

**Code for Sustainable Homes
(CSH):
Technical comments regarding
Levels 3 and 4**



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In the past few weeks we have discovered that there are several specific problems with the way that the CSH has been formulated, which particularly affect the way that buildings will be designed and specified at levels 3 and 4. Unfortunately these may in some cases lead to an increase in carbon emissions and energy use in comparison with building regulations standards rather than a decrease.

It should be stated that the Good Homes Alliance is very supportive of the attempt by Government to reduce Carbon Emissions and sees the Code for Sustainable Homes as an important part of this. The Good Homes Alliance also understands the problems of introducing new codes and that often problems only occur as a new code is tested. We are identifying these problems and suggesting ways to address the problems to help ensure that the Code is upheld as a useful and trusted mechanism for achieving carbon reduction in new housing. In our opinion it is important that these issues are addressed directly and forcefully by CLG in the very near future to provide a robust and long term solution. The GHA is very willing to assist in this process.

Problem 1 – Electric vs gas heating:

With certain building forms (particularly small buildings such as terraces and flats in small and medium sized developments), it is much easier to achieve CSH levels 3 and 4 by using electric on-peak heating, than by the more carbon efficient option of gas heating. In the case of CSH level 3 the emissions will often be worse than the building regulations base case (TER).

An example:

Taking a typical 2 storey mid terraced house from a real planning situation, with 79m² internal floor area, we get the following Building regulations requirements:

Building regs level

Heating and Hot Water system	TER kg/m ² yr	DER kg/m ² yr	% saving over TER	CSH level
Gas	19.89	19.53	2%	0
Elect on pk	28.03	30.09	-7%	-1

The Electric case needs more insulation to make it pass Building Regs - so far so good.

Now let's look at a very well insulated case, say one trying to reach CSH level 4.

Highly insulated

Heating and Hot Water system	TER kg/m2yr	DER kg/m2yr	% saving over TER	CSH level
Gas	19.89	12.6	37%	3
Elect on pk	28.03	15.28	45%	4

It is actually not possible to make CSH level 4 with large amounts of insulation when using gas for heating and hot water. However by swapping to Electric on peak, despite the higher carbon emissions, we can make code level 4.

If we consider how to achieve level 3 with Electric on peak heating it becomes clear from the mathematics that with such buildings the CO2 emissions will be worse than the building regulations base case for gas.

Code 3

Heating and Hot Water system	TER kg/m2yr	DER kg/m2yr	% saving over TER	CSH level
Gas	19.89	14.92	25%	3
Elect on pk	28.03	21.02	25%	3

Or put another way, if developers want to make code level 3, they can build a less insulated shell if they adopt Electric on peak heating.

The reason for the problem lies with the Fuel factor used to calculate the TER. This was set (at 1.47) to allow electric heating to small flats to still pass the building regulations, *but* this was intended to be phased out (or converge to a value of 1) as time went on. Keeping the same fuel factors as are in the present part L will inevitably lead to the anomalies above. The problem will be replicated, but to a lesser degree, with LPG, oil and solid fuels.

Possible solution:

One solution is to simply say that the CSH levels from 3 above have to assume convergence, ie that all fuels be treated solely on their carbon emission merits, rather than what is presently acceptable to the market. This is a small change in the software, and can easily be carried out manually in the meantime by energy professionals.

Problem 2 – Large and small-scale buildings and efficient building forms

It is easier to achieve Building Regulations and CSH levels 1-4 if the building is bigger, and the building form is less efficient. This is a simple mathematical consequence of the % reduction scale, which is a % of calculated heating, hot water and lighting. If you start with a building with small heat loss area, such as a mid-mid-flat, or a mid-terrace house, its more difficult to meet say a 44% reduction in carbon , simply because you are starting at a point where there may not be very much heating to save in the first place. This leads to anomalies whereby if you increase the external wall area of flats by pulling them apart or creating steps and set backs, you can pass the % test more easily as there are larger heat losses to save by insulation.

Consequently small and efficient building forms are penalised, and developers are driven to increasing inefficiency of building form. Furthermore large houses in high value developments will more easily meet high code levels than smaller affordable developments. This runs against the desire to push the high code standards in social housing, and means that efficient affordable housing will require expensive and complex renewables to meet high code levels, whereas expensive inefficient housing will not.

Possible solution:

The best measures will probably be absolute energy use figures measured in kWh/ m2/ year and also absolute carbon use per year, measured in CO2/ m2/ year, possibly with some relation to occupation density. This would deal with the problems of both electric heating and building form, as well as any future aberrations to the CSH that may be discovered later.

Problem 3 – general code issues

The two problems listed above are in addition to the more general concerns we have about certain aspects of the code, particularly the target of autonomous zero carbon new homes, the timescale for changes, and the risks to building fabric and human health. These will be clarified in a future GHA briefing paper on the Code.

GHA Position

In order to address the first two urgent problems identified above, The Code for Sustainable Homes should

1. Treat all fuels equally (i.e. based on carbon emissions) for levels 3 and above.
2. Use absolute energy use figures measured in kWh/ m2/ year and absolute carbon emissions per year, measured in CO2/ m2/ year, possibly with some relation to occupation density.
3. Include a monitoring requirement for a fixed percentage of new homes, to test whether the designed performance is actually delivering the required CO2 savings.

Neil May, Pete Warm, NBT Consult for the GHA

Notes about the GHA

The Good Homes Alliance is leading the way amongst developers to make the Code for Sustainable Homes work in way that really delivers sustainable buildings. The GHA is adopting as its code what is called **3 plus plus**. This refers to CSH level 3 as a basic code aim, but with two additional requirements:

- The first plus is the requirement for a fixed maximum Carbon target (CO₂/m²/yr) and/or a fixed maximum Energy target (kWh/m²/yr) according to building type. These will ensure only the best solutions are chosen which will reduce energy and carbon in absolute terms. This will be similar to our former code target of at least a 70% reduction from the actual energy/ carbon use of the existing building stock.
- The second plus is the requirement to monitor homes post occupation for at least 2 years, to compare the designed with the actual performance.

The GHA is also developing further social requirements that will enhance the community and personal well being of occupants. It is the conviction of the GHA that the social design of communities also has a significant impact on carbon emissions and other environmental issues through the lifestyles, transport, food and employment choices made available in the layouts and provision of amenities, services and facilities. The danger with focussing entirely on the energy use of individual houses is that the greater picture and the greater impacts are overlooked

In this way the GHA believes it can begin to show how to really deliver sustainable homes in the widest possible sense, in reality and not just in theory.