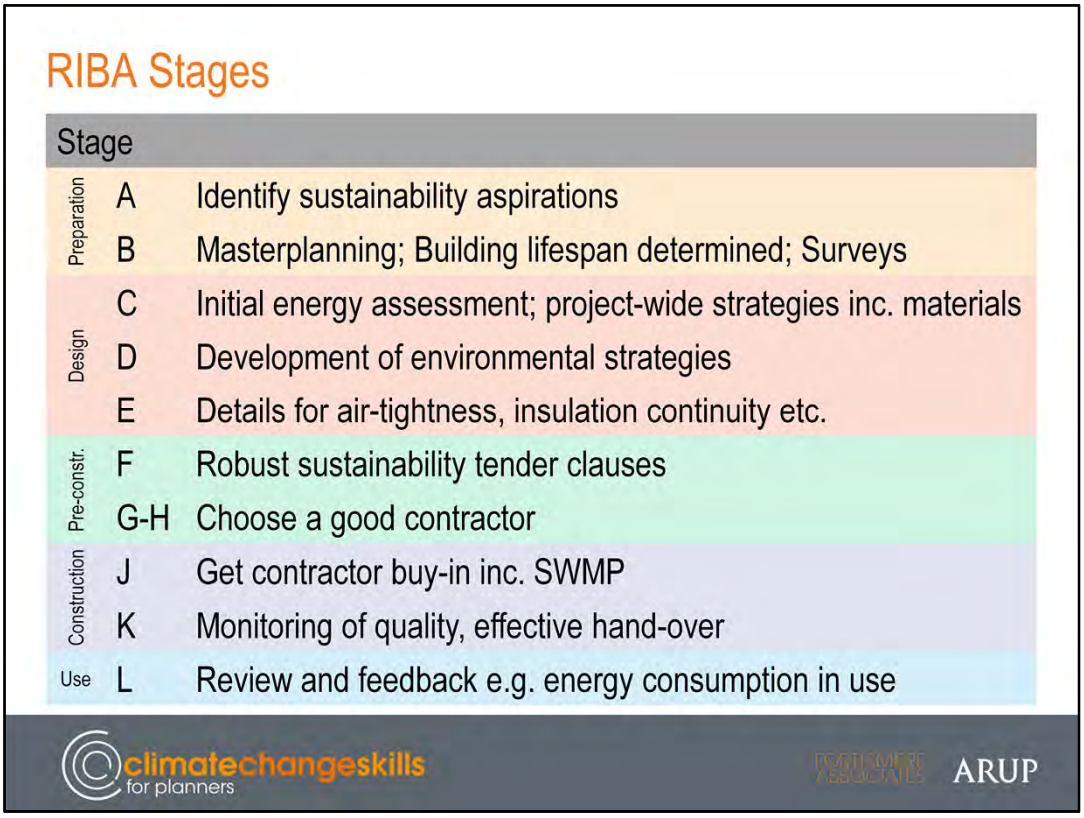
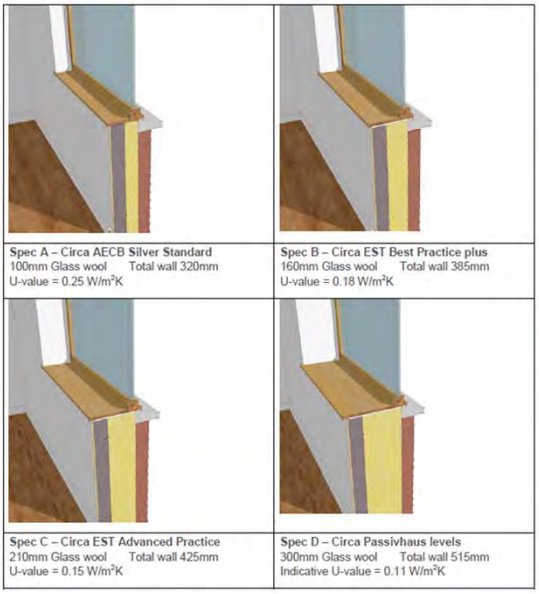


Design teams think of design in terms of relating to the RIBA Stages.
There are many versions depending on complex procurement routes but the classic version is the single stage tender. Line between consultants and contractors are blurred on smaller jobs
Source: RIBA Plan of Works



B – lifespan impacts on adaptation
C – includes BREEAM or CSH assessment to define actions (if not at B). Also effect of major decisions on construction methods
D – is just developing what was decided in C so it's too late in a lot of respects
E – areas where lots of detail is required to ensure compliance of contractor. Also thermal bridging etc.
F – passing over of requirements to contractor
G – don't do this right and everything else might not have been worth anything!

Fabric First – Beyond Building Regs



	2010 Regs	2013 Regs	'Zero Carb.'
Walls	0.25	0.18	0.15
Roof	0.13	0.13	0.13
Floor	0.18	0.18	0.15
Windows	1.40	1.4	0.8
Air tightn.	10	3	3

Source: Zero Carbon Hub

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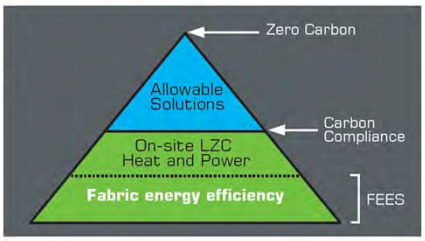
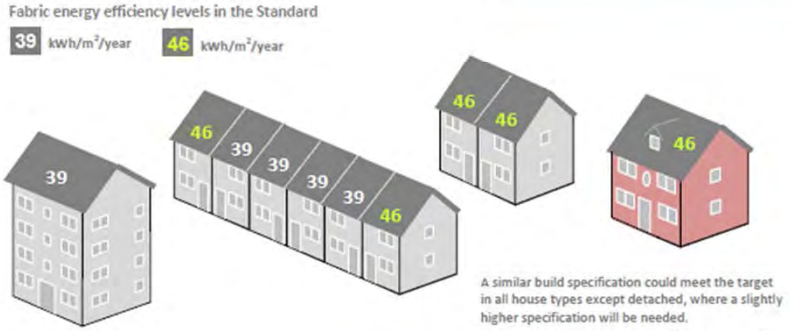
Building regs present the minimum standard
Walls are the major element that are affected by the increasing standards. Roofs are already pretty good. Floors can be improved with little impact on internal space.
Windows are just a matter of throwing more money at it.
Only adding about 50mm between 2010 and 2013 standards.
Walls of 0.15 are PassivHaus recommended levels

Building Regs 2013 for new-builds - FEES

- The forcing of passive design measures





Source: Zero Carbon Hub

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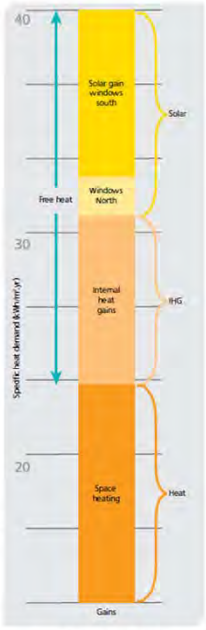
Air tightness is a mixture of detail design and construction quality
Start with the basics
Then move onto the detail
Check before things get buried
Planning – outline app can have the zones thought about. Detailed app should have drawings with the barrier line identified

Solar gain in domestic buildings

- More glazing on the South
- East-West axis so light/heat can penetrate
- 'Comfort' rooms on South (mainly lounge
  - For 'normal' buildings

'Late' heat W  E 'Early' heat

Source:passivedesign.org



Source: BRE PassivHaus Primer

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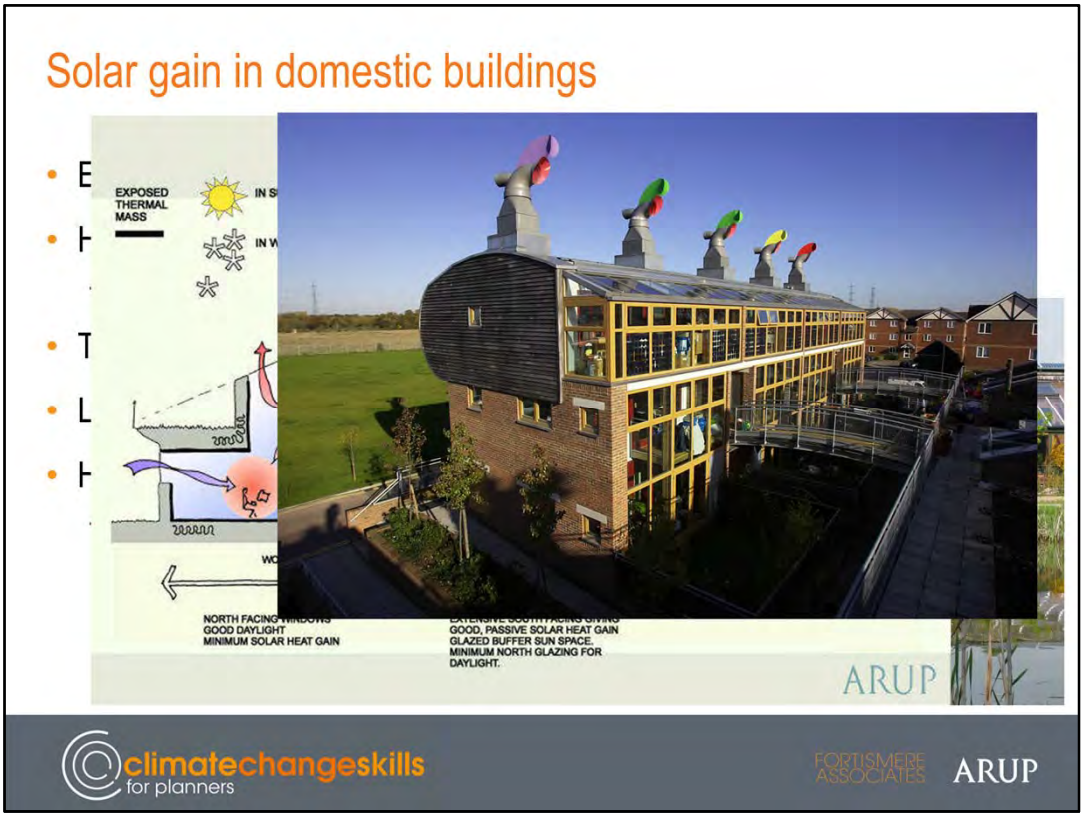
How to do it in normal buildings
Be careful about solar shading
Can be most of the heating!



Extreme examples of solar gain
Both using conservatories. Can see on bedzed bow sun won't penetrate living spaces.
Ddue to opaque roof and intermediate floor

Glazing

	Normal glass	One low emissivity coating		Two low emissivity coatings	
		Air	Gas	Air	gas
Double	2.5	1.8	1.6	1.8	1.6
Triple	2	1.5	1.3	1.2	1.0

- Effective thermal breaks in the frame can reduce U-values by a further 0.2

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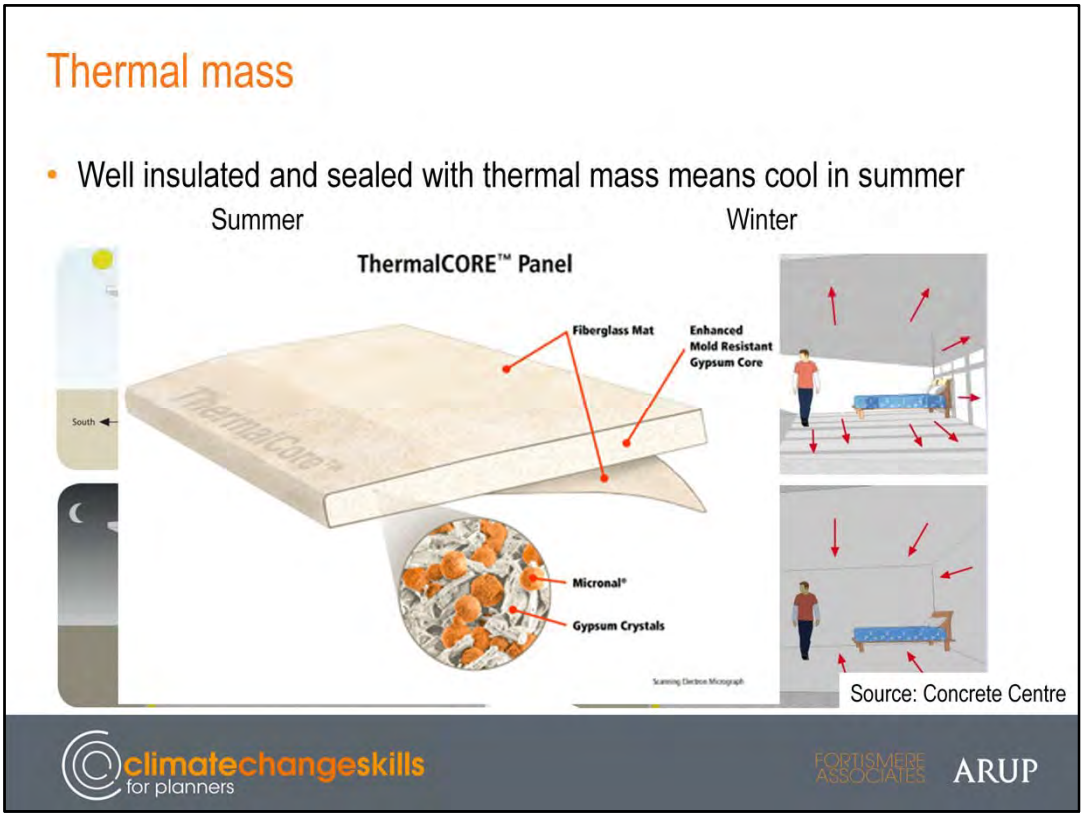
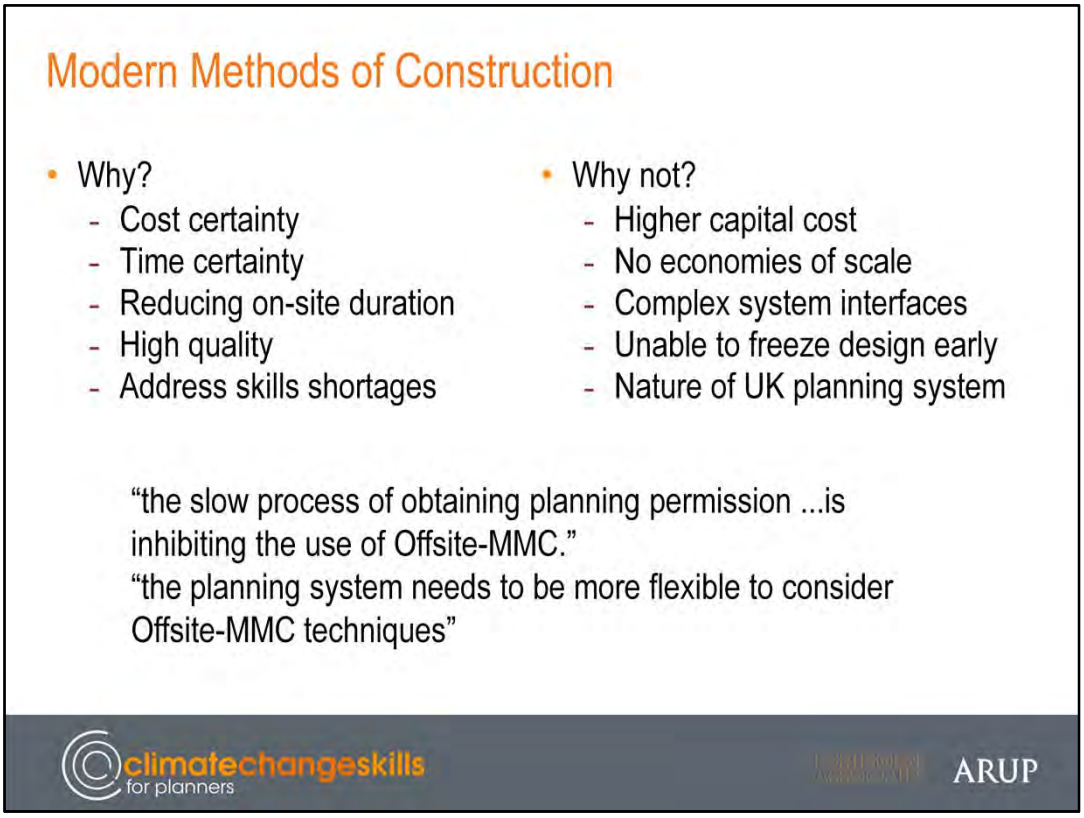
Blindly going for triple glazing isn't enough
There are lots of other factors



This is how it works. Reduced peaks. Lags not as effective as in non-domestic as evening peaks can be uncomfortable
Only 80-100mm of concrete is needed – don't need to make walls 3 feet thick
Could use phase change materials if you've got deep pockets
Are lightweight buildings a problem for the future – adaptation?



Various MMCs and their benefits with respect to the small developer
Do you need to be ordering 100 houses at a time?

Info from Offsite Modern Methods of Construction in Housebuilding Perspectives and Practices of Leading UK Housebuilders Wei Pan, Alistair Gibb & Andrew Dainty Loughborough University

2005 data but has anything really changed since then?

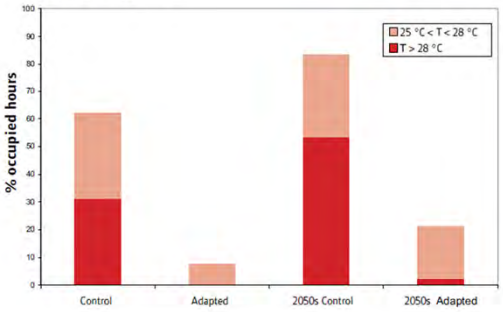
Climate change adaptation

Flooding Water Stress Overheating

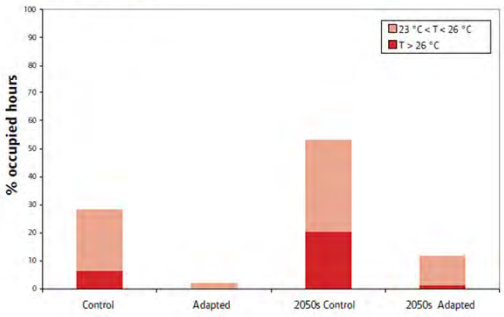
Adaptation Overheating Resilience

Measure	Measure	Cost
Check the Environment Agency Floc		Free
Register with Environment Agency f warning scheme	Measures which aid overheating only	Free

House Living Room



House Bedroom



Install waterproof membrane on ext	with low-e coatings.

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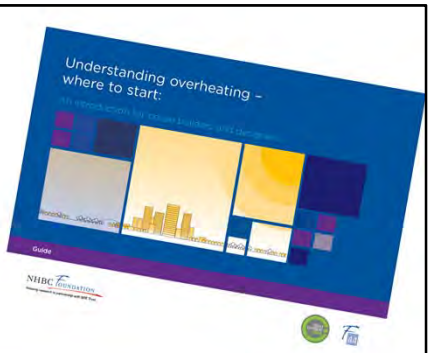
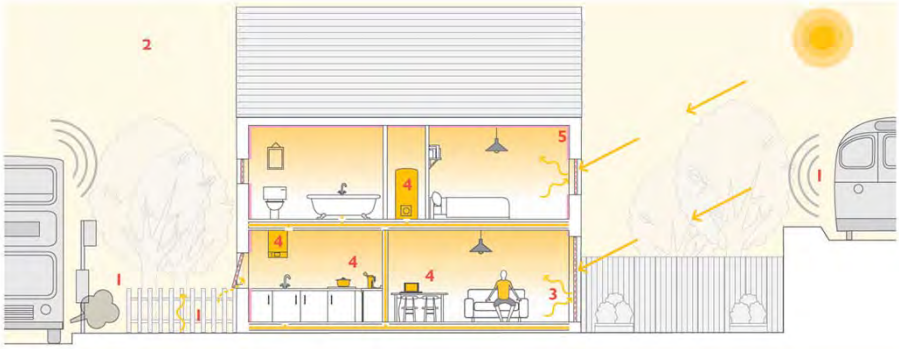
Climate change adaptation

1. Site Context
2. External Temperatures
3. Solar Gains
4. Internal Gains
5. Building Design





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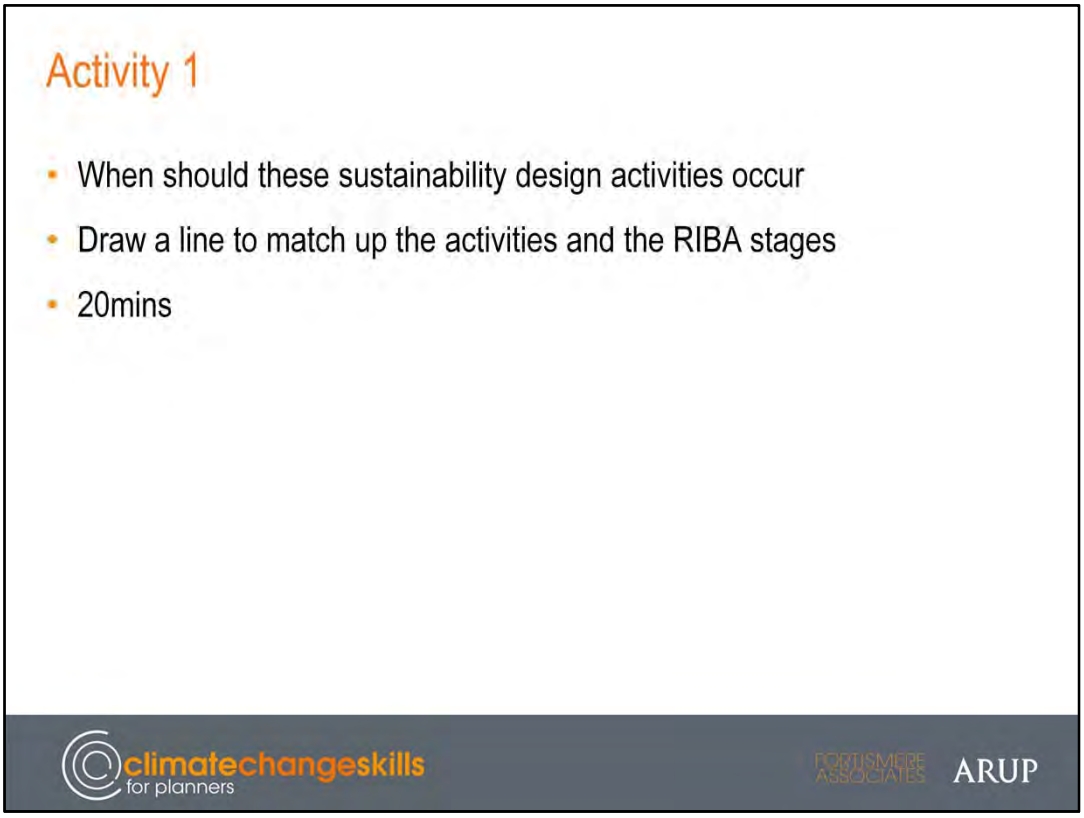

Each delegate group to get a set of small pieces of paper with sustainability related design activities printed on them and a blank RIBA Stage sheet.

Put the activities in the 'right' place.

Possibly also choose one activity that is most likely to either be carried out late so affecting the ability to influence the project or not carried out at all.

Session 2

Dealing with small scale developments

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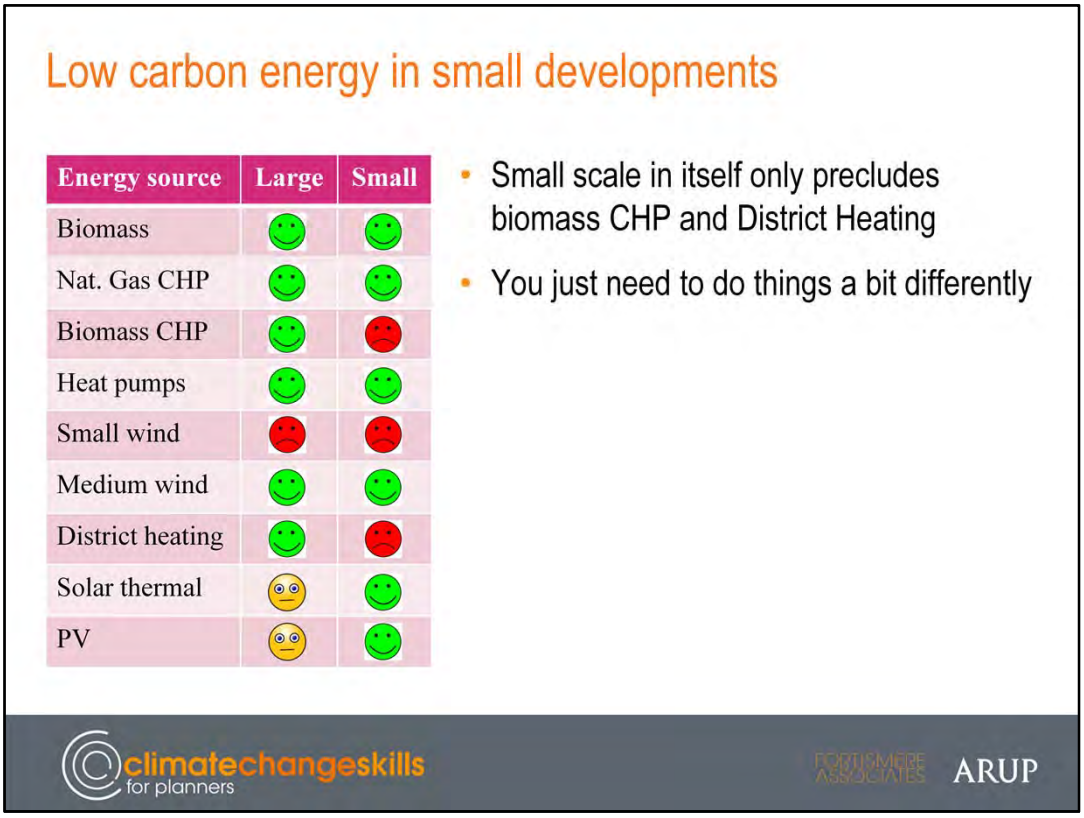

Small wind is useless nearly everywhere
Solar thermal and PV not so good on large developments as can't contribute very much of energy demand
Biomass CHP only good in Very Large Developments
Heat pumps are pretty scale independent and will be covered by another module on renewables so lets look at things that mimic the combi boiler Joe Public is used to.

Biomass

- How viable are they really?
- Can be bigger then an average boiler
- More expensive

Baxi Bioflo
12kW - £7k

Baxi MultiHeat
15kW - £4k

<£1,000

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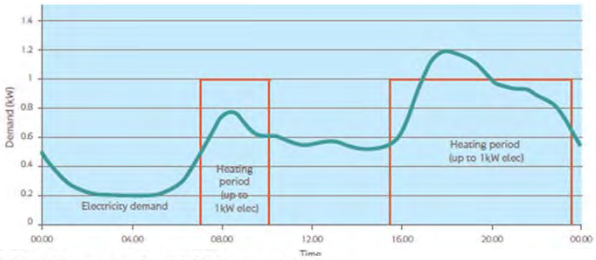
Or a wood burning stove would be fine in a well insulated new building

Comparable combi is ~£1,000

Micro CHP



- 24kW thermal, 1kW electric
- Graph implies 24kW thermal load for 8 hours (!)
- Heat lead
- ~£7,000

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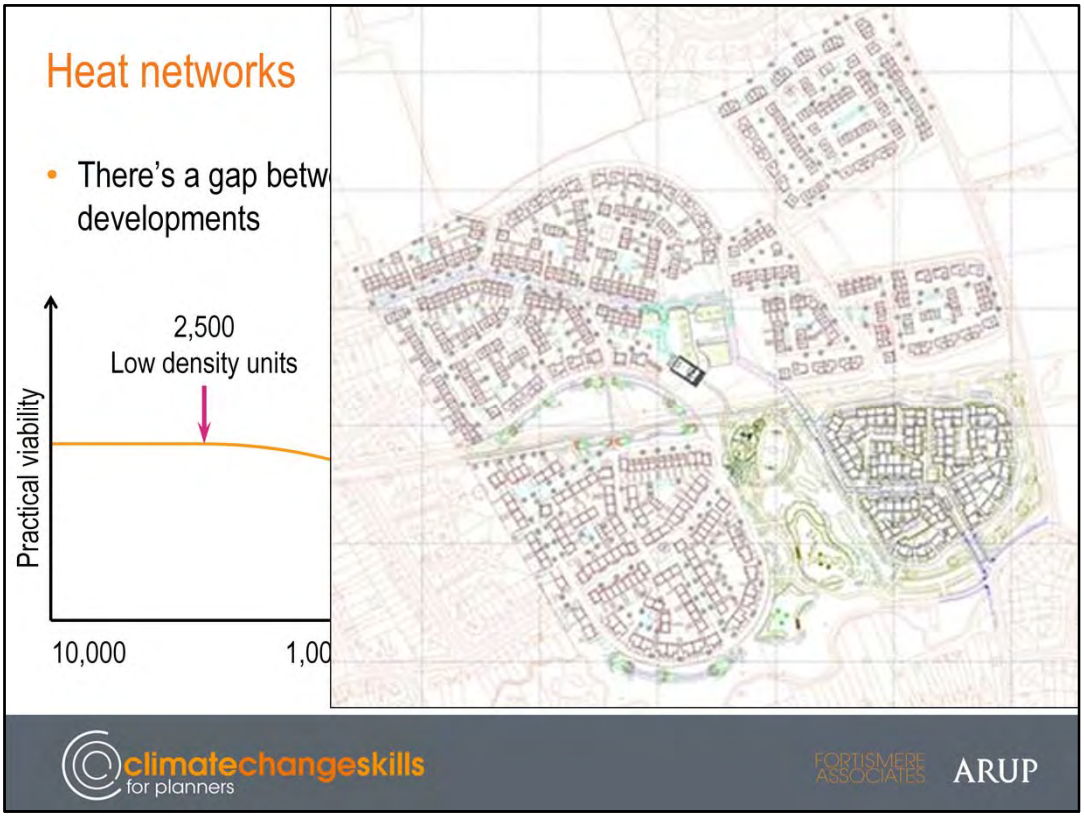
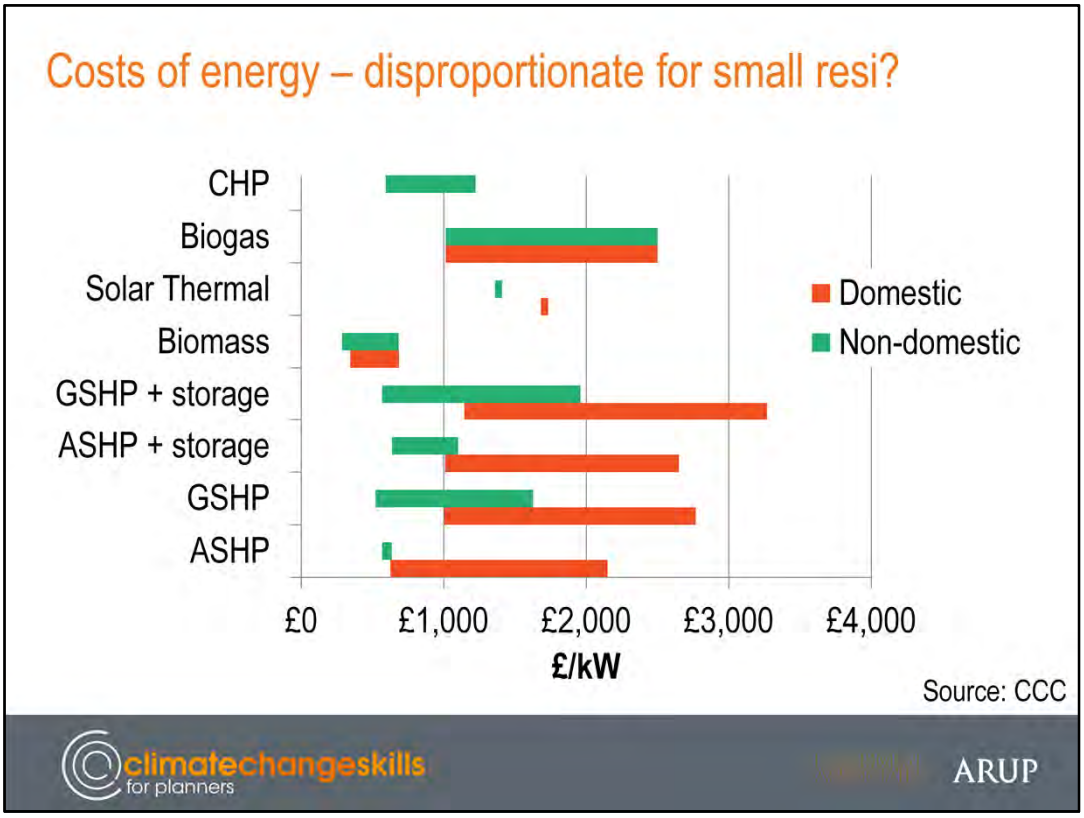
Manufacturer's data – use with caution
BAXI Ecogen
I'm not sponsored by BAXI – just thought having comparable products would help!



Low density – detached and semi-detached.

Commercially viable is the key. It's always technically viable to put one in but generally there's no point

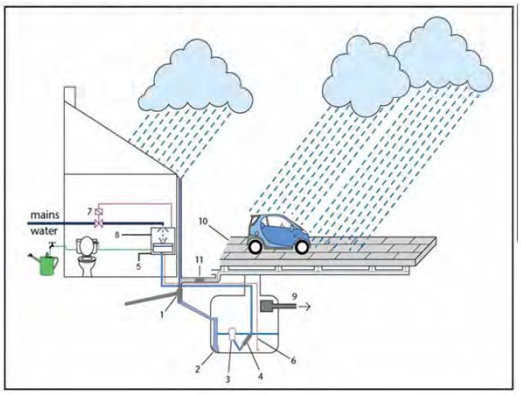
Example is Derwenthorpe with each phase of 64ish houses served by the central biomass plant. Only done because JRHF are particularly forward thinking



Source CCC 4th carbon budget report
£7k for 24kWth microCHP works out as £300
Can see that non-domestic is generally cheaper due to economies of scale
The non-domestic range probably corresponds to district heating of a large resi development

Water conservation

- Rainwater harvesting and low flow fittings are just as valid in small developments.
- Even on large scale developments, centralised systems are incredibly rare



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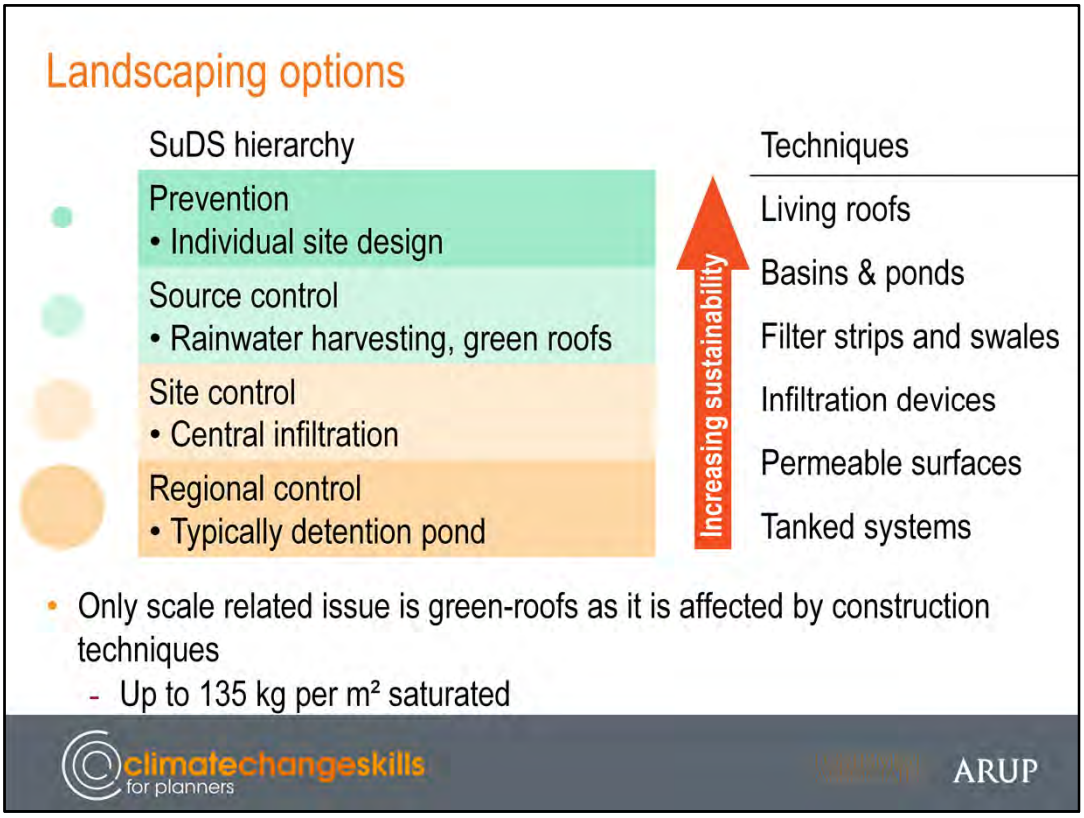
Source: Environment Agency

Digging a hole and popping a local tank in is almost always going to be more viable than the large infrastructure needed for a district-wide system. Also pumping losses



Sustainability source is environment agency. Hierarchy is DEFRA

Site design is key

Disproportionate cost of compliance

- CSH is done by house type
- Large developments – more of a given type
- Small developments – more individual
- More expensive per unit.

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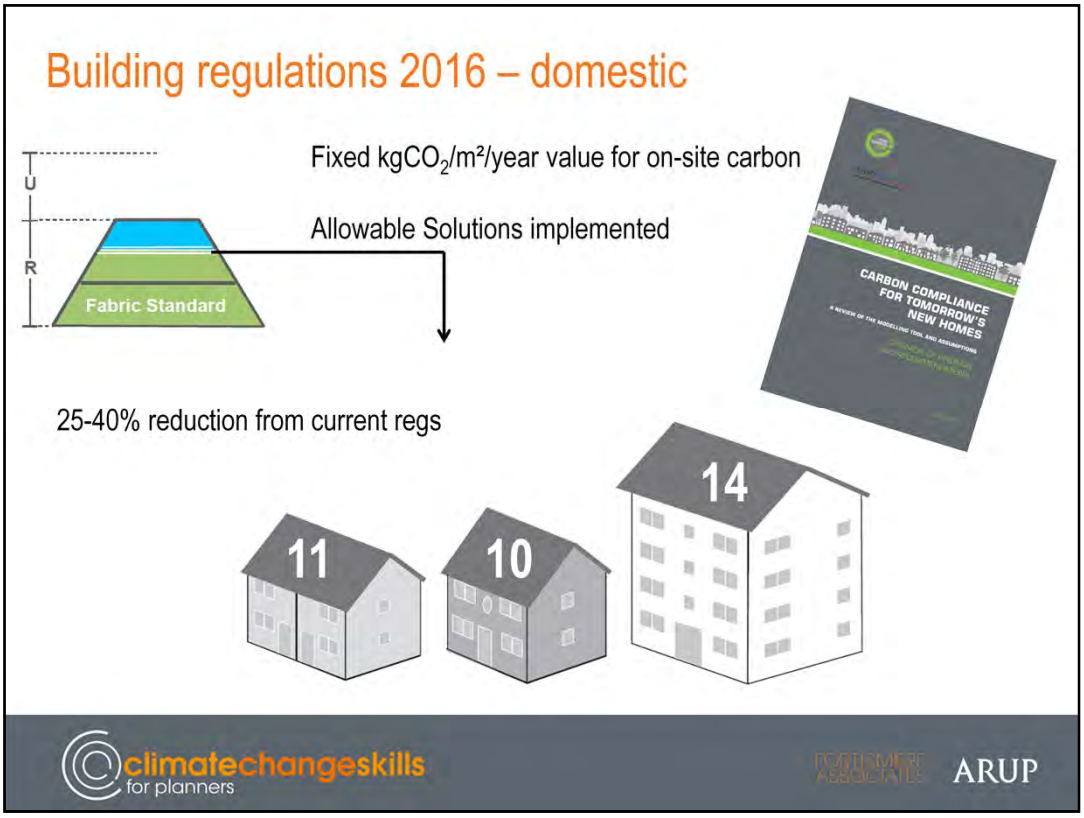
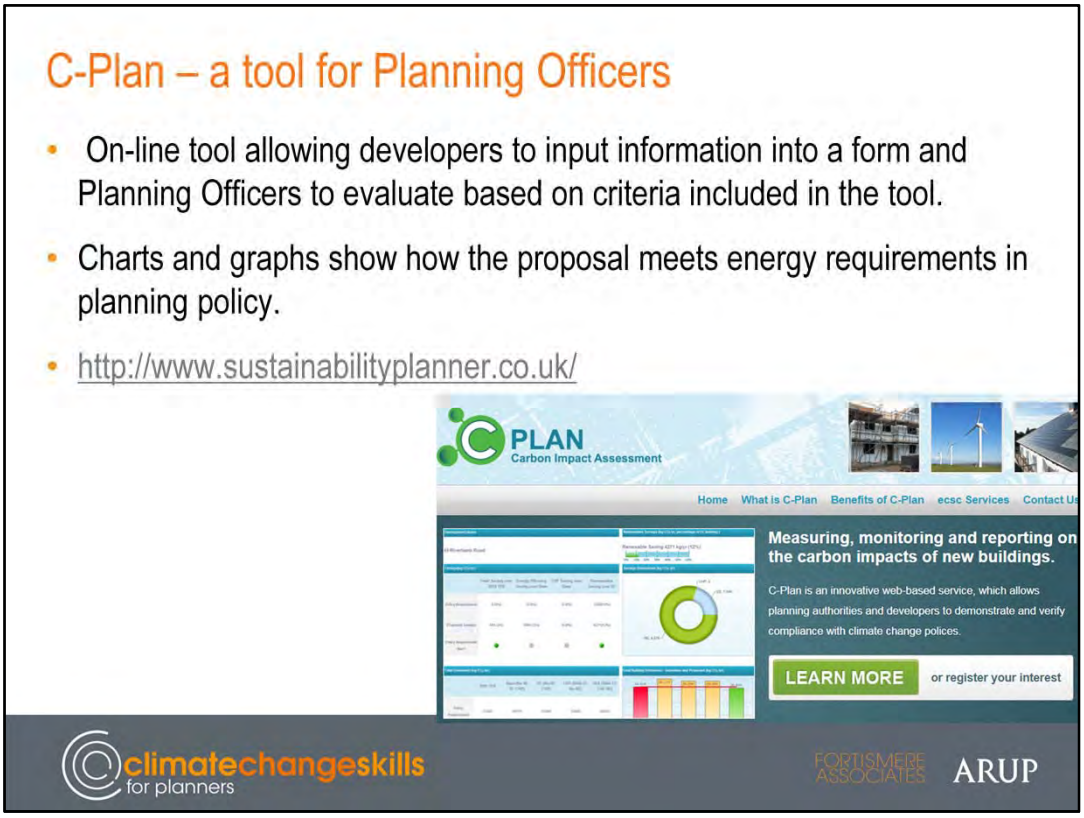
Smaller teams - lack of expertise?

- Is this where the issue really lies?
- Targets above Building Regs needs specialist expertise
  - Ecologist
  - Materials
  - Experienced energy assessor
  - M&E team for more complex builds



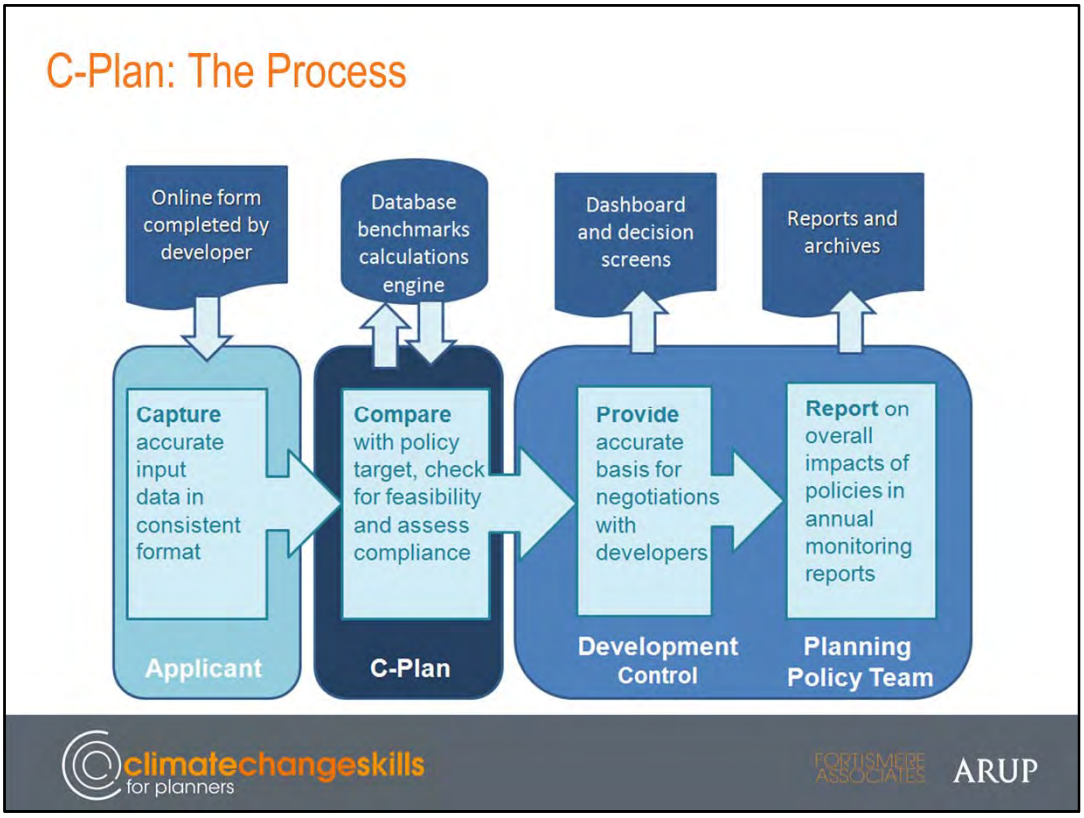
How the carbon compliance (on-site energy) levels might be set for 2016 regs
Anything above these requirements will be Allowable Solutions



Planning authorites that have issued consents with conditions requireing scheme to demonstrate compliance with Local Planning Policy seeking carbon reductions above building regulations either through efficiency or renewables will be able to use C-Plan.

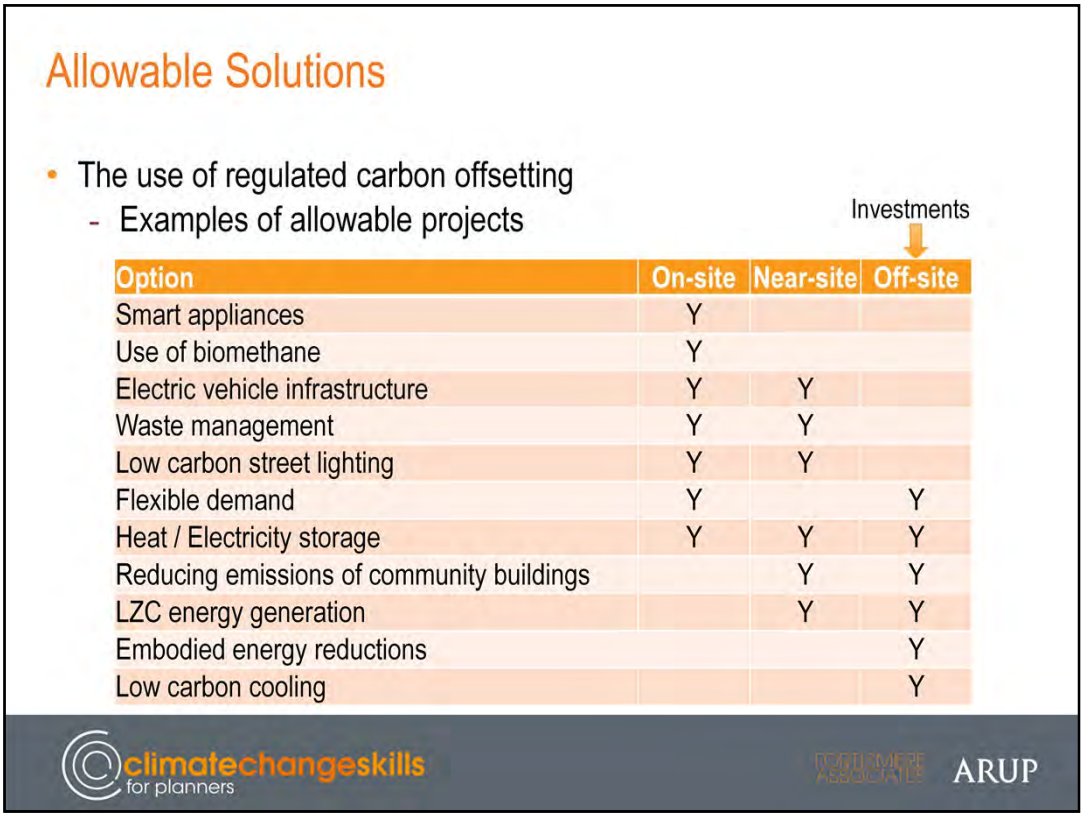
C-plan is filled in by the developer – it handles complex information and then displays it in a form that can be readily understood by planners. Charts and indicator lights explain how a development measures up against energy targets in planning policy.

They are displayed on the screen and in a report.

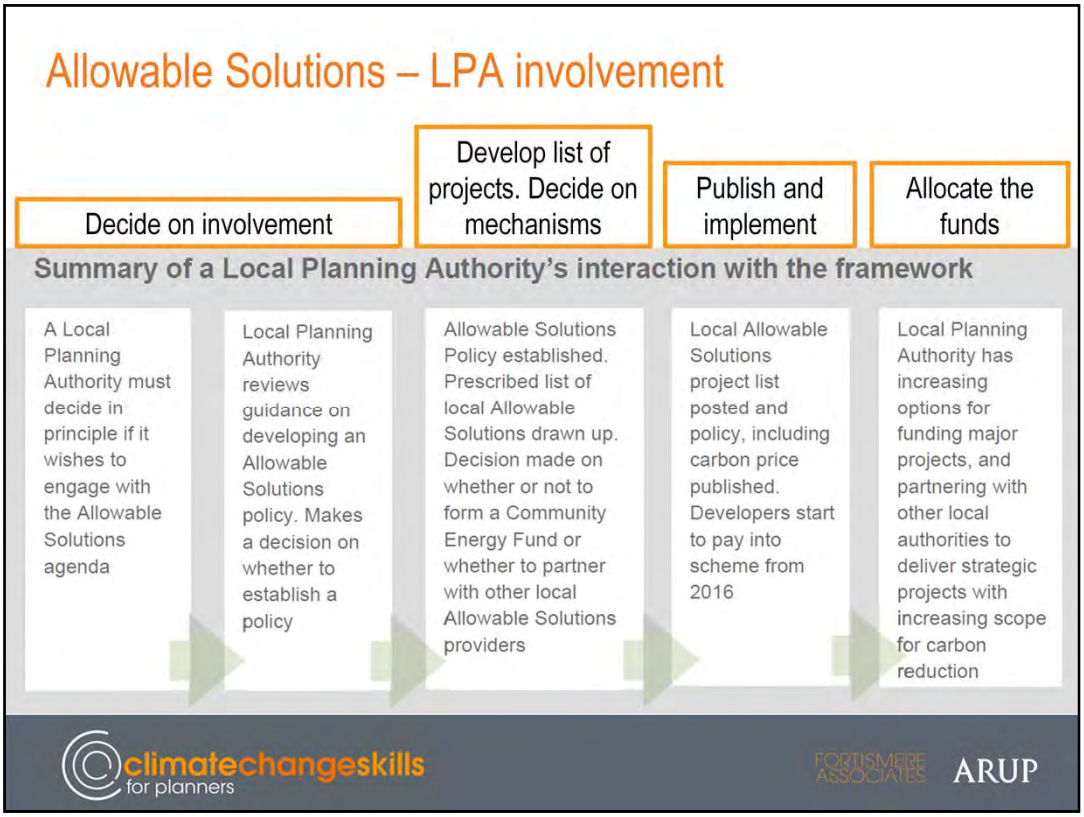


Can be used by Development Control team to understand if developers are meeting the requirements of the policies / conditions on planning application.

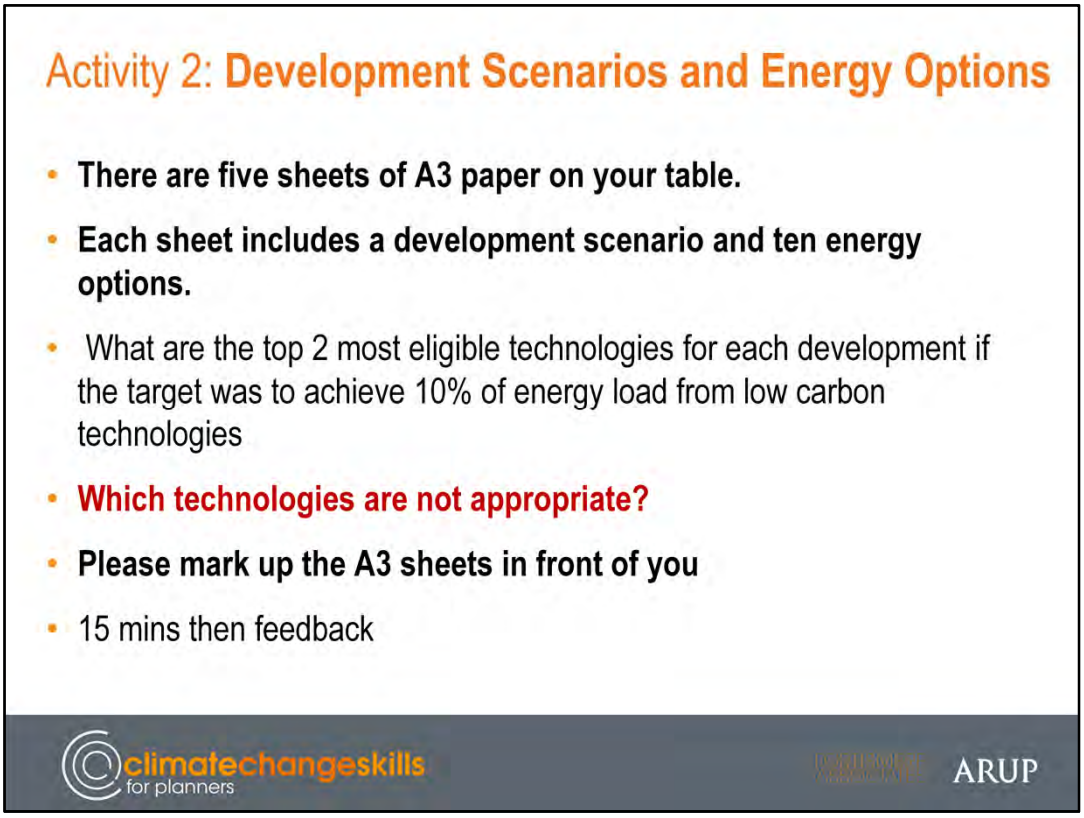
The planning policy team can use the data outputs to monitor the take up of renewable policies – which is always tricky to monitor.



These are the projects that have been given as examples of allowable solutions but the exact framework has yet to be developed.



This is from the Zero Carbon hub's document.



Facilitated discussion around the topics on the slide with the intention of the delegates understanding the common themes and issues from other authorities in their region and to share any breakthroughs they may have had

Break

- Break – 30 mins
- Back at...
- Happy to answer queries

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Session 3

Code for Sustainable Homes

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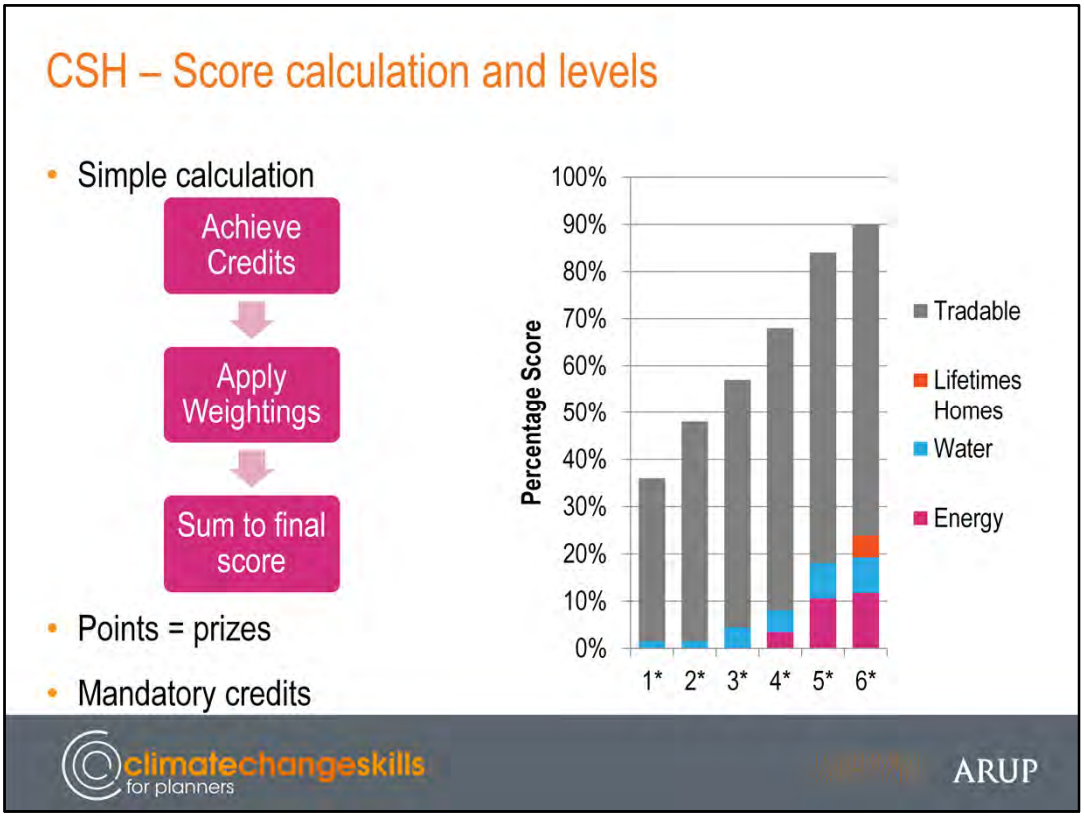
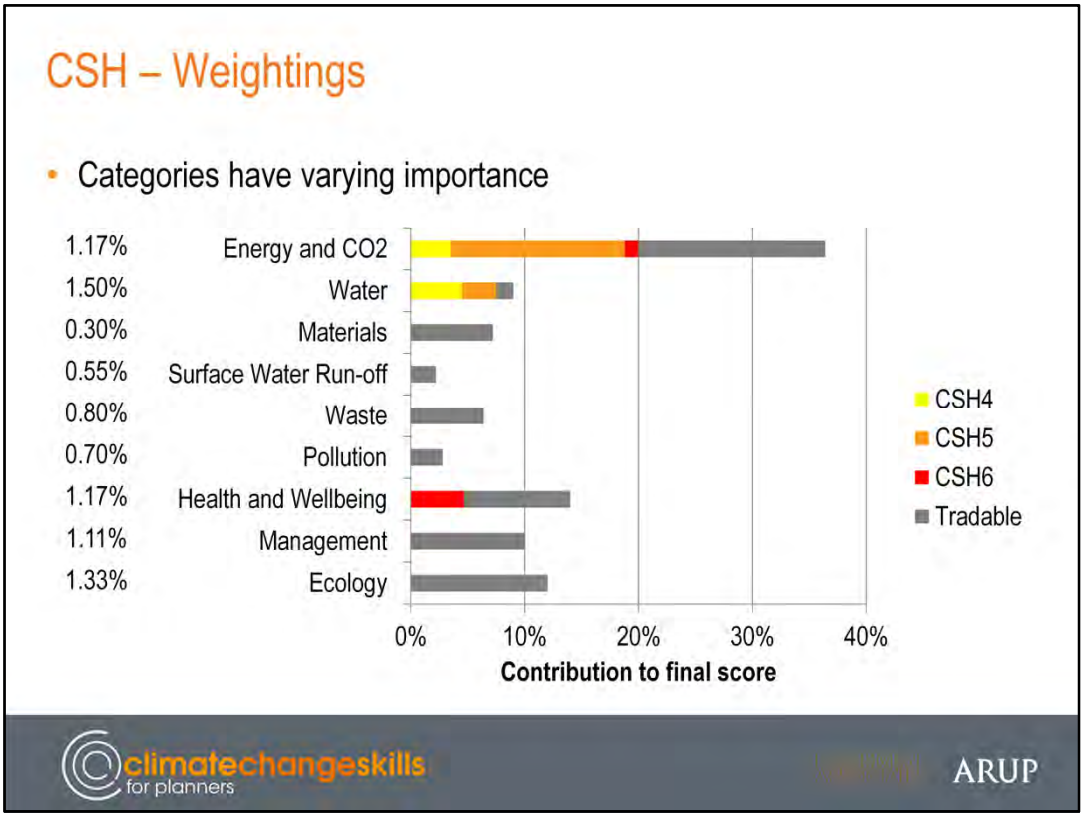
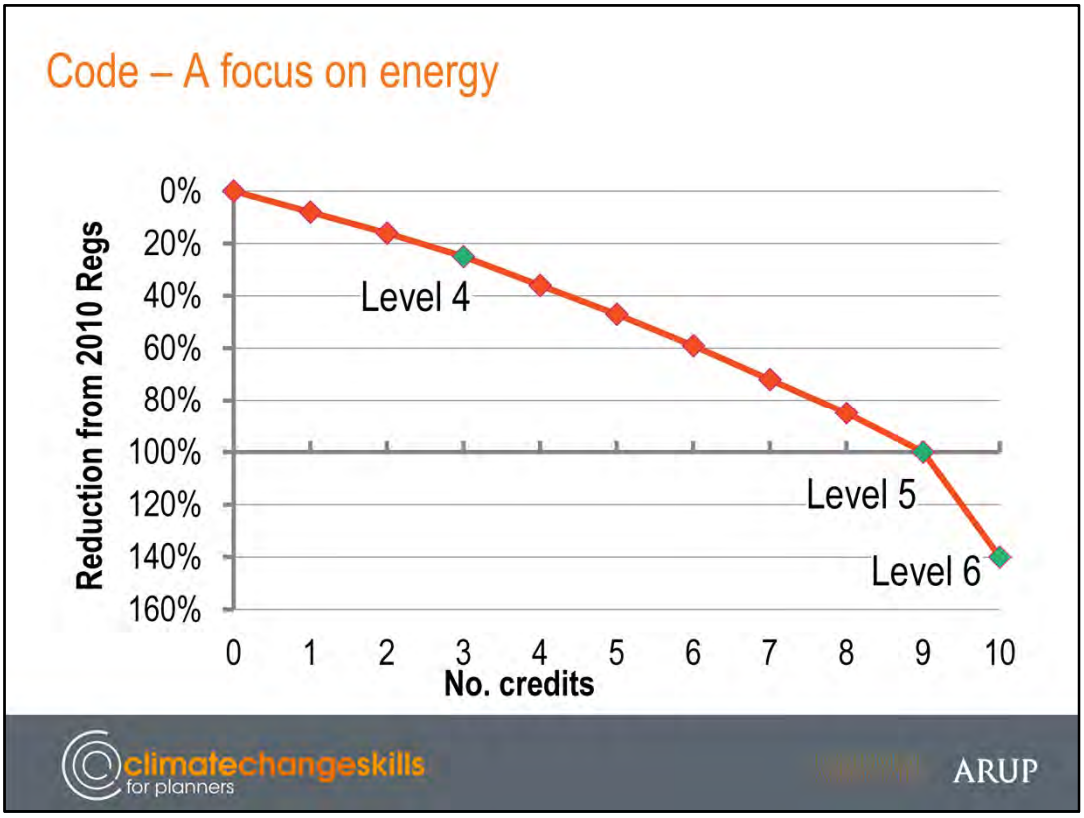


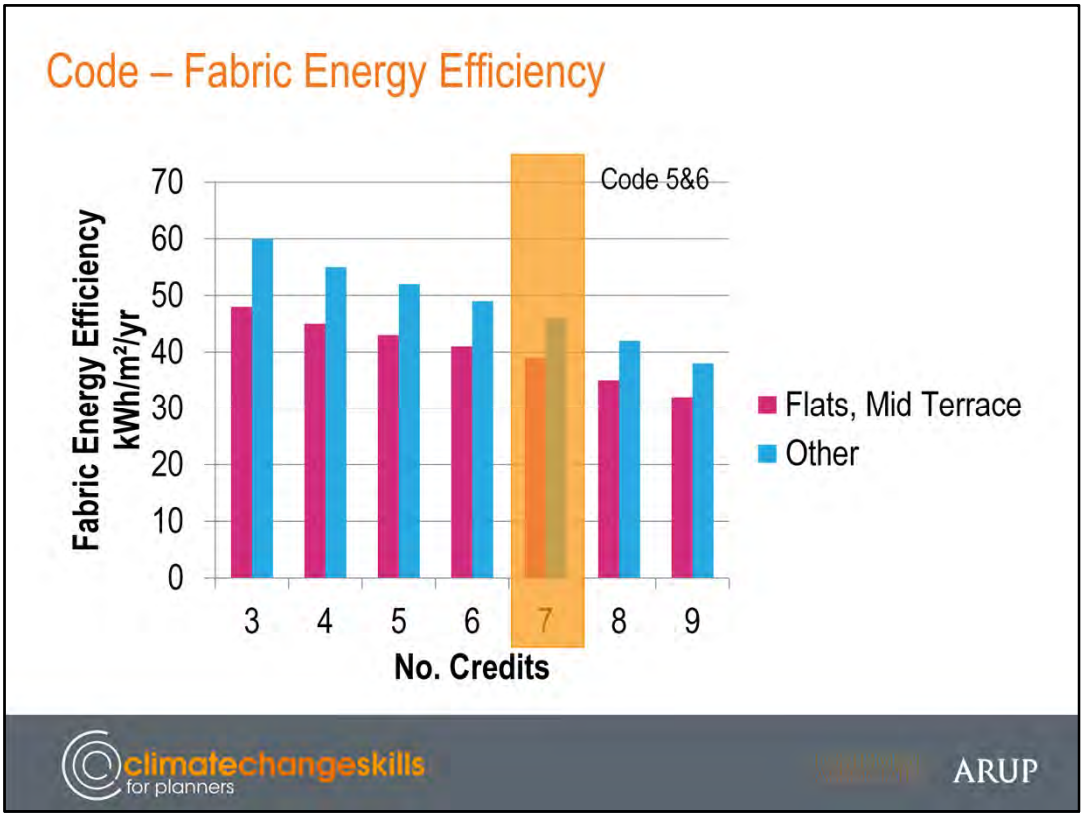
Can see how the need for more points increases as the levels increase



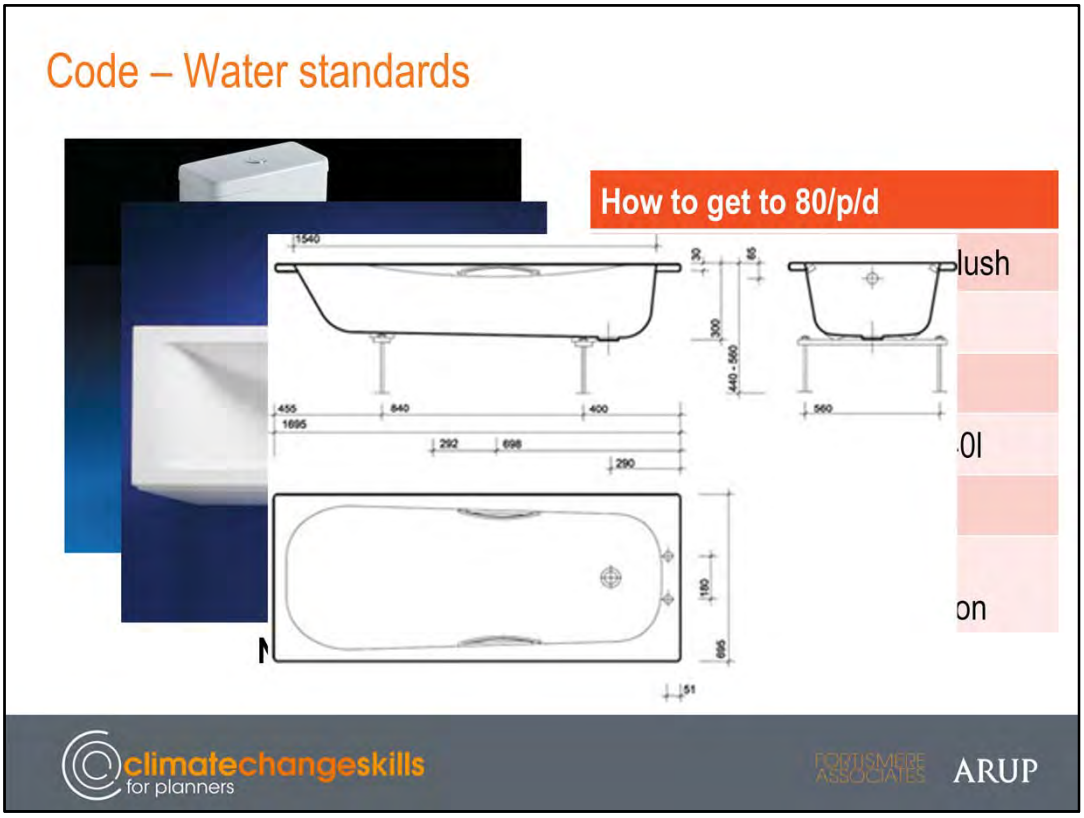
After explanation – will now go through some of the more trickier credits to achieve that are often stumbling blocks to higher scores.



Can see that significant reductions from current regs are needed
Code 4 needs a little renewables
5 and 6 need lots



Code 5 and 6 mandatory level is the preferred option for 2013 regs
An alternative is the level for 5 credits

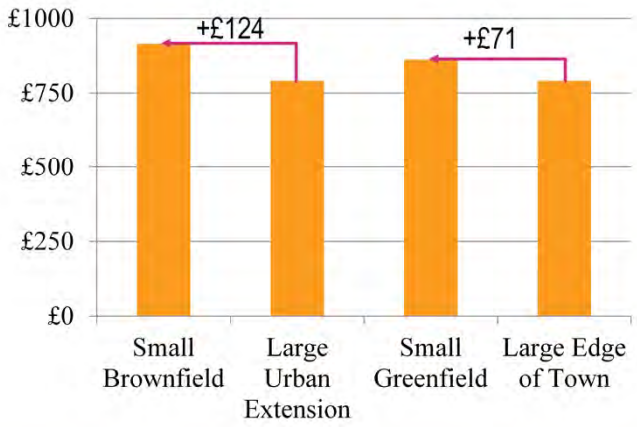


Wash hand basin taps ‘normally’ 12 l/min
Showers normally 14l/min

Bath 300 deep at the deepest point, 560 total width! 110 l capacity

Code costs for small developments

- Costs to Code 3 from Building Regs 2010



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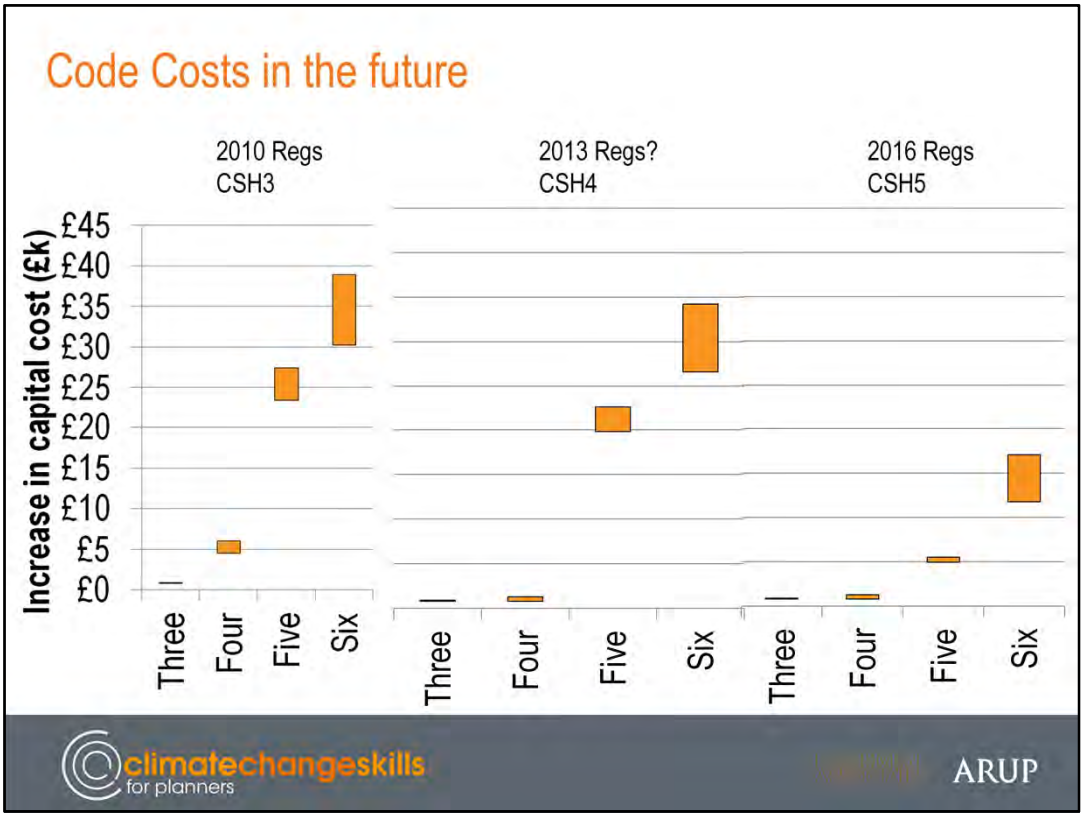
Code Costs in the future
2010 Regs
CSH3
2013 Regs?
CSH4
2016 Regs
CSH5
Increase in capital cost (£k)
£45
£40
£35
£30
£25
£20
£15
£10
£5
£0
Three
Four
Five
Six
Three
Four
Five
Six
Three
Four
Five
Six
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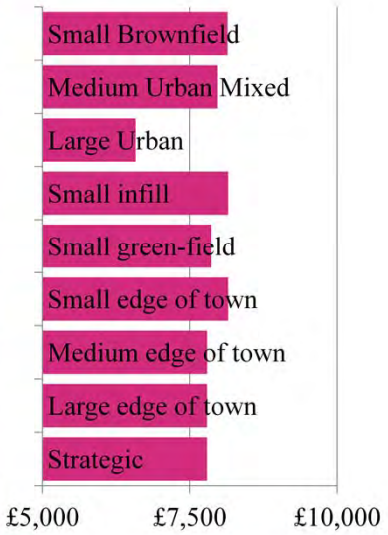
Effect of development type on costs

Scenario number	Description	Dwelling density (dph)	Total number of dwellings	Dwelling mix			
				Flats	Terraced	Semi	Detached
Brownfield							
1	Small brownfield	80	20	40%	35%	20%	5%
2	City infill	160	10	100%	0%	0%	0%
3	Medium urban (mixed)	80	350	50%	25%	20%	5%
4	Medium urban (flats)	160	400	100%	0%	0%	0%
5	Large urban (mixed)	80	3,600	50%	25%	20%	5%
6	Large urban (flats)	160	4,300	100%	0%	0%	0%
Greenfield							
7	Small infill	40	10	0%	60%	20%	20%
8	Small greenfield	40	50	40%	30%	20%	10%
9	Small edge of town	40	10	0%	40%	20%	40%
10	Medium edge of town	40	650	30%	30%	20%	20%
11	Large edge of town	40	3,300	30%	30%	20%	20%
12	Strategic	40	5,000	30%	20%	25%	25%



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Costs are extra over for achieving Code 4 from 2006 baseline (so need some interpreting) on a semi detatched

But there's hardly any difference

Code 4 example – LILAC Leeds

- ModCell construction
- Community gardens
- Central Common House

Source: www.lilac.coop

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Code 6 example – Airedale, Castleford

- 91 homes
- MVHR, greywater recycling, PV
- Biomass district heating
- Smart metering
- £120k build cost

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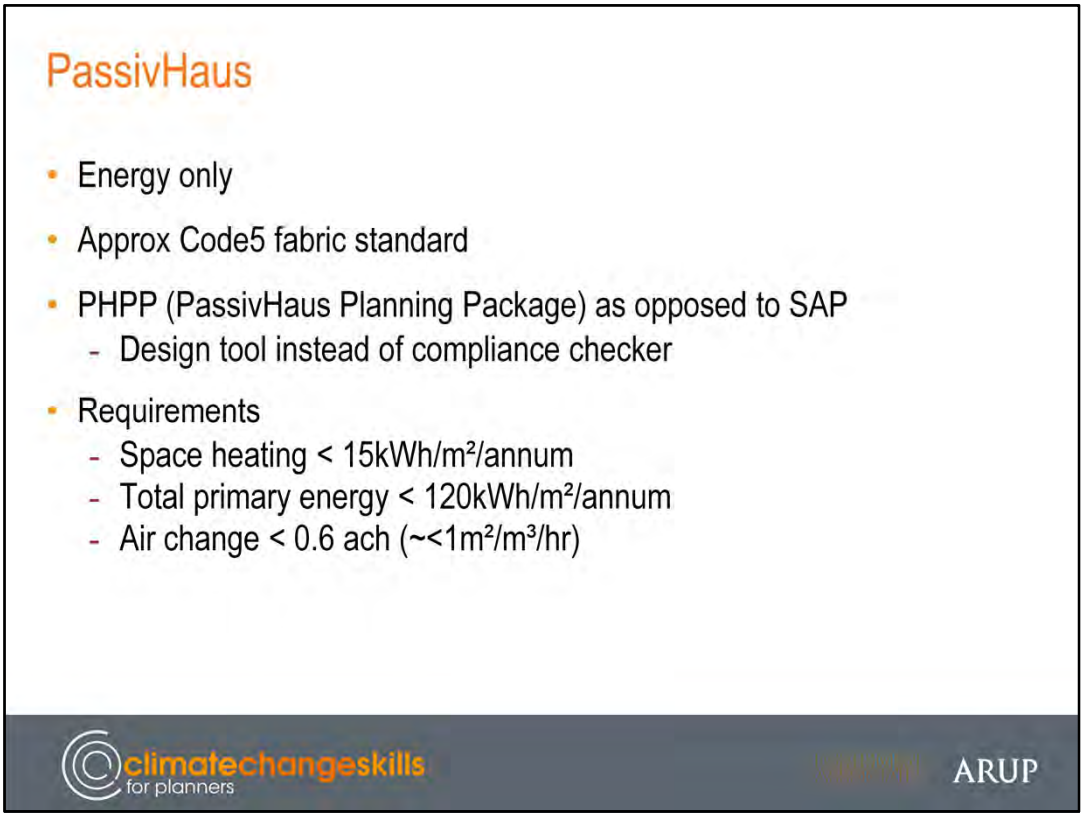
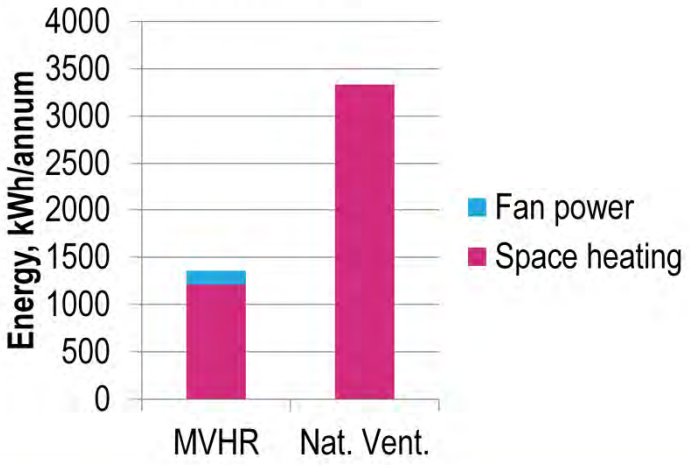


Space heating is £60/yr based on 4p/kwh gas
Incidentally, 0.6ach at 50Pa is about 1 air change every 30 hours under atmospheric conditions (factor of 20)

PassivHaus – why MVHR?

- SAP recommends 0.5 air changes per hour



Case Study - PassivHaus

- Denby Dale
- First cavity wall PassivHaus in UK
  - Don't have to use lightweight materials
- 300mm insulation in walls
- Passive solar gains
- Needed a 1.1kW boiler to cope with -10ºC

Source: Green Building Store

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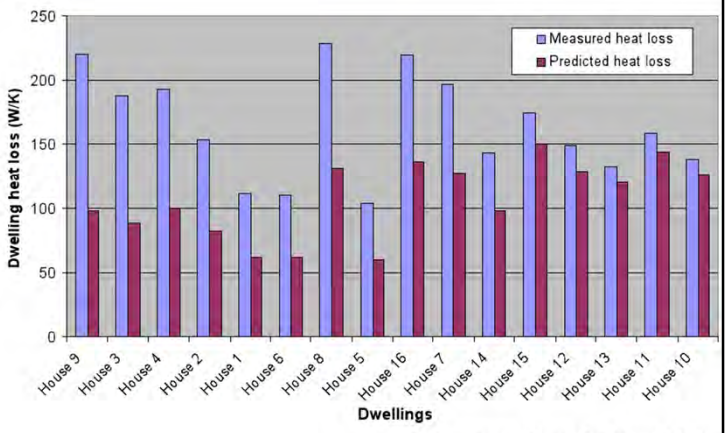
Predicted versus actual performance

- Study eliminates behaviour effects
- Requirements for improvement
  - Design Stage
  - Construction



Source: Zero Carbon Hub

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Whether what gets designed is what gets built

Info shows shortfall from 15 to 120%. All bar four were from buildings with s significant focus on energy efficiency. Mix of house types etc.

Info from Zero Carbon Hub study
Leads into discussions of planning vs. building control

Session 4

Assessing developments

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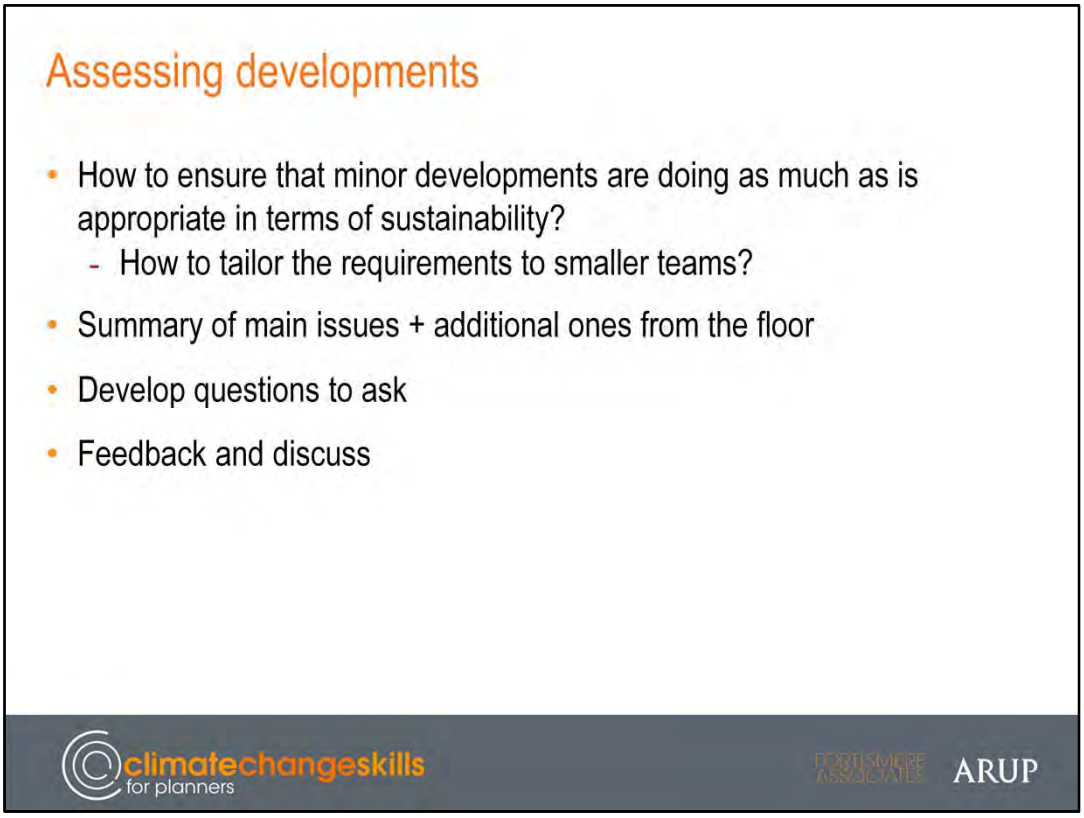


Issues to be summarised include those most commonly mentioned in policies and most commonly mentioned in the feedback from planners that informed the development of these modules

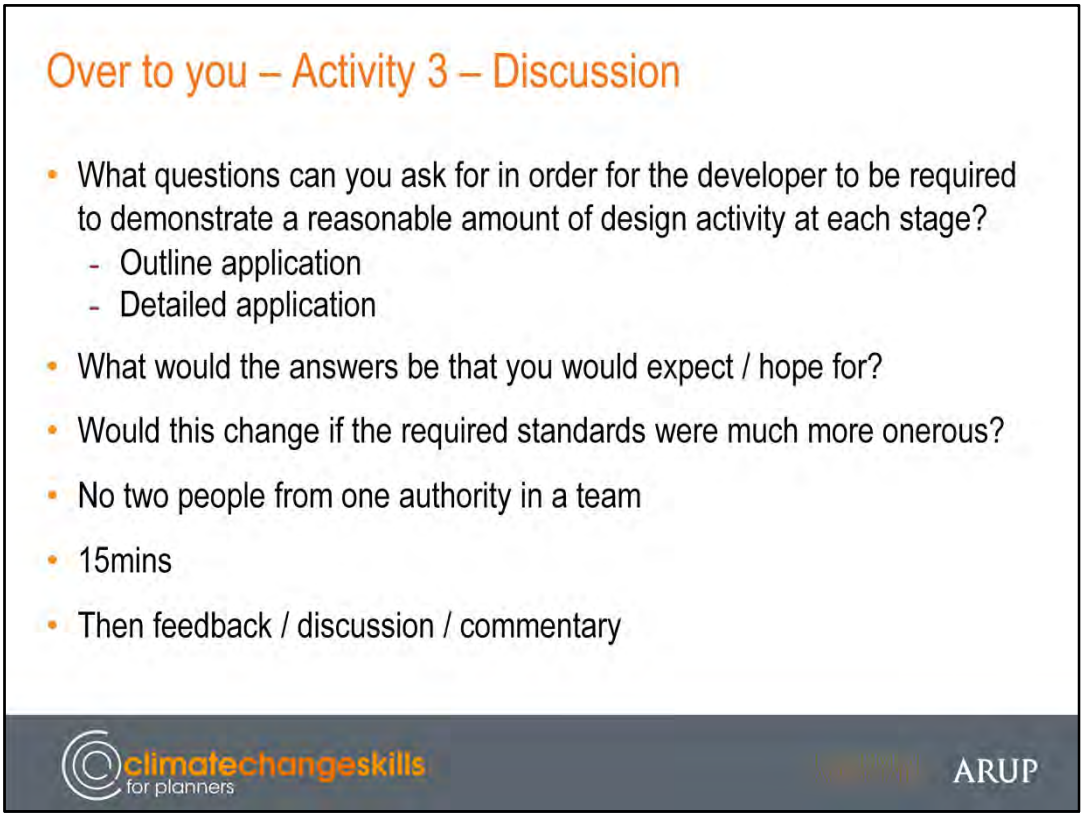
Main issues

- Energy & emissions
  - Demand reduction
  - Low carbon energy strategy – necessary?
  - Quantified or qualitative?

- SuDS & flooding
  - EA flood map output?
  - Proportion hard-standing calcs

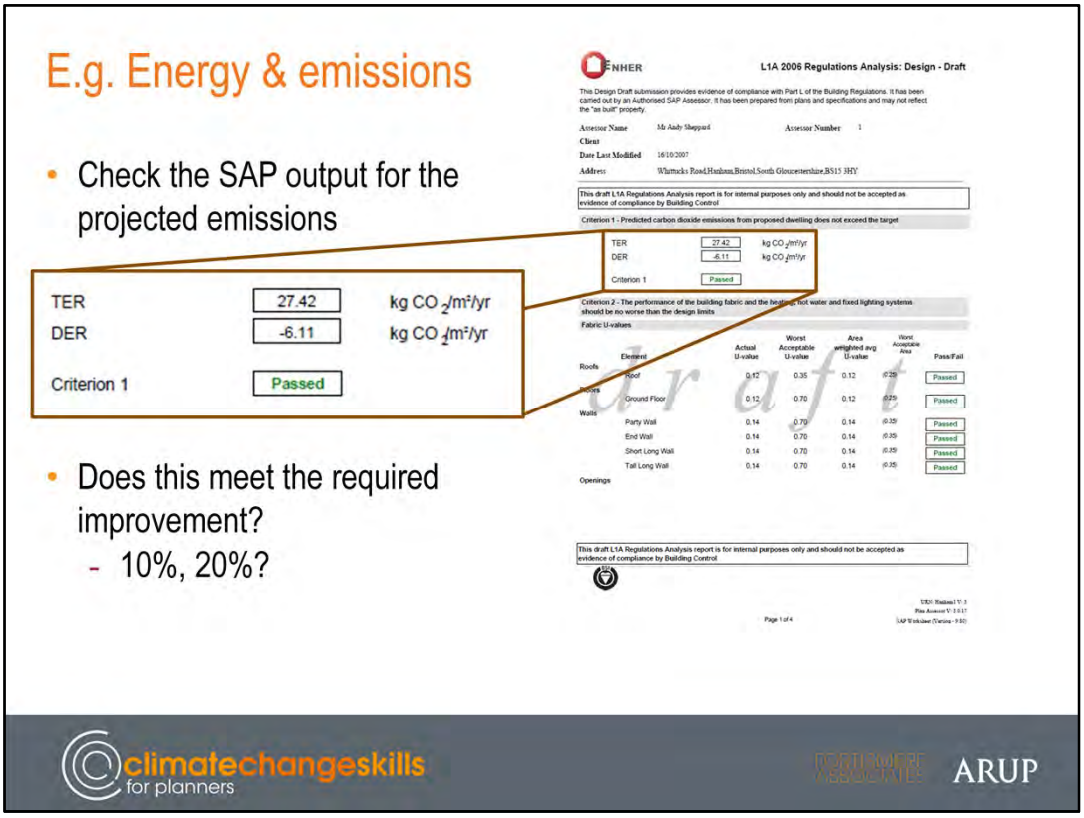
Main issues

- Ecology & biodiversity
  - Simple habitat evaluation using BREEAM criteria that allows non-specialists to estimate species numbers?
  - Simple searches for SSSI's etc
- Code for Sustainable Homes
  - Robust pre-assessment
  - Evidence of activity on key items at detailed planning
  - Use calculator outputs as evidence? E.g. water consumption
- Are there any other significant issues you'd like to explore?



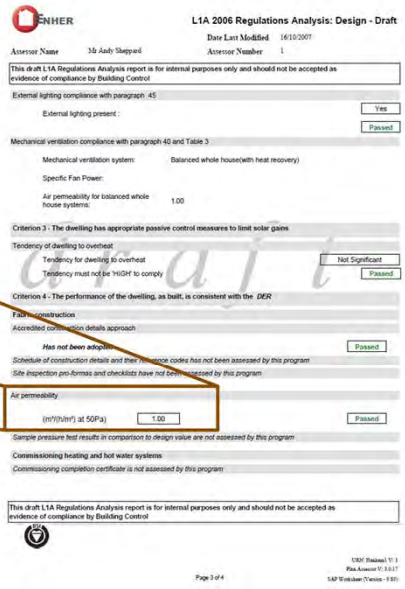
These are the key questions for the delegates to develop answers to (in the form of more questions)

Splitting people up with the intention of getting different ideas discussed and for people to learn from each other's practices



Really not sure if this is the sort of thing they're after.

E.g. Energy & emissions



- Is this realistic?
- Could it be improved?

Session 5

Refurbishments

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The importance of refurbishments

- 21 million homes in the UK – 27% of UK carbon emissions
- 86% of existing homes will exist in 2050
- Represent an 'investment' in natural resources and embodied energy
  - Not to be thrown away lightly
- Societal cohesion of familiar streetscapes

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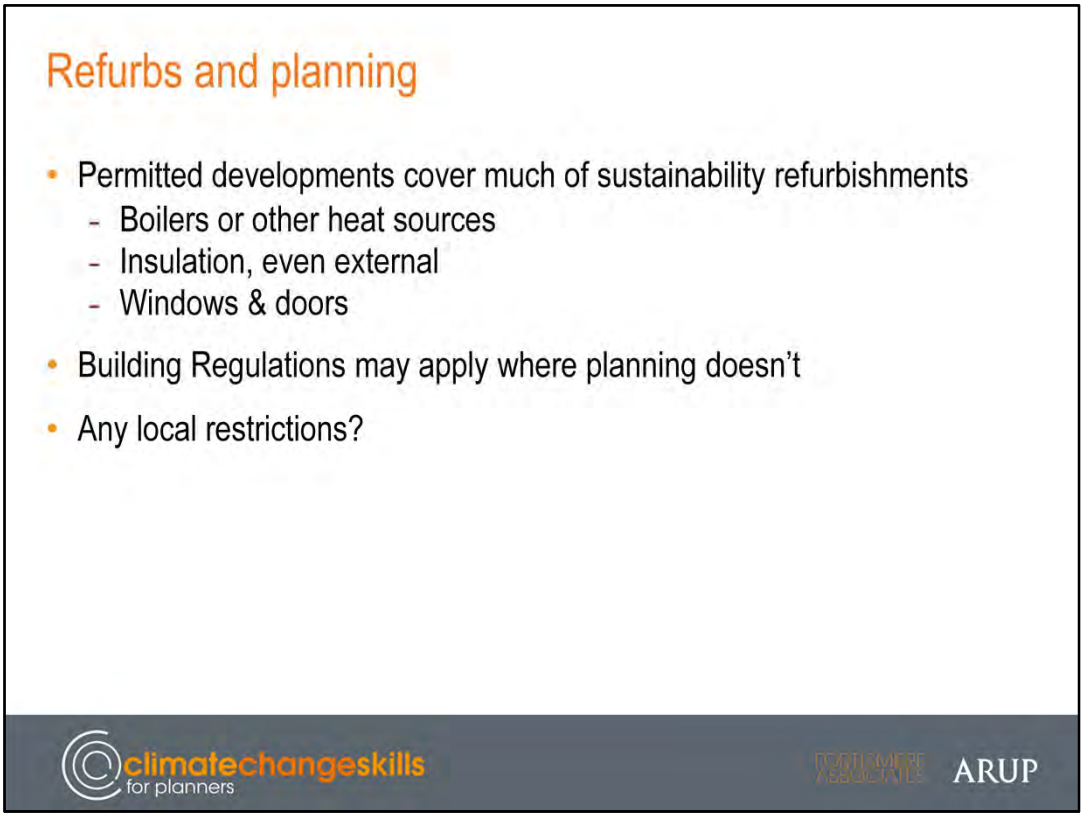


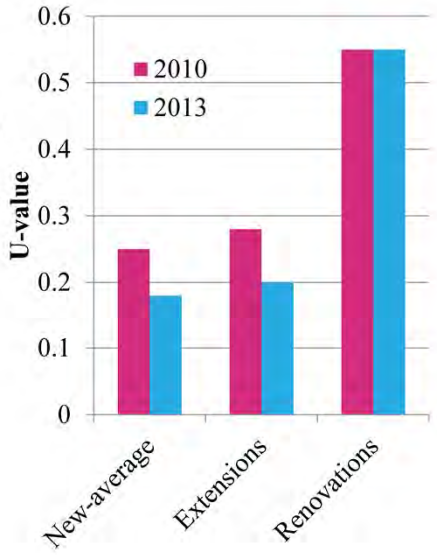
Would it be feasible, practical or desirable to locally raise the required standard of refurbishments above the national minimum required by building regs?
Who would implement and enforce this – building control or planning?

L1A is new build, L1B is existing. L1A and L2A for new builds have changed significantly over the last decade as the carbon agenda has increased in prominence. In comparison, changes to existing building regs have been less significant.

Don't expect any massive changes either

What are the standards

- Extensions
  - Fabric standards are average at best
  - Glazing recommendations
  - Policy opportunity?
- Renovations
  - Fabric standards very variable
  - Lenient for walls
  - Lowest common denominator
- Consequential improvements
  - Only when over 1000m²



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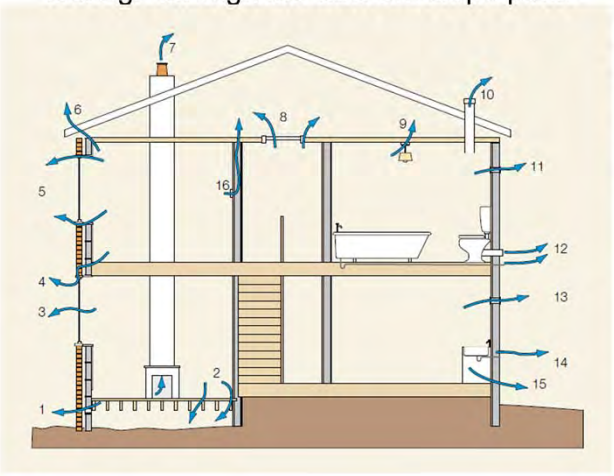
Extension fabric improvement standards are pretty poor – could be improved

Windows potentially moving to 1.4 in 2013
Walls to 0.20

Air tightness

- L1B – “Reasonable provision should be made to reduce unwanted air leakage through the *new* envelope parts”



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There are often lots of areas for improving airtighness on refurbishment projects but it’s not required and is often not tackled in any coordinated way.
Particularly need to think how extension join into the existing property.

Consequential improvements

- Currently only over 1000m² but in the future...

Increase in habitable area

SAP

Boiler or window replacement

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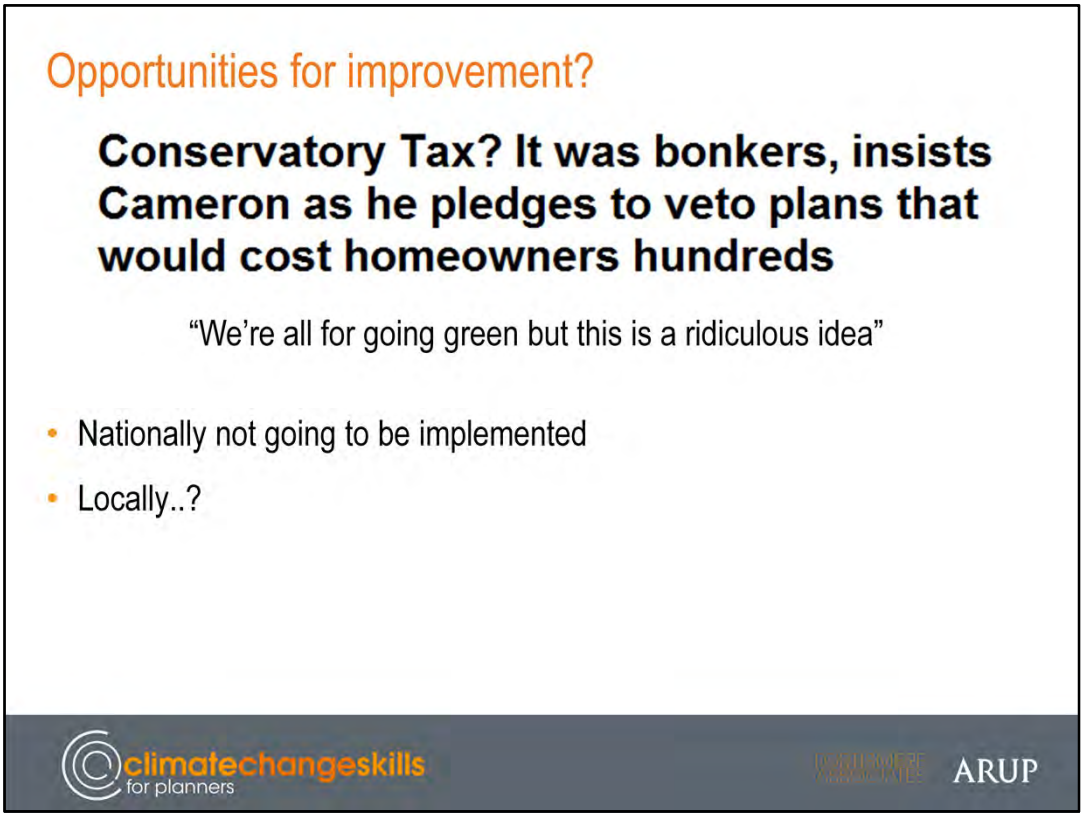
SAP Appendix T



These were all great plans until Mr Cameron got involved

However, it does mean that there are sets of developed policies out there with impact assessments that are ripe for local implementation.

Consequential Improvements – Case Studies

Kirklees COUNCIL

Policy SCS6 Energy Efficiency Extensions states that where planning permission is required for extensions to residential properties smaller than 1000 square metres proposals for extensions **must incorporate measures to increase the energy efficiency of the host building by at least 30%** unless this can be demonstrated to be unfeasible or to render the proposal unviable.

Submission Core Stratetgy, May 2012

A SPD will be produced to provide further information on how to implement this policy.

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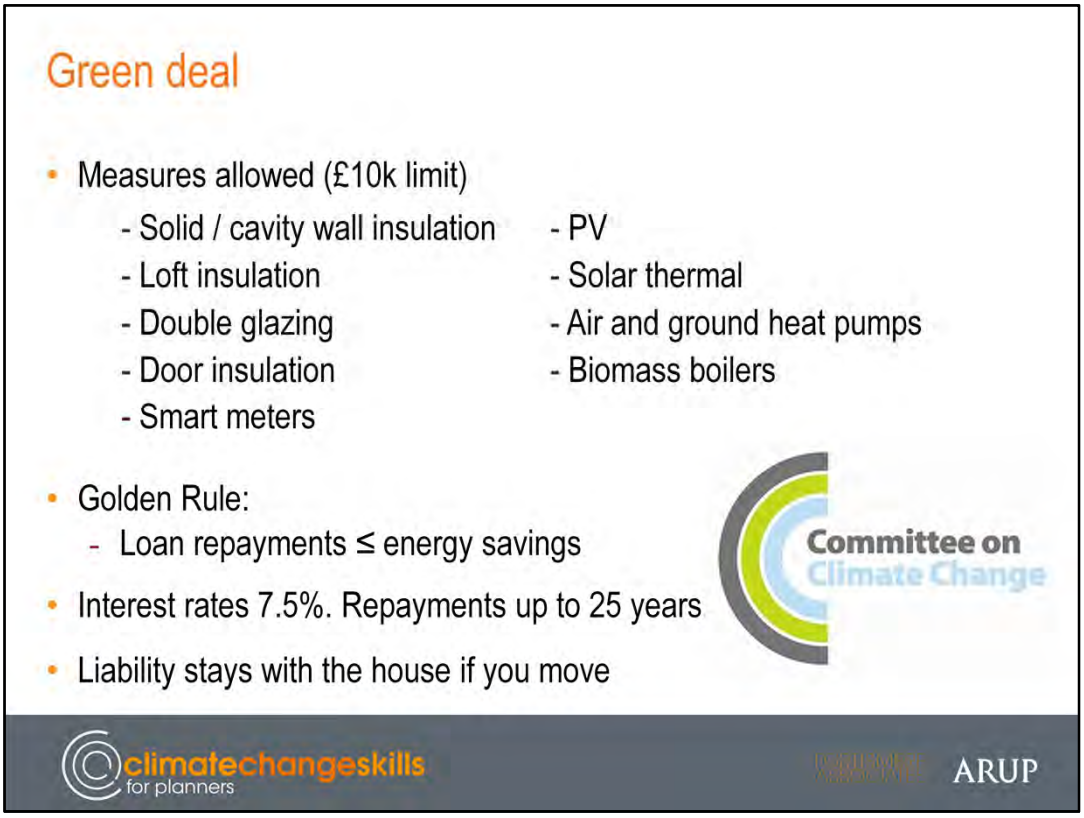
Consequential Improvements – Case Studies

As part of a wider climate change policy (CP1 2a) seeks to:

Ensure carbon savings in existing developments – Consequential Improvements

'when applications are made to extend dwellings the Council will seek to **secure reasonable improvements to the energy performance of dwellings**. This will be in addition to the requirements of Part L of the Building Regulations for changes for which planning permission is sought'.

Submission Core Strategy, August 2012



Measures need to be approved by Green Deal Accredited Advisors

Some scepticism as to whether it's going to work

Refurbishment Case Study

- Solid brick walls
- 300mm external insulation, MVHR, solar thermal
- 95% reduction in primary energy
- No mention of costs....

RefitSW	~50% red^{n} in CO_2	~£15k - £20k
TSB PassivHaus	~80% red^{n} in CO_2	~£60k - £100k

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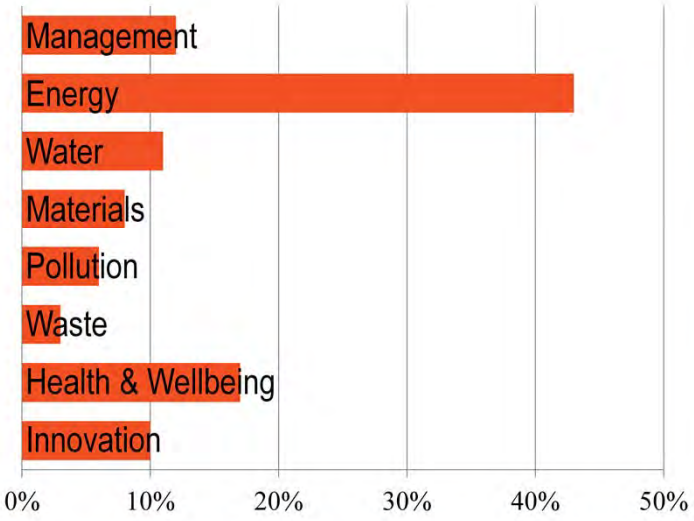
BREEAM for domestic refurbishments

- Replaces EcoHomes
- Choice of certification routes
  - Formal assessment
  - Self declaration
- Two categories
  - Alterations and extensions
  - Conversions and change of use
- Individual dwellings or site-wide

Weightings and scoring



Rating	Score
Pass	30
Good	45
Very Good	55
Excellent	70
Outstanding	85

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Where are the credits available

0. Determine existing performance
1. Set Targets
   Energy and water — 40%
2. Identify wider opportunities
   Design for inclusivity, daylighting etc. — 16%
3. Specify through procurement
   Responsible sourcing and specification — 17%
4. Set contractor requirements
   Management etc. — 10%
5. Identify additional measures
   Bolt-ons — 17%

Case Study – Cornbrook Court, Manchester

- BREEAM Domestic Refurbishment – 'Very Good'
- Additional insulation & new windows reduced emissions by 20%
- Low-flow sanitary-ware and water butts
- Lifetime Homes, rotary driers, home office

Source: www.breeam.org

Case Study – Boleyn Road, London

- BREEAM Domestic Refurbishment – 'Excellent'
- Internal wall insulation, MVHR, triple glazing
- Air-tightness <3 $m^3/hr/m^2$
- Micro CHP
- Maximum credits in Water, Waste, Management and Ecology

Source: www.breeam.org

Session 6

Types of guidance

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Guidance Case Study – Leeds SPD

- Sets out policy (but for 10 dwellings or more)
  - Sustainable principles "applicable to small developments"
- Difficulties of small developments not specifically mentioned
- Sections based around issues
- Useful checklist for developers
- Adaptation weaved throughout sections

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Guidance Case Study – York IPS

- Flowchart guides developers to relevant sections
- Sections based around development type
- Sets our minimum standards clarifying policy

Part h) of policy GP4a:
Development should maximise the use of renewable resources on development sites and seek to make use of renewable energy sources, such as heat exchangers and photovoltaic cells.

Minimum Standard (Renewable Energy): The sustainability statement must demonstrate that at least 5% of the expected energy demand for the development will be provided for through on site renewable generation for heat and/or electricity. In addition, it should be identified how the development could accommodate renewable energy installations in the future, for example the number/area of south facing roofs.

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Interim Planning Statement

Guidance Case Study – Doncaster SPD

Doncaster Local Development Framework
Supplementary Planning Document
Sustainable Construction

- Backed up by Sustainable Construction Checklist
  - Cross references throughout document

4 Design of Development	Applicant	Rating	Officer
4.1 Reducing Energy Demand	*Tick box to answer*		*Correct? If not Tick*
a) The orientation of the building(s) are within 30 degrees of due south for solar gain; and/or	☐	10	☐
b) Main rooms with highest occupancy are located on the south of the building(s); and/or	☐	10	☐
c) The building(s) include glazed sunspaces (atriums and conservatories) that are thermally insulated; and/or	☐	10	☐
d) The building(s) includes methods of solar shading (e.g. shutters, blinds or brise-soleil)	☐	10	☐
e) Potential separate buildings are joined to increase thermal massing	☐	5	☐
f) None of the above methods have been designed into the proposal(a-e)	☐	-45	☐
Energy Demand SUB-TOTAL	0	*Max*	*45*

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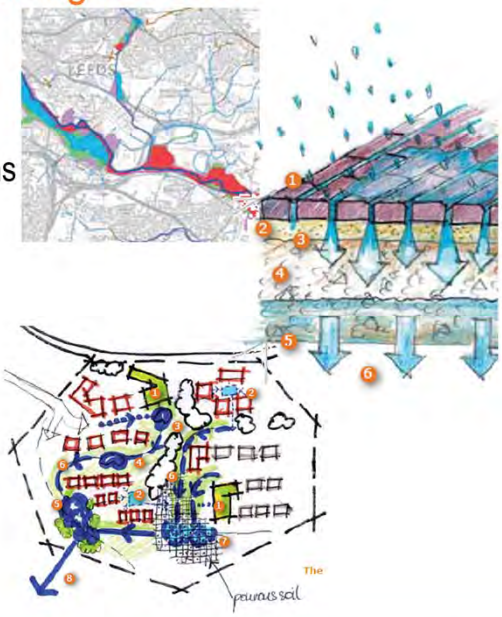
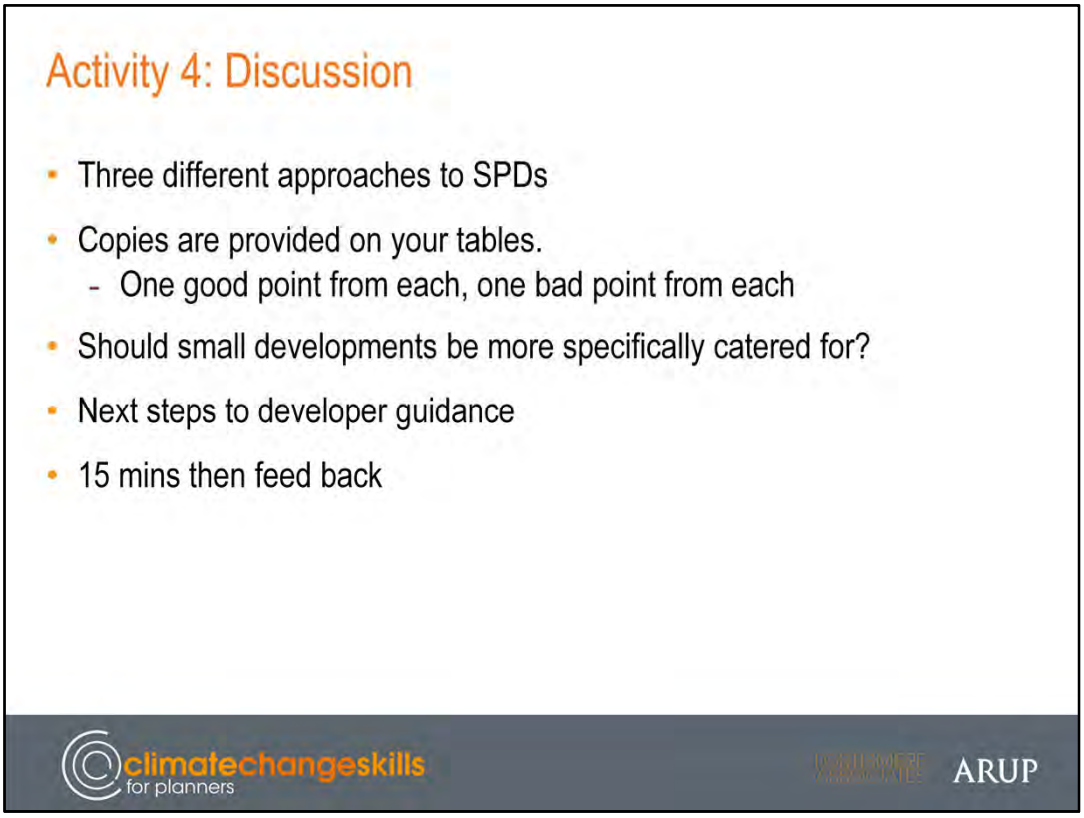
Guidance types – focus on flooding & SUDS

- Leeds SPD
  - Background inc flood map
  - Detailed site management solutions
  - What the authority is doing
- Doncaster SPD
  - Brief site management options
- York IPS
  - Nothing





Each group to get a copy of each of the SPDs mentioned for reference

Session 7

Sources of further information

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Zero Carbon Hub

- Very detailed research into energy standards at low energy levels
- Backed up with excellent levels of data
- Also step outside the technical aspects

- www.zerocarbonhub.org

FACILITATING THE MAINSTREAM DELIVERY OF LOW AND ZERO CARBON HOMES

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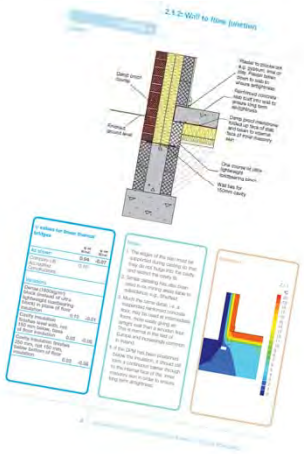
AECB

- Association of Environmentally Conscious Builders
- 3 sets of standards and design guidance:
  - Silver
  - PassivHaus
  - Gold
- www.aecb.net



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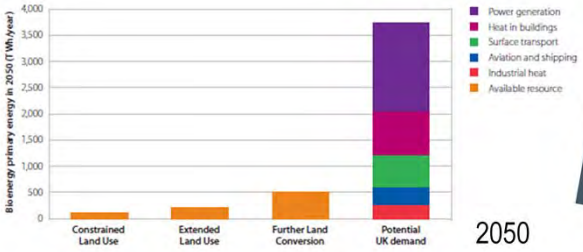
Energy Saving Trust

- Generally relatively non-technical but detailed
- From guidance to myth-busting research
  - E.g. Small wind
- Grants database

- www.energysavingtrust.org.uk

Committee on Climate Change

- To get a longer range idea
- Advise government and influence policy
- www.theccc.org.uk



2050

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For example, bioenergy report commented that we could provide 10% of our primary energy by biomass. If CCS turns out not to be viable this will not be enough to reach the 2050 targets. More biomass would require unsustainable land use changes.

Miscellaneous

- BSRIA – Air tightness in Dwellings
- Concrete Centre – some interesting information
  - So long as you're careful
- DECC – Consultation on Low Carbon Heat in the UK
- UK Green Building Council
- WRAP
- Low energy building database – retrofitforthefuture.org

Wrap-up

- Final questions?

Thank you

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