

A CHALLENGING ENVIRONMENT - NOW EVEN MORE CHALLENGING

The Code for Sustainable Homes came into force on April 10, 2007, bringing with it a step change in the way affordable housing is built and regulated in the UK. With the Code, the UK government has set some very important – but challenging – targets with respect to reducing carbon emissions and requiring zero carbon homes by 2016.

For affordable housing providers, the need to set out energy conservation targets, a sustainability agenda, and strategies for the use of renewable energy sources must be balanced with tight budgets, reduced grant funding, and a lack of universal support for the benefits of improved environmental performance.

This paper is intended to give RSL's, Contractors, Developers and Local Authority representatives an overview of DAC International's approach to achieving compliance with The Code for Sustainable Homes (CSH) rating system. It is not intended as a substitute for advice from an approved Code assessor.

The DAC approach to the Code is based on our long held “house as a system” philosophy, which relies upon building an exemplary building envelope. Simply put, a well-insulated building envelope with tightly controlled air leakage greatly reduces the need to rely on expensive and energy-intensive mechanical equipment to keep occupants comfortable.



Southern Housing Group's Lewis Gardens is a DAC SuperE™ project.

DAC International is a Canadian exporter of high-performance, pre-engineered homes with more than 20 years experience as a custom builder. We are a recognised leader in SuperE® homes, a government program to export Canada's expertise in timber frame housing to quality-focused and environmentally-conscious builders around the world.

ENERGY IS AT THE HEART OF ACHIEVING A THREE STAR RATING

The Code for Sustainable Homes uses a Star rating system to communicate the overall sustainability performance of a home. A dwelling can achieve a rating from One Star (also called Level 1) – representing a 10% improvement over building regulations, to Six Stars (also called Level 6) – representing an exemplary zero carbon building.

The Star rating for the home is based on its overall performance in nine design categories:

1. Energy efficiency/CO₂
2. Water
3. Materials
4. Surface water run-off
5. Waste
6. Pollution
7. Health and well-being
8. Management
9. Ecology

To achieve a One Star rating, minimum standards must be met in five of the nine design categories: energy efficiency/CO₂, water, surface water run-off, materials, and waste.

The minimum standards for energy efficiency/CO₂ and potable water increase beyond the One Star rating level. To achieve a Two Star rating or above, all minimum standards must again be met (including the higher minimums for energy efficiency/CO₂ and water), and additional points must be attained in the remaining design categories. The table below illustrates the points required to achieve each Star rating, or Level, of the Code:

SUSTAINABILITY/ STAR RATING	POINTS REQUIRED
Level 1 – ★	36
Level 2 – ★★	48
Level 3 – ★★★	57
Level 4 – ★★★★	68
Level 5 – ★★★★★	84
Level 6 – ★★★★★★	90

Each of the nine design categories has a prescribed number of available credits (a combination of site-based credits and unit-based credits) and an environmental weighting factor, considered a measure of the relative importance of that category in achieving the goals of the Code:

ENVIRONMENTAL IMPACT CATEGORY	NUMBER OF CREDITS	ENVIRONMENTAL WEIGHTING FACTOR
Energy efficiency/CO ₂	29	36.4%
Water	6	9%
Materials	24	7.2%
Surface water run-off	4	2.2%
Waste	7	6.4%
Pollution	4	2.8%
Health and well-being	12	14%
Management	9	10%
Ecology	9	12%
TOTAL	104	100%

With the largest number of available credits and the highest environmental weighting factor, the energy efficiency category/CO₂ category has the most impact on which Star rating is achieved. Together, the energy efficiency/CO₂ and water categories, with their higher minimum standards, play a very important part in achieving a Two Star rating or above.

For example, the energy efficiency/CO₂ category has a possible 29 credits available. A score of 16 credits in this category represents approximately 22 points when the environmental weighting factor is applied – $16 \times 1.364 \approx 22$.

Code Level 3 compliance – a Three Star rating – requires at least 57 points. In our example, the 22 points scored from having 16 credits in the energy efficiency/ CO₂ category represent nearly 40% of the total points required for Level 3 compliance.

In addition, each Star rating, or Level, in the Code for Sustainable Homes requires a minimum improvement in energy efficiency when compared to current building regulations:

SUSTAINABILITY/ STAR RATING	IMPROVEMENT OVER REGULATIONS – SAP 2005
Level 1 – ★	10 %
Level 2 – ★★	18 %
Level 3 – ★★★	25 %
Level 4 – ★★★★	44 %
Level 5 – ★★★★★	100 %
Level 6 – ★★★★★★	100 %

So in order to achieve Level 3 compliance or a Three Star rating, a house must achieve a Dwelling Emission Rate (DER) that is 25% better than the Target Emission Rate prescribed in the Standard Assessment Procedure (SAP 2005).

THE DAC SYSTEM AND THE ENERGY EFFICIENCY/CO₂ CATEGORY

Even before the Code for Sustainable Homes was conceived, DAC was designing and building pre-engineered timber-frame buildings that were “eco engineered” for optimal energy performance. For more than 20 years our building philosophy has encompassed not only energy efficiency, but increased occupant comfort, a healthy environment and the use of sustainable materials.

Many Local Authorities are now making it a condition of planning to achieve a CSH Three Star rating, for both private homes and affordable housing projects. DAC’s building philosophy and system are a good match with the requirements of the Code for Sustainable Homes.

The performance benefits of our value-added panel design and air leakage control detailing will help our clients achieve a Three Star rating – without necessarily resorting to costly renewable energy technology.

The DAC System meets the 25% improvement in Dwelling Emission Rate required for a Three Star rating using a combination of:

1. DAC value-added panel design and fabrication
2. Raised-heel trusses
3. Air leakage control that is five times more stringent than “best practice” as set out in Building Regulations Part L1A

DAC value-added panel design and fabrication

The DAC value-added panel uses an 89 mm stud frame and has no insulation in the void. Instead, all insulation is fixed to the outside face of the structural sheathing material, leaving the stud void available for wiring, plumbing and mechanical services. By insulating the outside of the timber framing, thermal bridging is dramatically reduced. To increase the thermal



Continuous exterior insulation minimises thermal bridging and leaves the stud cavity empty, making it easier to install services

performance of the panel further, insulation may be added to the stud cavity after the services are installed. No vapour check membrane is required behind the dry lining, even with the stud cavity filled with insulation, because the exterior insulation eliminates the condensation risk.

These panels achieve U-values of 0.22 to 0.26W/m²k, depending on the thickness of the insulated sheathing. It is possible to upgrade the panels even further to improve U-values to 0.15 W/m²k with no significant increase in wall panel thickness. Our standard exterior wall thickness is 327 mm,

including a 102 mm brick outer skin with 50 mm cavity and 13 mm interior dry lining. With a light-weight cladding rainscreen this thickness goes down to approximately 250 mm, but still achieves U-values as low as 0.15 W/m²k.

Raised-heel trusses

Conventional pre-built roof trusses don't leave enough space at the eaves to allow for adequate insulation where the side walls and the roof of the home intersect – an area of the building where heat can easily escape.

The use of raised heel roof trusses can solve this problem. Raised-heel trusses provide room for more insulation at the top wall plate by adding a small extension to the top of the exterior wall where it meets the roof.

In addition to increased energy performance, by preventing cold interior surfaces at the intersection of walls and ceilings, raised heel trusses reduce the risks of condensation, possible mould growths and ice dams.

Air leakage control

The high-performance building envelope that results from our value-added panel design must be paired with controlled air leakage to achieve optimal energy efficiency.



Air barrier continuity creates an airtight building envelope

DAC is an acknowledged leader in SuperE technology, the air-leakage control standards for which are five times more stringent than Part L1A. DAC's frame erectors are trained in the art of air leakage control to ensure that the benefits of airtight panels built in a factory are translated to the erected building.

Additionally, every dwelling is fitted with a balanced mechanical system, a mechanical ventilation system with heat recovery (MVHR) that exhausts stale air from the house and supplies fresh, filtered outdoor air to every habitable space in the house on a continuous basis. The core of

the MVHR removes heat from one air-stream and transfers that heat to the other air stream. In the winter, this means that heat energy is captured and transferred to the incoming cool air stream. In the summer, the warm outdoor air is pre-cooled by the outgoing air stream. This system is robust, easy to maintain, exceptionally quiet and costs pennies a day to operate (most systems are rated at 80 watts or less). The system controls humidity in the home and ensures a very high standard of indoor air quality.

Finally, every DAC SuperE home is blower door tested by a third party to ensure that it meets or exceeds air-leakage requirements.

Renewable energy technologies

Renewable energy technologies are often considered as attractive alternatives for reducing the environmental impact of a housing project over its lifetime. Some Local Authorities are asking for a portion – typically at least 10% – of all energy to be provided by renewable sources.

It is our view, however, that the best initial investment is in reducing energy loads to a minimum through a well-insulated building envelope with controlled air leakage – before committing funds to renewable energy technology. *“There are two ways to keep water in a leaky bucket; go look for more water, or plug the holes in the bucket.”*



All corners and joints are taped for optimal air leakage control

When renewable energy sources do make sense for a project, or when a Four, Five or Six Star rating is desired, DAC can integrate renewable technologies into the overall energy plan for the building.

We have experience with the integration of – and have supply chain partnerships established to provide – a range of renewable energy technologies, including: solar domestic water heating, photovoltaic technology, wind energy and grey-water heat recovery, micro Combined Heat & Power (CHP), geothermal heat pump and air-source heat pump systems.

Recently, DAC conducted an analysis to demonstrate how the introduction of solar domestic water heating can be used in conjunction with the DAC value-added panel system to achieve the 44% energy/CO₂ reduction required to achieve a Four Star rating under the Code.

THE DAC SYSTEM'S IMPACT ON OTHER DESIGN CATEGORIES

The DAC System greatly impacts the energy efficiency/CO₂ design category, moving a project toward a Three Star rating under the Code. There are other areas required to achieve the rating that fall under the responsibility of the Main Contractor, but where the DAC approach can have a positive impact. Some examples are below:

DESIGN CATEGORY	REQUIREMENT	DAC IMPACT
Energy efficiency/ CO ₂	Must provide a minimum of 4m of drying space, or a clothesline, in each apartment	In some designs the MVHR can serve a drying cupboard - supplying fresh outdoor air and exhausting the humid air as the clothes dry
Energy efficiency/ CO ₂	Must supply energy advice to house occupants	DAC's homeowners' manual outlines the measures taken to conserve energy in the design of the home and provides details on the operation and maintenance of the ventilating system
Materials	Must source timber from forests managed to international standards	The timber elements in DAC wall, floor and roof assemblies are sourced from FSC, CSA or SFI certified forests
Materials	Must use insulation materials that are GWP less than 5 with an Ozone Depletion Potential of zero	All DAC products supplied comply with these requirements
Health & well-being	Must demonstrate construction benefits - acoustic performance	The DAC system controls air leakage from outdoors and from adjacent units in multi-unit buildings, reducing the infiltration of noise from both sources
Health & well-being	Must provide minimum levels of private open space	DAC recommends independent, supported balconies of at least 3m ² to provide private open space
Management	Must provide Home User's Guide	DAC provides a homeowners' manual that can contribute to the Health & Safety file
Management	Must consult with Secured by	DAC can supply Secured by Design

	Design officers and incorporate all reasonable recommendations	approved windows and external doors
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SUMMARY

To be effective, every housing project assessment must consider unit -and site-specific information, as well as the client's goals, in order to determine the most economical route to CSH compliance. Careful consideration must also be given to any statutory requirements imposed on a development by 106 Planning Agreements.



Downland Housing Association set a new performance standard for social housing with this SuperE building from DAC

DAC International strongly advocates an Integrated Design Approach where we become an early stage participant with our clients, contractors, developers and other design team members to achieve the most economic solutions to meet the Code for Sustainable Homes. We are committed to providing good environmental solutions, but equally understand the financial framework in which affordable housing units must be delivered.

For more information on the DAC System and how it can help achieve a Code for Sustainable Homes Three Star rating or above, contact DAC International in the UK: 020-8144-2499 or in Canada: +001 613 839 0888, x 24, or visit our website at www.dac.ca.