



# **GREENER HOMES PROSPECTUS**

## **THIRD EDITION**

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# GREENER HOMES PROSPECTUS

## THE OBJECTIVE

- To invest in greener technologies, modern methods of construction and modern materials by applying them to new-build homes and retrofitting them to existing homes in Scotland.
- To boost economic growth by supporting larger-scale projects, skill development and business opportunities.
- To modernise and invigorate house building in Scotland.
- To reduce carbon emissions in housing.
- To reduce the impact of energy prices on households and the number living in fuel poverty.

## BACKGROUND

The Greener Homes Prospectus is an updated version of the document first produced for the Greener Homes Summit in November 2011 and updated in June 2012.

The Climate Change (Scotland) Act 2009 set world-leading targets for Scotland to reduce its greenhouse gas emissions: a 42% reduction by 2020 compared to the 1990 level, and an 80% reduction by 2050. This sits alongside the Scottish Government's Energy Efficiency Action Plan target to reduce energy use by 12% by 2020.

One of the main ways of achieving these targets will be by making homes more energy efficient. The Scottish Government is committed to the 2020 climate-change targets and beyond. But, another factor pushing forward change is the need to reduce running costs for householders and increase their disposable income. Household energy costs rose by 76% in real terms between 2000 and 2010. It is likely that prices will continue to rise due to pressures in worldwide energy markets. This is expected to create growing consumer demand for housing with lower running costs.

National Records of Scotland forecast that 450,000 extra homes will be needed in Scotland by 2033. This is a huge opportunity for innovation and investment (about £100 billion<sup>1</sup> by 2033) or up to £40 billion by 2020. This includes about £20 billion<sup>2</sup> for retrofitting renewable technology (like solar power) to existing housing stock. However, the actual cost of retrofitting arising from climate-change targets may be higher.

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<sup>1</sup> An estimate of the cost that could vary according to the assumptions that underpin it.

<sup>2</sup> Source: Scottish Government, Report on Policies and Proposals 2011 / Scotland's Domestic Energy Model v.1, Scenario 2 (rounded up to reflect additional uncertainty)

80% of existing homes will still be in use by 2050. Getting them fit for the future will require the use of the Scottish Government's Home Energy Efficiency Programmes for Scotland (HEEPS). This will draw on all available funding sources – private sector, Scottish Government, UK Government, energy companies, EU, and income from renewable heat and energy. These Programmes will form a main strand of the forthcoming Sustainable Housing Strategy for Scotland.

## OPTIONS and OPPORTUNITIES

The Greener Homes Prospectus supports the delivery of the Scottish Government's Sustainable Housing Strategy, which will consider how to deliver a major step-change in providing energy-efficient homes to 2030. The Prospectus uses examples and case studies to show how high-quality materials and modern methods of construction can contribute. It sets out **options** and **opportunities** for the industry's developers and builders and shows how greener ideas can produce low-cost and energy-efficient houses.

1. In recognising the higher standards needed for **new homes**, different builders have offered different solutions. Many have adopted the 'fabric first' approach, paying attention to the design and construction of the insulated building 'envelope' before adding any renewable technologies. See **Annex 1** for examples and **Annex 2** for a table showing the running costs of the 'completed projects' highlighted.
2. Several other innovative housing projects in Scotland show how new construction methods and techniques can produce high-quality, energy-efficient buildings with reduced carbon emissions. These prove that although higher standards mean higher costs, over the long term the costs fall and are lower when building is on a large scale. See **Annex 3** for examples of these **demonstration projects**.
3. In meeting our climate change targets, we will need large-scale programmes that **retro-fit Scotland's existing homes** with energy efficiency measures and renewable technologies. The UK Government estimates Energy Company Obligations (ECO) investment is worth around £1.3 billion each year across Great Britain. So, for Scotland, this opens up the prospect of a combined energy-efficiency funding pot, including Scottish Government funding of at least £200m a year. See **Annex 4** for examples of existing retrofit projects across Scotland.
4. The scale of work will also bring significant **business and employment opportunities** to Scotland. Estimates show that jobs in the low-carbon sector in Scotland could grow by 4% a year to 2020, rising from 70,000 to 130,000. This would represent 5% of the Scottish workforce. Research by the Energy Saving Trust for WWF<sup>3</sup> estimated that upgrading all homes to a minimum Energy Performance Certificate (EPC) level of D would support around 9,900 jobs. However, these opportunities will only arise with a skilled and adaptable

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<sup>3</sup> Which Way Up – Report by the Energy Saving Trust for WWF and Friends of the Earth, 2011

workforce. Providing the right training will be essential to enable Scottish companies to take advantage of the emerging low-carbon economy.

5. As well as the domestic market there is considerable **export market potential** for products designed, made and assembled in Scotland. Scottish Development International (SDI) can provide free and heavily subsidised support services to companies based in Scotland to help them export and explore business opportunities overseas. SDI's Smart Exporter project is an international trade skills development initiative for all Scottish businesses, whatever the export experience or business size and is backed by funding from the European Social Fund. Most services and products provided are free to companies based in Scotland. Others are subsidised to help keep financial costs to a minimum while still adding real value to export activities. More details can be found at [www.sdi.co.uk](http://www.sdi.co.uk) In 2008/09 Scotland exported £117m in building technologies including windows to the value of £44m and insulation worth £35m. Despite an uncertain economic outlook significant growth is forecast for this sector, from £13,526 million in 2008/09 to £19,234 million in 2015/16. This is equivalent to an overall compound growth rate of 42% across the UK<sup>4</sup>.
6. **Annex 5** describes opportunities to secure external **funding** that supports new homes and the retrofit of existing homes, as well as the production of renewable energy. These opportunities include web portals designed with housing and buildings specifically in mind.
7. **Annex 6** provides an explanation of terms and key areas to note.

## DRIVERS OF CHANGE

**Building standards** in Scotland are a key driver for change, to which the market will continue to respond. We review the energy standards periodically to maximise CO<sub>2</sub> reduction for the baseline performance of all new homes.

Calculating energy standards reduction levels using SAP (the UK Methodology) means that innovative technologies that are on the verge of becoming normal practice can also play their part. Standards on CO<sub>2</sub> emissions and energy performance were improved in 2007 and 2010. This helped new housing to deliver progressively lower emissions and energy use. We are working closely with housebuilders to explore how we can make further improvements in the near future and beyond.

In May 2011, the Scottish Government also introduced a sustainability labelling system which applies to all new buildings. New dwellings that meet the 2010 energy-efficiency standards are awarded a Bronze label, while those who choose to meet higher energy-efficiency levels receive Silver, Gold or Platinum labels.

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<sup>4</sup> Scotland's Low Carbon and Environmental Goods and Services Sector Study, Innovas Solutions: 2010

On 14 January 2013, the Scottish Government issued a consultation on the proposed introduction of improved energy standards within building regulations from 2014.

The consultation follows investigation into recommendations within the 2007 Sullivan Report<sup>5</sup> - 'A Low Carbon Building Standards Strategy for Scotland' on staged improvements to energy standards within building regulations and research into the cost and benefits of implementing improvement up to and including the 60% reduction on 2007 emissions for new homes recommended for 2013 within the Sullivan Report.

The consultation proposes emissions reductions on 2007 levels of 45% for new homes (which equates to a 21% improvement on current domestic standards). Whilst the proposed improvements are below those recommended in the Sullivan Report, they still represent a significant step change in performance of new buildings. Given the need to both reduce CO<sub>2</sub> emissions and promote sustainable economic growth, proposals offer a balanced approach for the construction industry.

In December 2012, Ministers decided that it would be appropriate to reconvene the Sullivan Panel to look again at the best steps needed to deliver enhancements to energy performance and carbon abatement through the Building Standards system. The Panel are scheduled to meet in May 2013.

During the last 12 years many construction companies have entered the **off-site manufacturing** (OSM) sector. And within the next 5 years the sector is expected to grow (without needing extra manufacturing facilities) to £230 million. The majority of current OSM construction is for the private and public housing market. The output in 2011-12 was 6,000 houses/apartments. If market demand were to increase, the current capacity of the sector would be able to support 16,600 houses/apartments in Scotland<sup>6</sup>.

Lenders tell us that there are fundamental issues about the acceptance of, standards for, and education about green home products by lenders, developers and consumers. Yet energy-efficient homes are warmer and cheaper to run than other homes because of lower energy bills. **Green mortgage products** currently only have a niche position in the market (see example below), but could play a bigger part in the greening of Scotland's homes in the future. So it is important to ask what changes should lenders be prepared to make to enable/provide mortgages for low-carbon, energy-efficient homes, and how should other bodies, including the Scottish Government help with this?

*Example – Ecology Building Society are using their mortgages to encourage all homeowners to cut their carbon footprint. With every grade improvement in your home's Energy Performance Certificate (EPC) rating, their 'Shrink This' mortgage will give you a discount of 0.25% on the standard variable rate. The discount*

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<sup>5</sup> See <http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/about/sullivanreport>

<sup>6</sup> Source: Napier University Report – Review of Off-site Construction Sector, 2011

*applies to the whole of your mortgage, for the lifetime of the loan – not just to the money you borrow to improve your home's energy efficiency.*

Pilot studies in Scotland and other countries have proved that green technology can create affordable and desirable homes. However, industry has not yet adopted green technology on a large scale to offer it to consumers. This is partly because **building valuation surveys** and mortgage offers do not yet give value to home energy-generating or energy-efficient measures. However, there are signs that this is beginning to change. From January 2013, the EPC rating of a building is required to be included in advertisements when the property is offered for sale or rental. As greener homes start to become the norm we can expect to see more use of 'green' mortgage products that recognise and reward the added value in low-carbon homes.

Making Scotland's homes more energy efficient could create **employment and training** (see example below). This will require new skills to enable greater use of modern methods of construction, and changes in the pattern of skills, for example multi-skilling to enable retro-fit. We will only be able to take advantage of these opportunities with a skilled and adaptable workforce that can meet the new needs.

*Example – the construction of the Glasgow House has provided a unique chance for apprentices, and has equipped them with excellent training and development opportunities, coupled with practical work experience in a real-life environment. Each prototype has a real-time training centre attached, which has ensured apprentices have access to, and take part in, all aspects of practical training incorporating all the technologies. It has produced the first generation of skilled 'renewables' trades people. This gives them vital training opportunities with potential jobs, and at the same time is helping the environment by delivering energy-efficient products that will cut people's fuel bills.*

Further to the Climate Change (Scotland) Act 2009, and as part of the wider Sustainable Housing Strategy, an energy-efficiency standard for social housing is being developed. The standard aims to improve the **energy efficiency of existing social housing** and thereby help to reduce energy use, fuel poverty and the emission of greenhouse gases.

The Scottish Government wishes to secure greener homes through its housing supply programme. **Greener Homes Innovation Scheme (GHIS)** is now underway and the selected projects approved will start in 2013. Projects were approved to :

- be innovative and have the potential to be repeatable;
- promote the use of modern methods of construction that can meet or exceed the Silver level of the Scottish Building Standards; and
- provide quality, sustainable, greener homes in suitable locations.

In addition, the greening of the mainstream Affordable Housing Supply programme will be measured against achieving the Silver level of the Scottish Building Standards

for carbon dioxide emissions and space heating with additional support granted to meet this.

## NEW BUILD EXAMPLES

In recognising the higher standards needed for new homes, different builders have risen to the challenge, offering their range of solutions. To achieve these new standards, most have opted for off-site prefabrication of panel sections, which are fitted together on site. At this time, construction costs are higher than traditional build, but this is partly due to small-scale batches being made. Unit costs will fall with larger production runs.

As factory prefabrication is likely to become the norm for new houses, changes in the whole building process will emerge. For example:

- designs will be suited to production-line criteria
- labour will be factory orientated
- materials and components will be delivered to the factory
- waste and on-site accidents will be cut to a minimum
- only finished panels will be delivered to and erected on site.

The housing industry has responded positively to these new challenges, as shown by the following examples.

### Example 1 – Lomond Homes Ltd – Dynamic Insulation Systems

Lomond Homes have used [Energyflo Insulation Technologies' Dynamic Insulation](#) in their 'Breathing Wall' construction system in a housing development at Lochgelly for the Fife Housing Alliance with Kingdom Housing Association and Ore Valley Housing Association. It is a modern method of construction (MMC), using 'fabric first' principles to give affordable performance. This is achieved without much thicker walls, and by using familiar building methods.

Incoming fresh ventilation air is pre-warmed as it is drawn through the external wall itself. The pre-warming reduces the demand for space heating, lowering energy use and carbon emissions and bringing savings on fuel costs.



- **Construction costs** – average works costs £93,500.
- **Market value** – homes are for social rent, so there is no recorded value. However, new homes in the surrounding area are being advertised at £130,000–150,000 for 2-bedroom and £135,000–180,000 for 3-bedroom.



## Example 2 – Passive House

Passive House (or Passivhaus) describes an accreditation process for buildings of a high standard of energy efficiency. To achieve this standard, construction costs are expected to be higher but living costs will be much lower. Each year more homes built to the Passive House standards are commissioned.

The Passive House standard reduces the requirement for space heating and cooling to create high levels of indoor comfort. It is achieved by a ‘fabric first’ approach to the design. This means specifying high levels of insulation and airtightness, and using whole-house mechanical ventilation. Construction costs are higher than for traditional building methods because of the need for higher insulation levels, which means the building has to be larger to accommodate thicker insulation and using triple glazing instead of double glazing and accurately sealed joints throughout.



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[Dormont Park](#), Lockerbie is a development of eight new 2- and 3-bedroom houses, built and certified to the very exacting Passive House standard for long-term affordable private rent. Part funded by the Scottish Government’s Rural Homes for Rent pilot grant scheme, the houses can reasonably claim to be the lowest-energy multi-unit housing development in Scotland. This project received funding to monitor and evaluate the ongoing running / operating costs of Passive Housing, and results / conclusions will be available on completion.

- **Construction costs** – each unit on the Dormont estate cost about £130,000.
- **Market value** – homes are for affordable and market rent, so there is no recorded value. However, new homes in the surrounding area are being advertised at £170,000–180,000 for 4-bedroom.

## Example 3 – AIMC4 Consortium

The [AIMC4 Consortium](#) is a unique partnership created to research, develop and pioneer the volume production of the low-carbon homes for the future. The consortium members comprise developers Stewart Milne Group, Barratt Developments PLC and Crest Nicholson PLC, who are responsible for the design and build of a minimum of 12 world-class energy efficient homes; the Building Research Establishment (BRE), who advise on innovative solutions and evaluate the technical issues; and H+H UK Ltd, an innovative supplier of Aircrete concrete products. BRE Scotland will analyse and evaluate both the performance of the

homes and the occupants' behaviours once the homes have been sold and are occupied.

In the short term, the success of AIMC4 will mean that the next set of Scottish energy standards can be met by 'fabric first' solutions. In the longer term as the sector approaches lower carbon targets making best use of fabric and building services solutions with low- and zero-carbon technologies will yield cost-effective customer-friendly results that can be adapted to differing locations and planning needs. These will also respond to local needs and preferences.

Stewart Milne Homes, which is using its Sigma II Build System and introducing passive and operational energy-efficiency measures to its Woodlands House range, has built two five-bedroom detached houses at Leathan Fields, Portlethen, Aberdeen, and two three-bedroom family homes and one two-bedroom house at Prestonpans, Edinburgh.



- **Construction costs** – not disclosed by Stewart Milne (commercially sensitive).
- **Market value** – on the open-market at Easter 2012, a 2-bedroom offered for sale at £155,995 and a 3-bedroom at £179,995.

#### **Example 4 - Enemetric Limited (formerly Powerwall Space Frame Systems Limited) : Volumetric Buildings**

[Enemetric](#) use a factory built off-site structural steel frame volumetric system to



produce affordable homes. The system achieves high performance in thermal, acoustic and air-tightness specifications.

At Kingdom Housing association's Innovative Showcase development in Dunfermline, Enemetric have supplied a block of four flats which are constructed off-site in their factory in Wishart, transported to the site and erected in two days.

- **Construction costs** – average works costs per unit: £82,821.
- **Market value** – homes are for social rent, so there is no recorded value. However, new homes in the surrounding area are being advertised at £100,000–120,000 for 2-bedroom (flatted).

### Example 5 – Scotframe Limited: Val-U-Therm Closed Panel System

[Scotframe](#) have developed a closed-panel, factory-insulated, high-thermal-performance wall, roof and floor system called Val-U-Therm. It is based on a timber frame injected with polyurethane insulation, which effectively fills every void in the panel.

At Kingdom Housing Association's Housing Innovation Showcase development in Dunfermline, Scotframe have supplied the timber frames to four homes – two 2-bedroom cottages and two 3-bedroom houses which are being used as the 'control houses' for monitoring purposes.



- **Construction costs** – average works costs per unit: £89,671 for 2-bedroom. Average works cost for passive house £124,140 for 3-bedroom and, for the timber frame control house £96,865 for 3-bedroom.
- **Market value** – homes are for social rent, so there is no recorded value. However, new homes in the surrounding area are being advertised at £100,000–120,000 for 2-bedroom (flatted) and £135,000–180,000 for 3-bedroom (house).

### Example 6 – Aurora House – East Kilbride

The [Aurora House](#) is a collaborative project between South Lanarkshire College, Dawn Construction and over 50 private-sector partners. The house shows how a low-carbon, energy-efficient new-build house can be built to meet the twin challenges of global warming and fuel poverty.



The project involved researching, designing and constructing an affordable, low-energy house on the college campus in East Kilbride. It will

be used to promote affordable, low-carbon housing in Scotland, through education, skills development and knowledge exchange.

- **Construction costs** – a similar house built on a larger scale as part of a commercial housing development would cost £135,000–150,000.
- **Market value** – the Aurora House has not been valued. However, new homes in the surrounding area are being advertised at £200,000–240,000 for 4-bedroom.

### Example 7 – CCG Ltd: iQ System

[CCG](#) established an offsite manufacturing division in 2007, initially to produce conventional open-panel timber-frame building components. In late 2009 they moved to new £10m premises in Glasgow that provide a 100,000 sq ft, semi-automated German production line. This can make offsite closed-panel timber-frame building products to a wide variety of designs and specifications, using a team of 30 multi-skilled operatives. The facility is unique in Scotland and one of only a handful in the UK.



The offsite products fall within an ‘iQ system’ brand, encompassing wall, floor and roof cassette panels, manufactured in a strict quality-controlled environment, to consistently achieve high-performance buildings. The offsite installation can include: doors and windows; insulation; electrical, plumbing, ventilation services; internal lining boards; and external lightweight claddings.

CCG’s iQ System has been used in the Commonwealth Games Athletes Village and at Kingdom Housing Association’s Housing Innovation Showcase development in Dunfermline.

- **Construction costs** – average works cost £110,000.
- **Market value** – homes are for social rent so there is no recorded value. However, new homes in the surrounding area are being advertised at £130,000–150,000 for 2-bedroom and £135,000–180,000 for 3-bedroom.

### Example 8– Stewart Milne Group Ltd: Sigma II Build System

Stewart Milne Timber Systems are part of the Stewart Milne Group. They have developed their [Sigma II Build System](#) to achieve superior levels of fabric performance. The system uses conventional materials and skills with an easy-to-

understand approach. It is a 'fabric first' solution that provides an affordable, reliable and simple-to-install Build System, promoting a 'fit and forget' approach. They focus on higher levels of prefabrication to reduce build process and material waste, and a fabric first approach to meeting carbon targets.



Sigma II Build System has been used at Kingdom Housing Association's Housing Innovation Showcase Development in Dunfermline where four 2-bedroom cottage flats have been built.

- **Construction costs** – average works cost £90,676.
- **Market value** – homes are for social rent so there is no

recorded value. However, new homes in the surrounding area are being advertised at £100,000–120,000 for 2-bedroom.

### **Example 9 – Beattie Passive Ltd: Beattie Passive Build System**

The [Beattie Passive Build System](#) is a patented construction method that provides a continuous insulation seal around the core of a timber-framed structure. Using Passive House energy-efficiency principles, the continuous insulation system is housed in a treated timber structure that delivers dramatic cost, time and environmental benefits.

Fife Housing Association have chosen the Beattie Passive Build System for a development of four 3-bedroom homes at Inchkeith Drive, Dunfermline that satisfies both Passive House requirements and provides high-quality economical homes, allowing clients to tackle fuel poverty.

Beattie Passive designed and built the semi-detached homes to meet the needs of the local community. Using traditional and readily available construction materials Beattie Passive's innovative and unique construction method will ensure each home exceeds Passive House standards.



The Association is working closely with tenants settling in to their new homes. They are particularly interested in lifestyle issues and how tenants can get the maximum benefits from a Passive House.

- **Construction costs** – average works cost £112,382.
- **Market value** – homes are for social rent so there is no recorded value. However, new homes in the surrounding area are being advertised at £135,000–180,000 for 3-bedroom.

### **Example 10 - MAKAR – Stittenham, Ardross**

These two bedroom private houses are situated within a woodland site. The houses were designed to accommodate two families building their first homes.

The houses have a good southerly aspect and were designed as (upside down) houses with the open plan living accommodation on the upper level, allowing maximum solar gain and distant views. Service areas and bedrooms are located on the ground floor.



Constructed entirely from local timber such as Scots pine, Scottish larch, spruce and Douglas fir the houses represent a regional response to the materials available. Southerly glazing, sheep's wool insulation and airtight detailing ensure the houses stay warm. Space heating is achieved via wood burning stove and water heating via solar collectors which are also linked to the stove.

In order to minimize cost and wastage the houses were designed to incorporate modern methods of construction and were built in the MAKAR workspace with the superstructures being erected on site within three days.

The houses are finished externally with Larch cladding and profiled roof covering.

- **Construction costs** – average works cost £110,000.
- **Market value** – homes are for private ownership so there is no recorded value. However, new homes in the surrounding area are being advertised at £120,000–135,000 for 2-bedroom.

### Example 11 – Springfield Properties PLC – Duncanshill, Elgin



Springfield are currently building 30 bungalows in Duncanshill in Elgin.

All bungalows sold out within a couple of months and the construction phase is progressing rapidly. This site meets the 2010 Bronze standard building regulations, but Springfield will be constructing 3 identical properties on this site to bronze, silver and gold standards and monitoring them

to establish where they can make improvements and to determine the actual costs to run these properties compared to those stated in EPC's and SAP calculations.

- **Construction costs** – average works cost £110,000.
- **Market value** – homes are for social rent so there is no recorded value. However, new homes in the surrounding area are being advertised at £120,000–135,000 for 2-bedroom.

### Example 12 - Castlehill HA & Scotframe at Port Elphinstone

At Castlehill H A's new housing project in Inverurie, instead of having to connect to the gas grid - an alternative "fabric first" solution used a Scotframe kit which achieved thermal performance and energy efficiency requirements which met Scottish Housing Quality Standards.

The Val-U-Therm high performance thermal fabric solution, coupled with its' thermally engineered details resulted in a much lower level of demand for space heating. This in turn suited the use of electric panel heating system which also significantly reduced the capital costs.



- **Construction costs** – average works cost £138,500.
- **Market value** – homes are for social rent so there is no recorded value. However, new homes in the surrounding area are being advertised at £135,000–180,000 for 3-bedroom.

## Greener homes projects in Scotland – key figures

Anonymised Example	A	B	C	D	E	F	G	H	I	J	K	L
<b>Construction costs</b>	£83K	£89K	£91K	£105K	£110K	£95K	£130K	£120K <sup>7</sup>	£110K	£112k	£138K	£135K–150K
<b>Energy use per m<sup>2</sup></b>	67kWh (2 bed)	88 kWh (2-bed GF)	76kWh	91kWh	100kWh	131kWh (3 bed)	57kWh	78kWh	19kWh (3 bed)	53kWh	121kWh	-2kWh
<b>CO<sub>2</sub> emissions per m<sup>2</sup></b>	13kg	15kg	14kg	17kg	4kg	22kg	4kg	14kg	4kg	9kg	21kg	-3kg <sup>8</sup>
<b>Running costs<sup>9</sup></b>	£322	£301	£292	£337	£300	£492	£127	£290	£331	£300 <sup>10</sup>	£482	£318
<b>Running costs of a standard (similar size) property<sup>11</sup></b>	£920–1000	£920–1000	£920–1000	£920–1000	£920–1000	£1210–1370	£1210–1370	£1210–1370	£1210–1370	£1210–1370	£1210–1370	£1370–1610
<b>Minimum difference between running cost</b>	£598	£619	£628	£583	£620	£718	£1083	£920	£879	£910	£728	£1052
<b>Market value<sup>12</sup> (range)</b>	£100K–120K 2-bed flats	£100K–120K 2-bed flats	£100K–120K 2-bed cottages	£120K–130K 2-bed houses	£120-135K 2-bed houses	£135K–180K 3-bed houses	£170K–180K	£180K 3-bed houses	£135K–180K 3-bed houses	£135K–180K 3-bed houses	£135K–180K 3-bed houses	£200K–240K

<sup>7</sup> Estimated cost – not disclosed as commercially sensitive.

<sup>8</sup> Negative CO<sub>2</sub> emissions achieved through on-site energy generation

<sup>9</sup> Running/energy costs include lighting, heating and hot water costs and are taken from Energy Performance Certificates (but do not include household appliances like TVs and fridges).

<sup>10</sup> Estimated costs as data is currently not available.

<sup>11</sup> Current homes in Scotland – energy costs include lighting, heating and hot water and are taken from the Scottish House Condition Survey 2009.

<sup>12</sup> Market value is taken from current new-build prices in the local areas.



## DEMONSTRATION / CATALYST PROJECTS

In Scotland there are several important and innovative housing projects that use new construction methods and techniques. They are producing high-quality, energy-efficient building with reduced carbon emissions.

### Commonwealth Games 2014 – Athletes Village

The Athletes Village is being built by the [City Legacy Consortium](#), made up of CCG, Cruden, Mactaggart & Mickel, and Malcolm. After the Games, it will become a residential community with housing, amenities and public spaces, some on a riverside setting. City Legacy will build a range of affordable properties on this site, regenerating the local area.



From two-bedroom apartments to four-bedroom houses, the residents of the Athletes Village will have a wide choice of property type. All will be built as sustainable homes, meeting the 60% carbon-reduction targets set. It is expected that this will significantly cut energy bills. 704 homes are being built with 304 for private sale, 100 for mid-market rent and 300 for affordable rent through local housing associations.

In addition, Vital is designing a bespoke CHP (combined heat and power)-based district-heating system for the Athletes Village and National Indoor Sports Arena in Glasgow, ultimately helping the development reduce its projected carbon output by up to 60%.

### The Glasgow House

The '[Glasgow Houses](#)' are four semi-detached energy-efficient prototypes of modern sustainable homes built by City Building, within Laurieston Skills Academy in Glasgow. They have exceptionally high levels of insulation and air tightness. Efficient heating systems use solar gain through the use of sun rooms, solar thermal panels and mechanically ventilated recovery systems. Independent validation testing on the homes' energy performance by the Mackintosh School of Architecture's Environmental Architecture Research Unit in Glasgow show that the houses give a two-thirds reduction in typical energy costs for a 3-bedroom house.



Using the results of in-house energy monitoring and lessons learned during the construction process, the design team are currently refining the product. They aim to achieve further efficiencies and incorporate them into future house-building programmes to help address the urgent need for more energy-efficient houses in Scotland. The knowledge gained from these prototype houses is being used, together with value engineering, to develop a range of more cost-efficient 'Glasgow House Type 2'. These homes will be part of a pilot project on a larger housing regeneration development site for a registered social landlord in the East End of Glasgow.

### **Housing Innovation Showcase 2012**

The [Housing Innovation Showcase 2012](#) is a partnership between Fife Council and The Fife Alliance, and is also supported by Fife Construction Forum and Green Business Fife. The development is managed and procured by Kingdom HA, as the lead developer for the Fife Alliance. Contractors developed plots of land using a selection of modern methods of construction. The aim is to showcase innovation in affordable housing, through design and construction that uses different approaches. An 'open house' event was held in May 2012. There is now extensive on-going monitoring of the occupied dwellings.



The main objectives of the project are to:

- develop a range of house types using modern methods of construction to meet a range of affordable housing needs
- show that the house systems used could become part of mainstream use in a wider affordable housing programme
- trial and promote sustainable housing products and services
- deliver community benefits as part of the project
- promote affordable housing in Fife.

Kingdom H.A. having concluded the construction phase of this project, aim to produce a report in January 2013 comparing and contrasting the different modern methods of construction used in this development.

Further information on this project is available on – [www.housinginnovationshowcase.co.uk](http://www.housinginnovationshowcase.co.uk)

## BRE Innovation Park

The [BRE Innovation Park @ Ravenscraig](http://www.bre.co.uk) follows a 'ground-up' approach to sustainable planning and development. The site features porous road surfaces and paving, a three-stage SUDS system, native planting and landscaping, street furniture and lighting, and a natural play area.

Nine demonstration dwellings will be constructed, which will showcase products and technologies that meet Scotland's future energy needs. A visitor centre will operate as a community facility, engaging with local groups such as schoolchildren, young adults and FE colleges. The visitor centre will also be a high-performance show building in its own right.



## RETROFIT of EXISTING HOMES EXAMPLES

Around 80% of current housing in Scotland is expected still to be occupied in 2050. So the primary focus must be on retrofitting of existing homes to increase energy efficiency, tackle fuel poverty and incorporate appropriate renewable technologies. Significant progress has been made, particularly in providing low-cost insulation through the active promotion and integration of Scottish Government and UK programmes, such as Universal Home Insulation Scheme (UHIS); Carbon Emissions Reduction Target (CERT); and, Community Energy Saving Programme (CESP). Yet there remains great potential for further action – for example, 544,000 homes still need cavity wall insulation and 611,000 homes have solid walls<sup>13</sup>. This presents a huge opportunity for Scottish businesses to take action to tackle fuel poverty and reduce emissions.

### Aberdeen Heat & Power – combined heat and power

Aberdeen Heat & Power Ltd is a 'not for profit' company that was set up by Aberdeen City Council in 2002 to develop and operate district heating and combined heat and power (CHP) schemes in their area<sup>14</sup>. The scheme has grown through the development of three principal projects and now supplies around 1,200 flats in multi-storey blocks and eight public buildings.

- Carbon emissions from these buildings have reduced by 45% and typical fuel costs to tenants have reduced by 50% over the previous heating system.

The company continues to develop its district heating network and is installing a £1m extension of underground mains towards the city centre. The aim is to provide heat to the Council's Town House and other public buildings en route.

### Glasgow Housing Association (GHA) – solar panels

GHA has fitted solar panels in 500 homes across the city – to help tenants save on their fuel bills and to protect the planet. The solar panels are designed to reduce the carbon footprint of each home and also provide free electricity during the day for its residents. Solar panels are just one way GHA is contributing to Sustainable Glasgow – a partnership that aims to make Glasgow one of the most sustainable cities in Europe and reduce the city's CO<sub>2</sub> emissions by 30 per cent by 2020.

- Tenants will benefit from free electricity during daylight hours – saving them around £100 a year on their bills.

<sup>13</sup> Source: 2010 Scottish House Condition Survey – includes 'other walls', e.g. steel-frame, pre-fabricated concrete.

<sup>14</sup> The schemes have received three high-profile awards: UK Housing Awards 2008 – Increasing Environmental Sustainability and Outstanding Achievement in Housing in the UK; and the COSLA Excellence 2008 silver award.

- Each house fitted with solar panels could cut 24 tonnes of CO<sub>2</sub> emissions over a 25-year period – equivalent to filling five hot air balloons or five Olympic swimming pools.

### **Dundee Multi retrofit project – District Heating**

The four 14-storey multi-storey blocks – Dallfield, Tulloch, Bonnethill and Hilltown Courts – which stand at the bottom of Dundee's Hilltown, are home to 336 households. Their prominence on the Dundee skyline provides a stunning illustration of the benefits of Community Energy Saving Programme (CESP) funding. In this case, the CESP funding has come from Scottish Gas.

As well as helping the Council to achieve the Scottish Housing Quality Standard (SHQS) and climate-change targets, this will deal a major impact to fuel poverty by cutting bills. To achieve this, gas is bought at commercial rates. To discourage tenants from wasting fuel, supplies have been metered. Enviro-Energy has devised a pay-as-you-go system, using its meters and wireless technology, so that tenants are responsible for their own fuel use. A unit rate for heat was set by taking the commercial rate and adding allowances for distribution losses and management charges. The resulting charge to tenants is less than the cost of domestic gas.

- In changing from electric heating and un-insulated walls to gas-fired district heating and insulated walls, tenants can expect their fuel bills to fall by at least 30%.
- For each property, there will be a lifetime saving of 40 tonnes of carbon.

### **Cube Housing Association – combined heat and power**

Cube Housing Association is working with Scottish Gas and SSE to deliver the £27 million project on the Wyndford Estate in Maryhill. The scheme includes installing a new district heating system and cladding 11 multi-storey blocks to make them more energy efficient. Up to 1,900 homes in a Glasgow community are to benefit from this multi-million pound scheme that will provide low-cost, energy-efficient heating and hot water for residents.

At the heart of the Wyndford scheme will be a combined heat and power (CHP) engine. The CHP uses gas to produce both electricity and hot water in a highly efficient way. The CHP will be housed in a new energy centre at the edge of the estate. The energy centre will also house gas boilers and a large thermal store (hot water tank). The energy centre will provide all the hot water and heating for the 1,527 tenanted properties and could supply up to 400 privately owned properties on the estate through a 5km network of new underground hot-water pipes. The electricity generated by the CHP will be exported to the local grid. The majority of the homes will be externally insulated to further increase energy efficiency and get the best from lower-cost heating.

- The system takes away the need for each home to have an individual boiler – making it an affordable, energy-efficient way of heating homes. It is estimated that as much as 7,000 tonnes of carbon emissions will be saved every year.

### **Improving hard-to-treat properties**

The Scottish House Condition Survey estimates that nearly a third (about 30 per cent) of Scotland's housing is 'hard to treat'. Most of these are solid-walled homes. While new-build developments are set to achieve higher and higher building standards, the vast bulk of our housing – the existing stock – is often overlooked.

Many of our older housing estates were developed at a time when design and construction didn't consider insulation, and to fit it now presents a challenge. Insulating older properties usually begins in the roof space, using quilt or granular material. Improving an existing wall needs a different approach: insulation can be applied externally, internally or into a cavity. Each approach has been used successfully, but as with every project, professional advice should be sought before deciding on a course of action.

- Shettleston Housing Association has a programme of works replacing the original exterior steel sheeting on their timber-framed houses. Costs for external insulated cladding will depend on the extent and specification of the works involved, but can vary between £12,000 and £25,000 per unit.
- Internal wall insulation can be a cost-effective alternative, especially where planning requirements restrict the use of exterior insulation and cladding. Costs usually range between £5,000 to £7,500 per unit – excluding redecoration and decant costs.
- Filling the cavities with insulation (in masonry walls) reduces heat loss and lowers fuel bills. A range of products are available, usually injected or blown under pressure into the cavity. Costs depend on the size and construction type, varying from £400 to £1,000.
- For some 'hard to treat' properties, another option is to insulate the cavity between for example, a solid-stone or no-fines concrete wall, and the plaster and lath or plasterboard internal finish. This approach has only recently been considered viable. It uses a low-pressure injection technique and is being pilot-tested by Grampian HA in Aberdeen.
- Robert Gordon's University in Aberdeen are preparing a report on this project.

## KEY FUNDING SOURCES TO FACILITATE ENERGY-EFFICIENCY MEASURES

<b>Name and delivery Funding / assistance</b>	<b>Eligibility</b>	<b>Funding and timing</b>
<p><b>Energy Company Obligation (ECO)</b> Main energy suppliers Amended powers underpinning CERT and CESP so as to provide a new obligation that will underpin the Green Deal</p>	<p>It will focus particularly on those householders most in need of support (e.g. the poorest and most vulnerable) and those types of property which cannot achieve financial savings without an additional or different measure of support (e.g. those with solid walls). Will also contain a Carbon Saving Communities obligation which will provide support to households in low income areas.</p>	<p>Estimated to be worth up to £120m per annum in Scotland.</p>
<p><b>Feed-in-tariffs</b> Energy providers Savings on energy bills as households will be generating their own electricity.</p>	<p>Individuals, local authorities, community groups and other organisations.</p>	<p>Depends on the scale of kilowatt hours of energy the technology generates.</p>
<p><b>Renewable Heat Incentive (RHI)</b> Department of Energy and Climate Change (DECC) Renewable energy generation is estimated and fixed payment is made based on the estimate.</p>	<p>The domestic sector will be linked to the Green Deal – expected in the summer of 2013. In the interim period, support will be available for the domestic sector through the <a href="#">Renewable Heat Premium Payment scheme (RHPP)</a>.</p>	<p>Variable, based on the estimate of renewable energy generated.</p>
<p><b>SPRUCE</b> AMBER – as the fund manager Programme is split between property and infrastructure and energy-efficiency investments.</p>	<p>13 local authority areas – as determined by the Scottish Index of Multiple Deprivation.</p>	<p>£50m in total. £15m to be used for energy efficiency. Until 2015 – although, loan funding will be recycled into new projects beyond that.</p>
<p><b>Green Deal</b> Certified and accredited Green Deal Finance Providers/and certified installers A financial ‘pay as you save’ framework to enable energy-saving measures to be paid for in instalments via electricity bills.</p>	<p>Finance to fund energy-efficiency improvements of domestic and non-domestic properties.</p>	<p>Market-driven initiative, so no estimation of take-up. Launched January 2013.</p>
<p><b>Community and Renewable Energy Scheme</b> Community Energy Scotland Ltd Loan finance of up to £150K available to cover pre-planning costs for any renewable project.</p>	<p>Not-for-profit community-based organisations.</p>	<p>£23.5m allocated to continue the scheme until 2015.</p>

## KEY FUNDING SOURCES TO FACILITATE ENERGY-EFFICIENCY MEASURES

<b>Name and delivery Funding / assistance</b>	<b>Eligibility</b>	<b>Funding and timing</b>
<p><b>District Heating Loan Fund</b> Energy Saving Trust</p> <p>Loans of up to £400,000 to support district-heating networks for both low-carbon &amp; renewable technologies, aiming to overcome of infrastructure costs.</p>	<p>Open to registered social landlords, local authorities, SMEs and ESCOs. Individuals and householders are not eligible.</p>	<p>£5m allocated to continue the scheme until 2015.</p>
<p><b>GAS INFILL FUND</b> Scottish Government</p> <p>Loan funding aimed at facilitating the connection of more households and communities to the gas grid/extension of the gas grid</p>	<p>Support available to individual households (interest-free loans) and to project aggregators (commercial loans).</p>	<p>£5m available in total - £1m in 12/13 and £4m in 13/14</p>
<p><b>Renewable Energy Investment Fund (REIF)</b> Scottish Government</p> <p>Will allow communities all over Scotland to reap the benefits of our green energy revolution</p>	<p>Supporting communities and rural businesses to develop their own local renewable projects, on supporting district heating, and on supporting wave and tidal developers with the development and deployment of array projects.</p>	<p>£103 million investment fund</p>
<p><b>Warm Homes Fund</b> Scottish Government</p> <p>Focus on the potential of renewable energy to provide a long-term, sustainable way of tackling fuel poverty.</p>	<p>Will assist those living in communities that are affected by fuel poverty. Eligible organisations include RSLs and locally based development trusts.</p>	<p>Estimated at £50m – up to 2015.</p>
<p><b>Home Energy Efficiency Programmes for Scotland</b> Scottish Government</p> <p>Comprising area based schemes led by Councils and leveraging in ECO funding from energy companies and national schemes to provide support to more vulnerable households.</p>	<p>Area based schemes: will be dependent on Councils but will need to be ECO eligible measures and all households in the defined area should be offered support.</p> <p>National schemes: mainly insulation and heating measures for the most vulnerable households across</p>	<p>£79m of funding for 2013-14</p> <p>With funding levered out of ECO, can deliver £200 million expenditure in Scotland.</p>

### WEB PORTALS that identify funding and/or other forms of support:

- [Energy Savings Trust](#)
- [Community Energy Scotland](#)
- [Scottish Government – Sustainable Housing](#)



- [European Union – Sustainable Housing](#)
- [European Investment Bank](#)
- [Energy Efficiency Partnership for Buildings](#)

## Explanation of terms and key areas to note

**Energy use costs** – to get the most from a greener home, lifestyles changes are necessary. As households are educated on how to work with the technology, this will be reflected in future energy-cost savings. In the examples we show, energy costs include lighting, heating and hot water and have been taken from the Energy Performance Certificates (EPC) for each home. To estimate heating costs, EPC's assume that for the heating season:

- homes are heated 9 hours each weekday and 16 hours a day at the weekend, and
- the main living area is heated at 21°C and the rest of the home at 18°C.

Individual householders' heating patterns will differ, but these assumptions enable properties to be compared on a like-for-like basis.

**Fabric Efficiency** - this means is that U-values, the measure of how well walls, roofs or floors stop heat leaving the dwelling, thermal bridging and air permeability have to be addressed.

**Green building** – buildings designed, planned and constructed to give priority to their current and future environmental impact. This results in lower carbon emissions and more energy-efficient buildings. The main characteristics of green buildings are as follows:

- Increasing the efficiency with which buildings and their sites harvest energy, use water, and materials.
- Reducing the impact of the whole building cycle on human health and the environment through better site planning, design, construction, operation, maintenance and removal.
- Creating energy-efficient homes: a well insulated fabric with good levels of air-tightness, energy-efficient appliances, windows, ventilation systems and water use.
- Using recycled and/or environmentally sustainable materials in the building process.
- Using the building site in a sustainable way.
- Using local manufacturers.
- Ensuring high indoor air quality.

**Hybrid** – A method that combines panelled and volumetric construction (also called semi-volumetric). Typically, hybrid construction uses volumetric units for frequently-used areas such as kitchens and bathrooms (sometimes called 'pods'), and panels for the rest of the building.

**Low-carbon technologies** – Examples include heat pumps and solar panels and they have a vital role to play in the move towards a green economy. Such technologies could reduce the carbon use of processes at every stage of the energy supply chain – from low-carbon energy generation, through storage and transmission, to end-user efficiency. In doing so, carbon dioxide emissions will be reduced, jobs will be created, and the UK economy will grow sustainably.

**Market value** –The market for green homes is in its infancy, so green building features are not yet recognised in property values. For the examples in this prospectus, the figures given are the current values of properties of that size in that area.

**Modern methods of construction** – These are ways of producing more, better-quality homes in less time. They are about better products and processes. They aim to improve business efficiency, quality, customer satisfaction, environmental performance, sustainability and the predictability of delivery times. Modern methods of construction are, therefore, more broadly based than a particular focus on product. They engage people and processes to seek improvement in the delivery and performance of construction.

**Off-site construction** – These are structures built at a different location than the location of use. Off-site construction occurs in a manufacturing plant specifically designed for this type of process. Individual modules of the building are constructed in the factory then transported to the site on specially designed trailers. Concrete foundations are dug into the earth allowing the building to be set at grade level, eliminating the need for ramps and stairs. Once on site, the building will be installed onto a permanent foundation by fastening it to the ground and to other modules and covering and sealing the seams. These buildings meet all applicable building standards and are indistinguishable from traditional site-built construction.

**Panelled construction** – Flat panels are produced off-site and assembled on site to produce a three-dimensional structure. The most common approach is to use open panels consisting of a skeletal structure. More complex or closed panels are more prefabricated and typically include lining materials and insulation. Services, windows, doors, internal finishes and external cladding may also be incorporated into the panel.

**Passive House (or Passivhaus)** – This describes an accreditation process for buildings of a high standard of energy efficiency. To achieve this standard, construction costs are expected to be higher but living costs will be much lower.

**Renewables** – This include biomass heating, combined heat and power, heat pumps, solar thermal units, photovoltaic or other renewables use to heat the dwelling

**Retrofit** – Refurbishing or re-fitting existing homes to make them more energy efficient.

**SAP** – Government's Standard Assessment Procedure for energy rating of homes. SAP 2009 is adopted by Government as part of the UK national method for calculating the energy performance of buildings. It is used to demonstrate compliance with Building Regulations for dwellings – Part L (England and Wales), Section 6 (Scotland) and Part F (Northern Ireland) – and to provide energy ratings for dwellings.

**SUDS or Sustainable Urban Drainage Systems** – they are a sequence of water management practices and facilities designed to drain surface water in a manner that will provide a more sustainable approach than what has been the conventional practice of routing run-off through a pipe to a watercourse.

**Sustainability Labelling System** – The labelling system in Section 7, 'Sustainability' of the Technical Handbooks in the Scottish Building Standards rewards new buildings that meet the 2010 building standards with a Bronze level label. Further optional upper levels of sustainability are defined by Silver, Gold and Platinum labels. These have been created by identifying cost-effective benchmarks verifiable by the building warrant system.

**Volumetric construction** – The building is made off-site in modules, which are then assembled on site. Modules may be constructed in various forms, from a basic structure to fully furnished and serviced units.

**Update complete 18 March 2013**