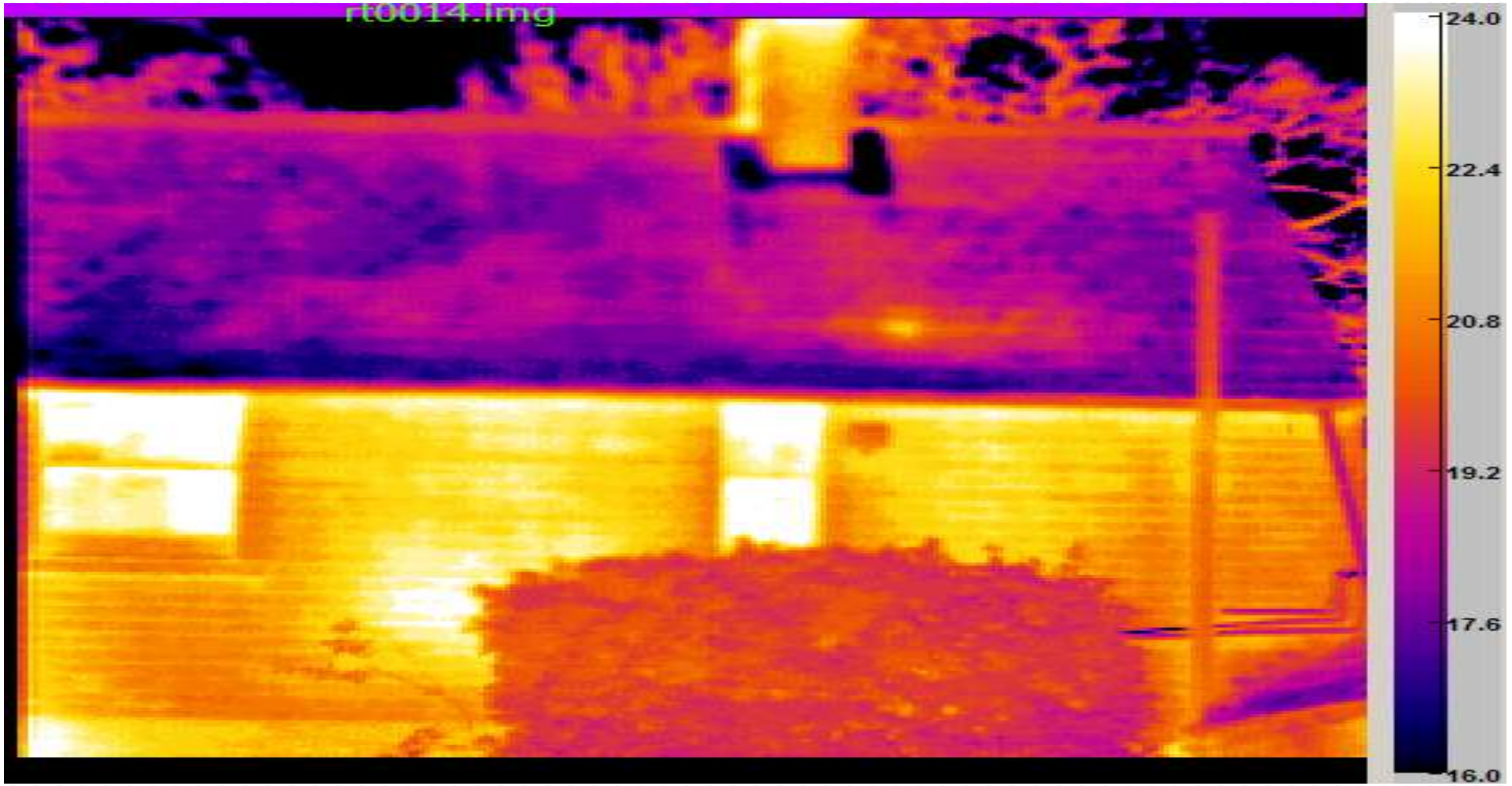
Low-energy, low carbon buildings – design, construction, construction waste….

South Lanarkshire College
East Kilbride



South Lanarkshire College
East Kilbride

Low Carbon House

- Energy and CO2 Emissions
- The Code for Sustainable Homes
- The Code for Sustainable Homes sets six levels of sustainability for new build housing. Each level includes mandatory requirements for energy performance and water usage, together with tradable requirements for other aspects of sustainability.
- In terms of energy, the requirements are a percentage reduction in carbon emissions compared with Building Regulations Part L1 (2006), as follows:
  Code level 1 - 10%
  Code level 2 - 18%
  Code level 3 - 25%
- Code level 4 - 44%
- Code level 5 - 100%
- Code level 6 - Zero carbon ???

SLC South Lanarkshire College East Kilbride

Key to a successful low-energy or energy-efficient building:

effective insulation
outstanding levels of airtightness
minimal thermal bridging

South Lanarkshire College
East Kilbride

Airtight/excellent thermal properties
Triple glazing
Innovative ventilation system
air-heat recovery system
solar hot-water panels
up-to-date ground source heat pump
rainwater harvesting system
photovoltaic panels
kinetic energy switches reduce the need for wiring
Low-temperature-fired "earth bricks"
Low-maintenance exterior

SLC South Lanarkshire College East Kilbride

South Lanarkshire College
East Kilbride

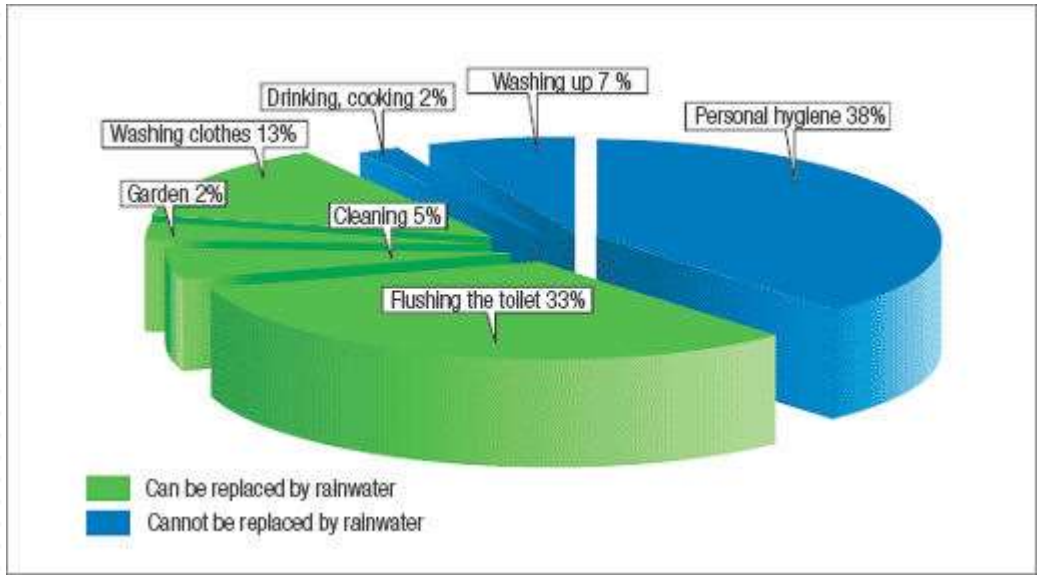
South Lanarkshire College
East Kilbride

Sun pipes

South Lanarkshire College
East Kilbride

Drilling for ground Source heat pump

South Lanarkshire College
East Kilbride



REHAU
Unlimited Polymer Solutions

SLC South Lanarkshire College East Kilbride

SLC South Lanarkshire College East Kilbride

Lessons learned

Minimise energy use first, then consider the appropriateness of micro-renewables in order to reduce reliance on carbon-rich fuels, including fossil fuels.

Ground source heat pump has used about a quarter of the energy expected – engineers over-specify.

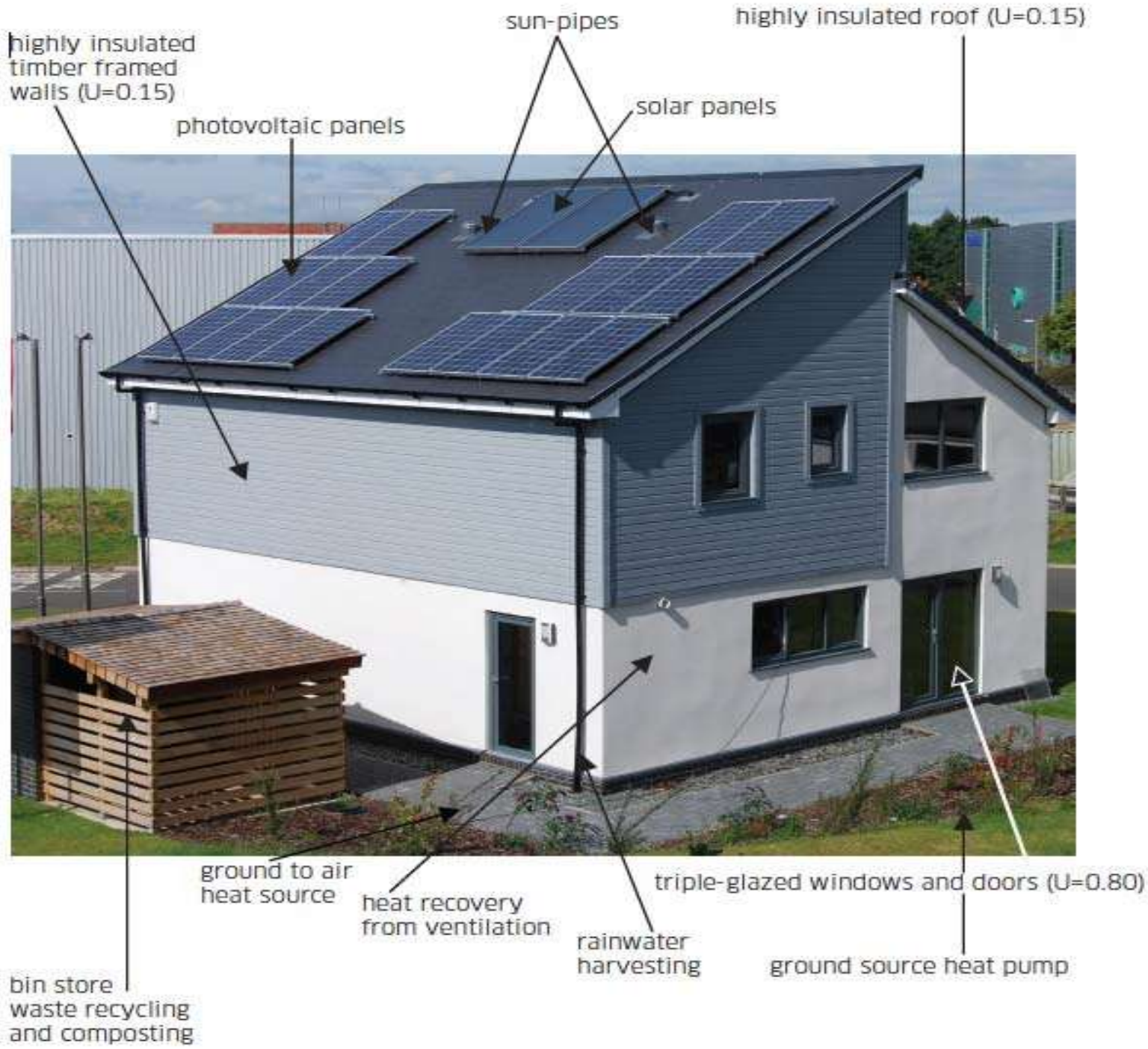
Air intake system:

December 2009: Outside air temp -12 degrees. Heating switched off deliberately to test insulation and air tightness …inside house temp dropped from 21 degrees centigrade to 20 degrees after 14 days.

Overall lesson learned environmental and economic approaches go hand in hand:

Reduce use of energy first THEN consider micro-renewables.

SLC South Lanarkshire College East Kilbride



South Lanarkshire College
East Kilbride

Recurring question:

"ahhh but can you replicate this with a more industrial/commercial size of building?

South Lanarkshire College
East Kilbride

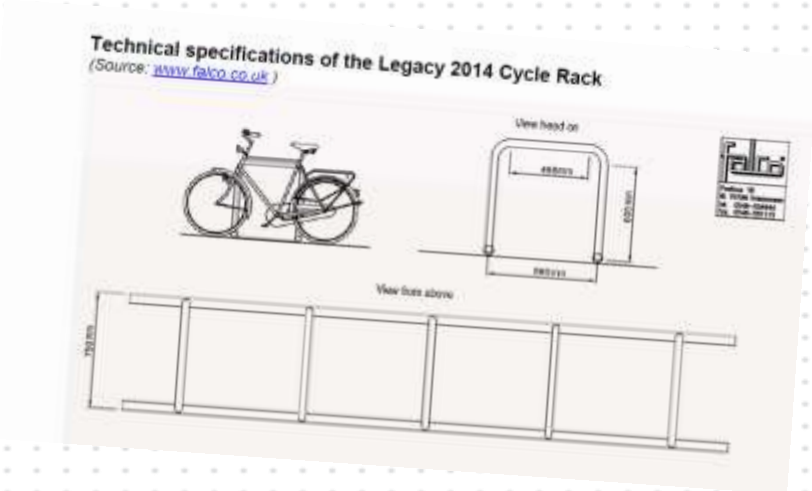
SLC South Lanarkshire College East Kilbride

Careful construction

- Design – user consultation
- Life cycle costing
- Timber sourcing
- Contractor procurement – distance, minimal waste, biodiversity before and after, environmental audit of suppliers
- Fabric first – design, insulation (recycled paper), minimal thermal bridging, airtight..
- Triple glazing

SLC South Lanarkshire College East Kilbride

- Edinburgh College, Sighthill Campus
- Fife College, Dunfermline
- Glasgow School of Art, Haldane building
- Inverness College UHI, Inverness
- Robert Gordon University, Aberdeen
- South Lanarkshire College
- University of Aberdeen
- University of St Andrews: Andrew Melville Hall
- University of Edinburgh: Peffermill campus
- University of Glasgow: Gilmorehill campus and Garscube campus
- University of Strathclyde
- West Lothian College, Livingston



South Lanarkshire College
East Kilbride

Waste Management Plan

South Lanarkshire College
East Kilbride

During construction

minimise waste.

Calculated carefully

what we needed and

rdered the right

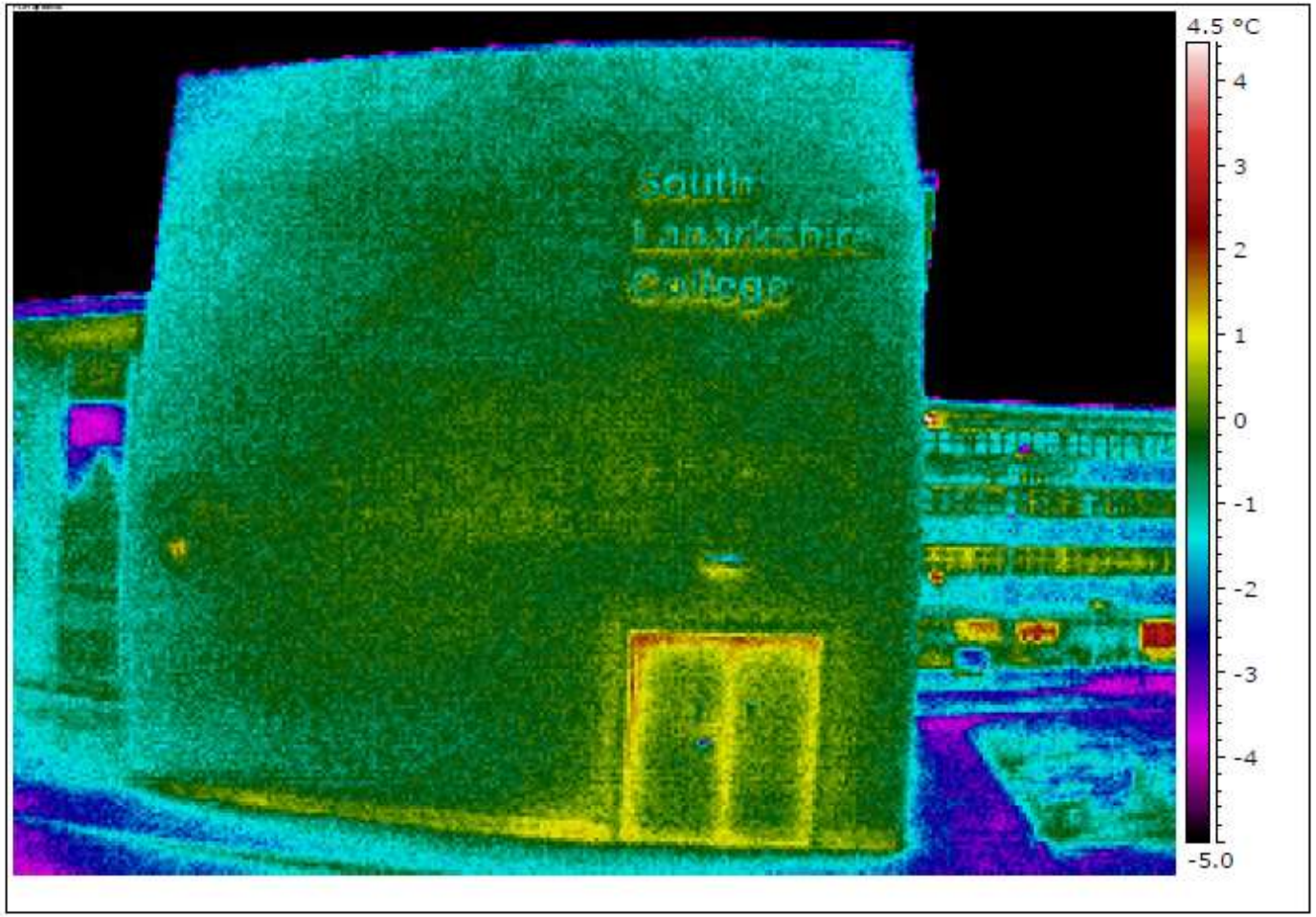
amount.

South Lanarkshire College
East Kilbride

Thick insulation to retain heat in winter and minimise the need for heating.

But is this the equivalent of asbestos for our next generaton?

South Lanarkshire College
East Kilbride



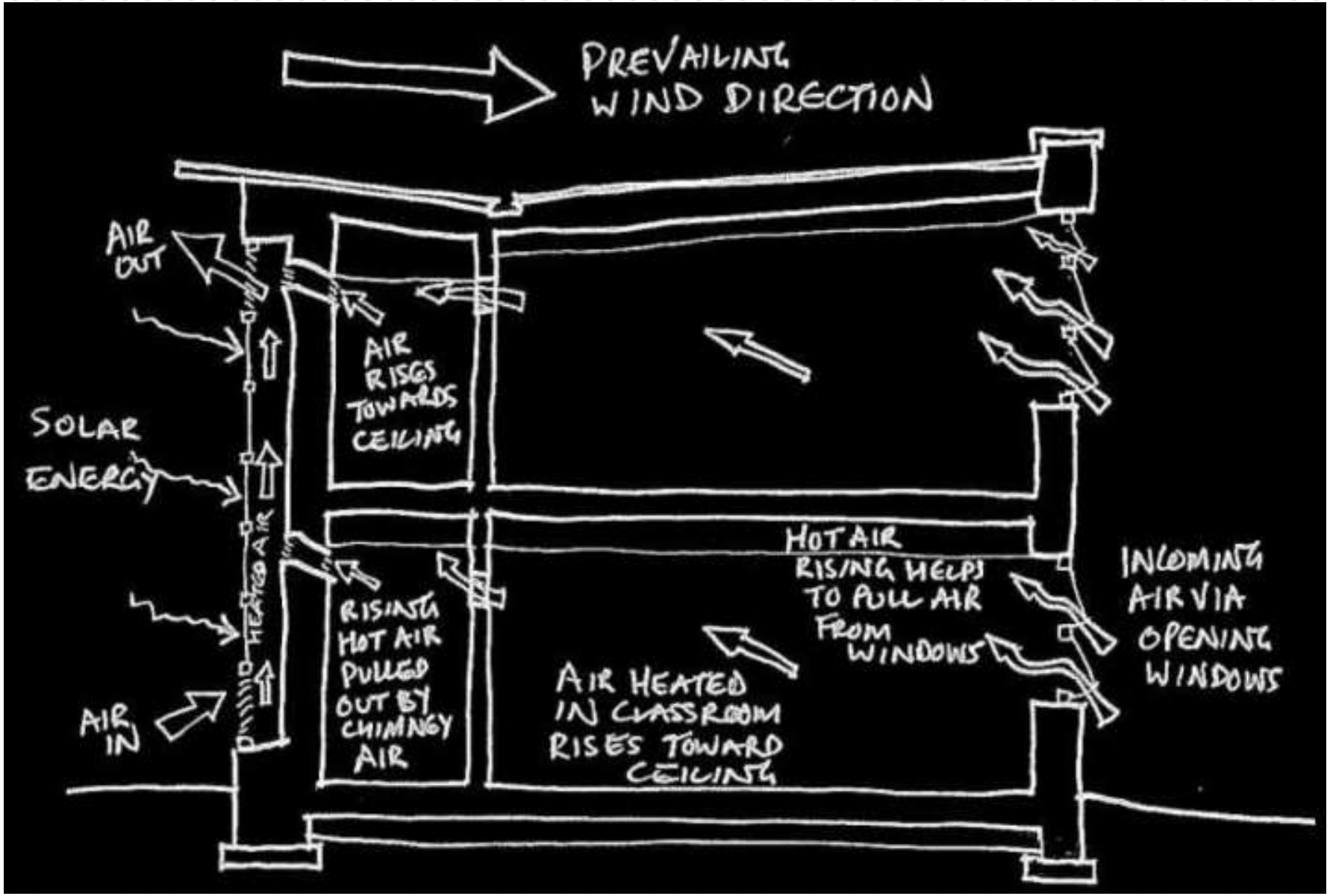
Analysis

Green colours across the elevation within the above thermal image reveal consistent temperatures characteristic of a good level of insulation.

South Lanarkshire College
East Kilbride

Triple glazing

South Lanarkshire College
East Kilbride



Low pressure in corridors pulls air from classrooms

South Lanarkshire College
East Kilbride

EUROPE & SCOTLAND
European Regional Development Fund
Investing in your Future

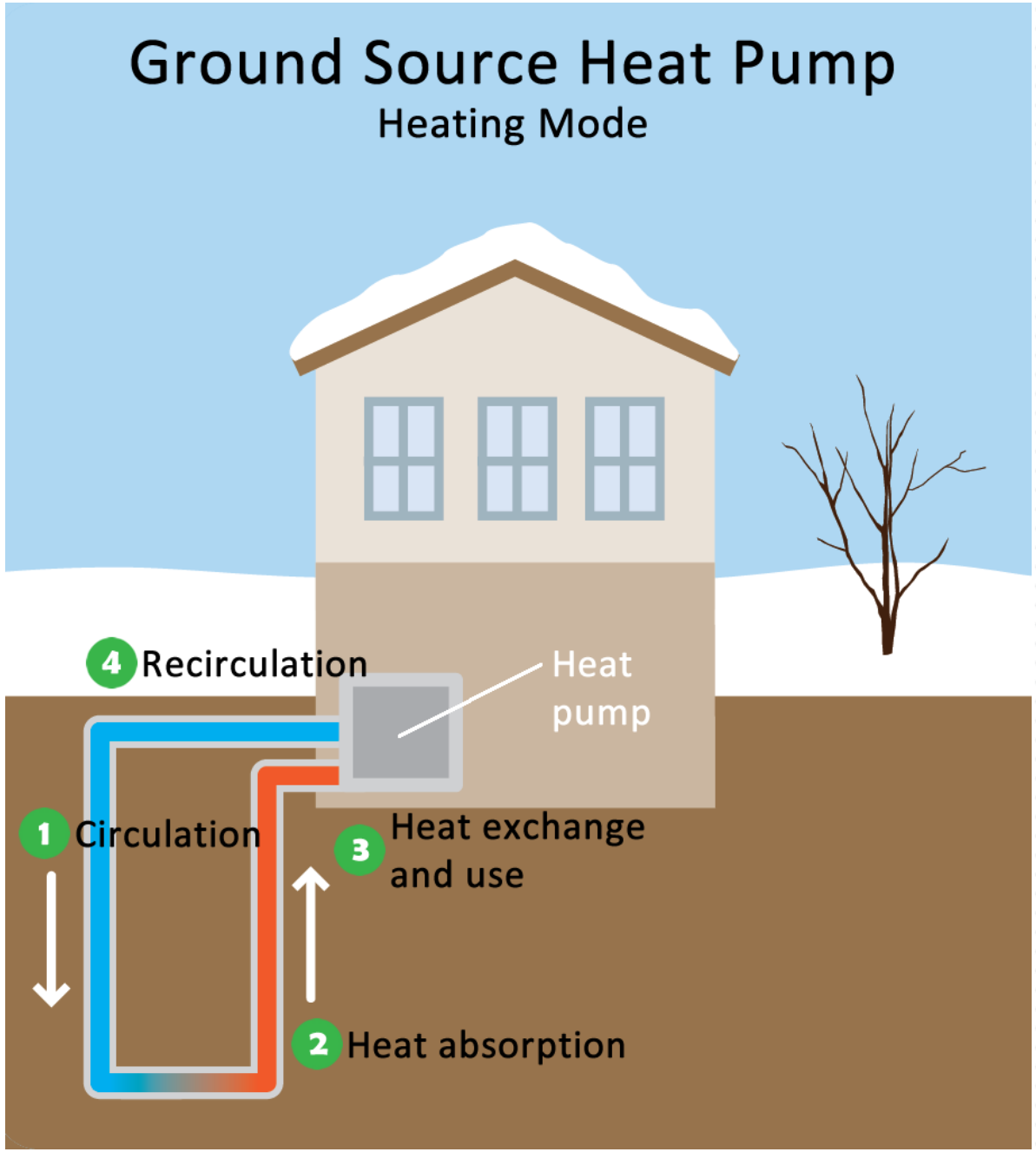
SOLAR CHIMNEYS FOR VENTILATION.

Louvres - arrowed

Low-energy, low carbon, low costs, keep it simple.
Corridors orientated towards the south.
No direct sunshine/heat to classrooms.

SLC South Lanarkshire College East Kilbride

South Lanarkshire College
East Kilbride



Back up system?

Top up system

Sizing the system

South Lanarkshire College
East Kilbride

- **Underfloor heating system – most efficient location for heat transfer to**

- **Reflective insulation under the heating coils**

South Lanarkshire College
East Kilbride

Solar panels produce

more energy each year

than the building uses

80kW at peak

South Lanarkshire College
East Kilbride

South Lanarkshire College
East Kilbride

NO!

- No complex lighting management system.
- No air conditioning, no associated problems with maintenance, legal requirements for regular testing, gas loss etc..
- No noise pollution from air conditioning systems.
- No fossil fuel or biomass boilers.
- No carbon emissions from heating systems?
- No complex building management system.
- Keep it simple…..

SLC South Lanarkshire College East Kilbride

Summary: South Lanarkshire College estate

Three buildings

Two are low-energy, low-carbon buildings with "fabric first", triple glazing, GSHP, PV, Rainwater harvesting, underfloor heating (One has solar thermal panels)

Main building: retro-fit GSHP, Air source heat pump and 300 solar panel array to offset energy use.

Environmental attraction – less energy use; less raw material use; less waste; fewer resource-intensive systems; less environmental damage; lower carbon emissions.

Financial attraction – lower lifecycle costs; lower running costs.

SLC South Lanarkshire College East Kilbride

Energy Performance Certificate

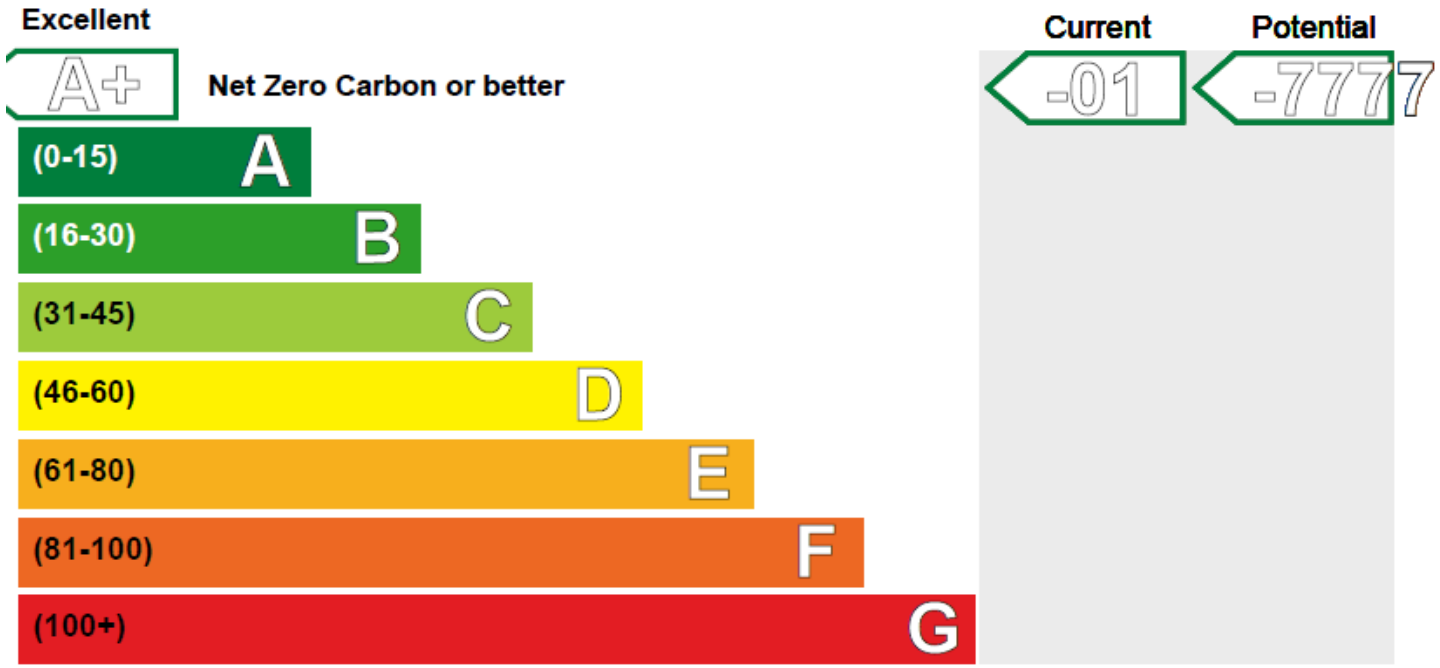
Non-Domestic buildings and buildings other than dwellings

Scotland

Annex Building South Lanarkshire College, College Way, East Kilbride G75 0NE

Date of assessment:	18 December 2015	**Reference Number:**	9929-1949-4335-1890-4020
Date of certificate:	26 January 2016	**Building type:**	Universities/college
Total conditioned area:	556.86m²	**Assessment Software:**	EPCgen, v4.1.e.5
Primary energy indicator:	56 kWh/m²/yr	**Approved Organisation:**	CIBSE Certification Ltd

Building Energy Performance Rating



Approximate Energy Use:	19 kWh per m² per year
Approximate Carbon Dioxide Emissions:	-0.67 kgCO_2 per m² per year

The building energy performance rating is a measure of the effect of a building on the environment in terms of carbon dioxide (CO_2) emissions. The better the rating, the less impact on the environment. The current rating is based upon an assessor's survey of the building. The potential rating shows the effect of undertaking all of the recommended measures listed below. The Recommendations Report which accompanies this certificate explains how this rating is calculated and gives further information on the performance of this building and how to improve it.

SLC South Lanarkshire College East Kilbride

BREEAM® UK

Code for a Sustainable Built Environment
www.breeam.org

Final Certificate

This is to certify that:

Low Carbon Teaching Building
South Lanarkshire College
College Way
East Kilbride
South Lanarkshire
G75 0NE

has been assessed to:

BREEAM UK New Construction 2014:
Education (Fully Fitted)

by a licensed assessor for:
South Lanarkshire College
and has achieved a score of **90.4%**
Outstanding

★★★★★

Certificate Number: **BREEAM-0061-1095** Issue: **01**

22 February 2016
Date of Issue

Signed on behalf of BRE Global Ltd.

Gavin Dunn
Director, BREEAM

South Lanarkshire College
Developer

Austin-Smith:Lord
Architect

Cundall
Building Services

Will Rudd Davidson
Civil & Structural Engineer

Easlar
Assessor Company

Amanda Gallagher
Licensed Assessor

AG07
Assessor Number

CCG Scotland
Principal Contractor

Gardiner and Theobald
Project Management

Doig and Smith
Quantity Surveyor

This certificate is issued by BRE Global Ltd to the Licensed Assessor named above based on their assessment of data provided by the Client and verified at the time of Assessment.
This certificate remains the property of BRE Global Ltd and is issued subject to terms and conditions - visit www.greenbooklive.com/terms
To check the authenticity of this certificate visit www.greenbooklive.com/check, scan the QR Tag or contact us: E. breeam@bre.co.uk T. 0333 321 8811
BREEAM is a registered trademark of BRE (the Building Research Establishment Ltd. Community Trade Mark E5278511)

bre

© BRE Global Ltd, 2014

Page 1 of 2

BF1227 Rev 1.2

South Lanarkshire College
East Kilbride

BREEAM UK New Construction 2014: Education
(Fully Fitted)

Overall Score: 90.4%
Rating: Outstanding

South Lanarkshire College
East Kilbride

The end

South Lanarkshire College
East Kilbride