Framing Opinions

Some consideration for our older windows…

Jarrod Hill

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HSI
HERITAGE SKILLS INITIATIVE

Because they’re worth hanging on to…

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The eyes of the building

Like all eyes they sometimes:

Sparkle

Open and close

Be of different colours

Are different shapes

Look a little tired

Need occasional make-up

Suffer from decay

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The eyes of the building

But let's not be shortsighted enough to put them out…

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Significance

Of real value for their:

History

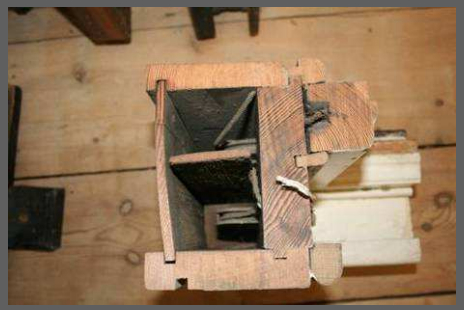
Character

Quality

Detail

Durability

Sustainability



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Once its gone its gone

Inappropriate windows come in all shapes and guises

…we're not just picking on PVCu

A generation ago…

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In need of TLC

Older windows had few friends:

Draughty

Noisy

Needed constant repair

Didn’t operate well

Expensive to fix

At the end of their life

Replacement

Was often considered the answer:

But modern timber and metal single-glazed replacement windows had not been particularly good

…then along came a ‘saviour’

‘Mastic Man’

Is it a bird, is it a plane?:

2-part

Silicone

Acrylic

Polyurethane

Feather Brained?

“You only fit double glazing once, so fit the best…”

Ten years later…

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uPVC

Had become established:

Better than earlier replacement windows

Took over from hardwood/aluminium

Reassuringly expensive

Increased property value

Became an expression of wealth

Maintenance free

Secure

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Before long

Even humble buildings were at risk:

Property market inflated

Whilst costs fell over time

Finance schemes

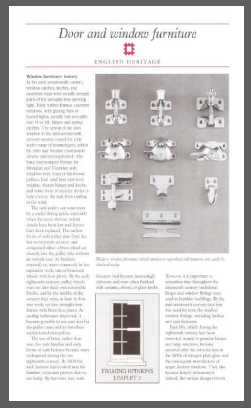
‘deal’ culture

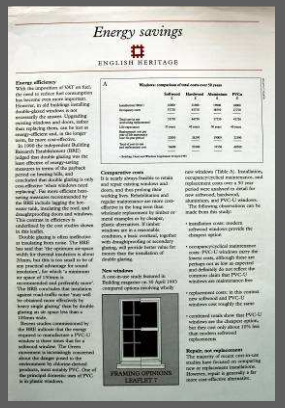
Quick-fix

So…

Framing Opinions

First Edition:





Draughtproofing & Secondary Glazing

Door & Window Furniture

Metal Windows

Timber Sash Windows

Window Comparisons

Energy Savings

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Education

The aims were:

Improve understanding of their history

Appreciate the detail and techniques

Provide a brief record for reference

Illustrate cost issues

Encourage fabric and character retention

Reverse damaging trends

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But the army marched on

…and defences were limited:

Protected buildings

Authority officers

Sympathetic owners

Education

Some fifteen years later…

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The situation has developed

There is now further threat:

Environment agenda
Design
Lifecycle
Organised industry
Legislation & Control
Cost

…and as always from ignorance

A brief look at the issues…

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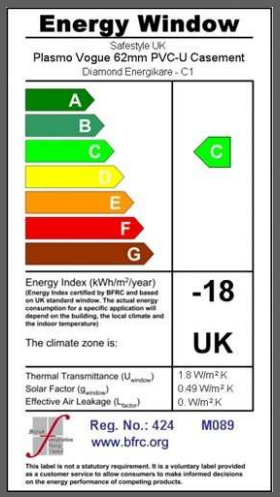
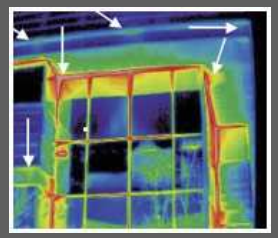
Environment…

Carbon Agenda:

80% reduction by 2050
10% of heating loss
Air-tightness
Part – L changes
BFRC rating scheme - only new
GGF carbon calculator
GGF window scrapage call





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Thermal Performance

Sash Windows:

Existing
U value 5.1

Thermal Performance

Upgrade Options:

Heavy Curtains
Timber shutters
Roller blind
Secondary glazing
Film

Thermal Performance

Results:

TABLE 4: ESTIMATES OF THE WHOLE WINDOW U-VALUES AND REDUCTION IN TOTAL HEAT LOSS THROUGH THE WINDOW WITH THE VARIOUS OPTIONS

		WHOLE WINDOW U-VALUE (W/M^2K)	REDUCTION IN TOTAL HEAT LOSS THROUGH WINDOW
0	Window with single glazing only	4.3	
1	Heavy curtains fitted to rail on inside of insulated panel above window	2.5	41%
2	Shutters	1.8	58%
3	Draught-proofed shutters	1.7	59%
4	Modern roller blind	2.7	38%
5	Modern roller with tighter fit to window	2.6	39%
6	As per Option 4, with low-e plastic film fixed to the window-facing side of the blind	1.9	57%
7	As per Option 4, with low emissivity plastic film fixed to the room-facing side of the blind	2.3	46%
8	Low-e roller blind as per Option 6, and shutters as per Option 2	1.4	67%
9	Honeycomb blind	2.1	51%
10	Secondary glazing	1.8	58%
11	Secondary glazing and shutters	1.6	62%

Thermal performance

Results:

Simple upgrades give up to 67% improvement

U-value 1.4

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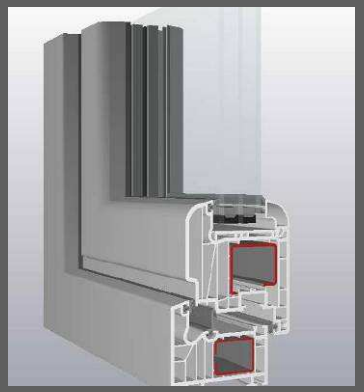
Design…

Developments:

‘Secured by Design’
DG types
‘Replica’ windows



To be honest…

“..it’s close, but that’s not it”

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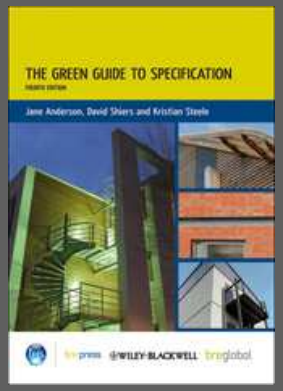
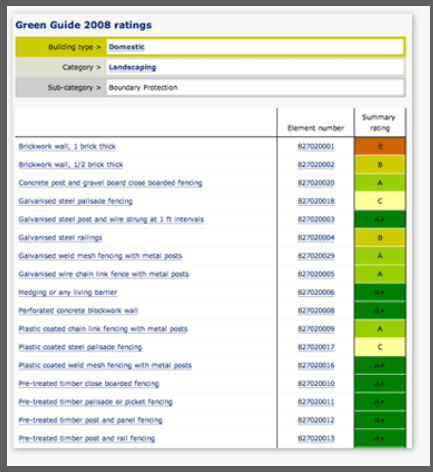
Lifecycle…

No proper comparison:

Green guide A+ rated
BRE 35yrs for timber and PVCu
Downward recycling
Sustainable source

Ham House or my house…





Organised industry

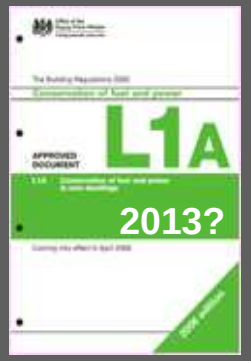
Strong competition:

PVCu getting consistently cheaper
Deals offers and finance schemes
VAT
H&S adding cost to maintenance
Finding a joiner – who can do it

Control & Legislation

Tools:

Building Regulation exemptions?
Protected Buildings
Article 4 Direction
Accreditation & standards



Cost

We'll come to this later…

Ignorance…

Remains:

Greenwash

Incorrect perceptions

e.g. conflict between energy conservation and building conservation

Inaccurate or negligible data

Poor design tools

Loss of traditional skills

Timber industry lagging behind

and over time we have formed a more balanced view…

Sash Window

Let's consider sash windows in an average older home…

c.530M tonnes CO_2 in UK 2008

46% from buildings
27% of which is domestic housing
20% of these are pre-1919 (c.4.5M)
3.1% of these are listed
60% is used for space heating
10% of this is lost through windows

Sash Window

c.2448 tonnes CO_2 lost through old sash windows

…enough carbon to manufacture UPVC windows for 1632 homes

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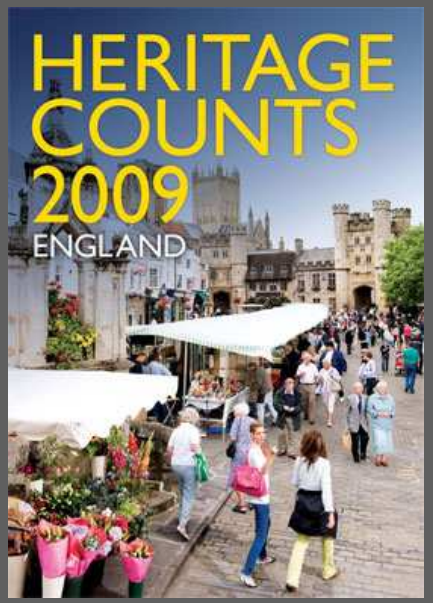
Sash Window

‘Heritage Counts’ 2009 English Heritage

142k listed dwellings
say -75k with sash windows (half)
say - average 8 windows
Gives 0.0375 tonnes CO_2 per window

…less than 1/10th of a 42” plasma tv



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Environmental Impact

Is not just thermal performance:

Environmentally harmful material

We discard that which cannot be maintained

We are recycling but not re-using

Short term solution long term cost

RECOVINYL

3

PVC

POISON PLASTIC

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‘Maintenance free’

Does not mean free from maintenance:

Painting

Replacing seals

Overhauling ironmongery

Strength degradation

DG replacement

Improving value

A sound investment?:

Market now values retention

In a 2009 national survey of estate agents:
"…82% felt that original features tend to add financial value to properties and 78% believed they helped a property to sell more quickly"

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Security

Secured by design:

Not really that secure

Not easy to uplift

Or repair

Strength over time

Bonded Glass

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And

The chickens are coming home to roost:

Tan Hill Inn now on its third re-fit in 25 years

…this time with “energy efficient windows”

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Framing Opinions a second edition…

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Scenarios

Short term:

I want to improve the property but to make sure that my limited funds are well directed and that I recover any money spent when I come to sell the building in a few years time.

"…if I am only going to be here for 7 years what is the best value thing to do?"

Adopting a short-term view we typically see older sash windows replaced with budget PVCu – a short term 'quick fix' in lieu of repair and maintenance.

Scenarios

Medium term:

I want to improve the value of the property and to balance the cost/benefit of keeping my old windows or replacing them with new ones.

"…I am going to be here for many years and want to 'invest' in a solution which will last for my home."

Elected replacement of windows so as to avoid the need for further maintenance 'in my lifetime' - a medium term fix with little regard to the lifetime of the building.

Scenarios

Long term:

I acknowledge the character of my older building is important although am balancing the long term environmental benefits of up-grade or replacement.

"…I wish to improve my building but would like to know that my choice will be the most sustainably justified."

Assumption made that replacement is necessary to achieve improved environmental performance is incorrect

looking at the financial cost…

The candidates

Budget:

Basic PVCu market product that meets current minimum statutory requirements.

Top-hung opening light to 20%

24mm low-e argon filled double glazing

Basic security features

Safety glazed

BFRC 'C' rated

Standard bead profiles

Mastic weather sealants.

Size 1060wide x 1760high

Including discounts, offers and 'showhome' rates

£691.36+VAT

The candidates

Replica:

High quality PVCu 'reproduction' mock double-hung sliding sash window to match historic pattern.

Twin sliding sash with 6-over-6 glazing pattern 24mm low-e argon filled double glazing,

Basic security features

Safety glazed

BFRC 'C' rated

Standard ironmongery

Standard bead profiles and mastic weather sealants.

Size 1060wide x 1760high

£1150+VAT

The candidates

Retained:

Standard double-hung sliding sash window
in painted softwood with oak cill
Single-glazed
Linseed putty sealed crown glass
Traditional brass ironmongery
Cotton corded weights.
Size 1060wide x 1760high

£ Free of charge!

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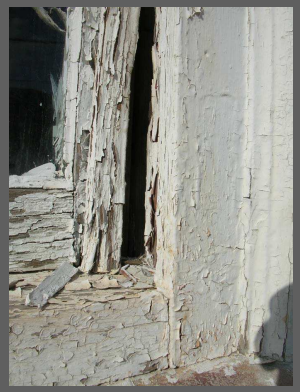
Repair

4 Poor 3 Medium 3 Fair condition:

External & internal redecoration
Ease and adjust
Adjust & replace ironmongery
Re-cording
Replace parting beads
Replace 50% staff beads
25% glazing replacement
Putty renewal
Re-make stile/rail junctions of sashes
Scarf repair to 50% of glazing bars
Scarf repair to 25% of stiles
Scarf repair to foot of sash boxes
Timber repair to external cill

£547.90 +VAT



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Upgrade

Improvements:

Basic (DIY) draught-proofing

6.3mm toughened single-glazed secondary glazing system with bottom lifting light.

Size 1060wide x 1760high

£585+VAT

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Maintenance

Timber:

Cleaning
Lubrication
Redecoration inside/outside
Bead replacement
Joinery Repairs
Glass breakage
Ironmongery

Maintenance

PVCu:

Cleaning
Lubrication
Gasket seal overhaul/renewal
DG unit renewal
Ironmongery
Fixings

The figures

Summary:

Option	Initial Cost	Maintenance				
		1 year	7 years	25 years	35 years	60 years
Existing						
Repair	£547.90	£557.85	£710.72	£1,128.46	£1,265.10	£1,506.14
Upgrade	£585.00			£596.95		£612.76
Replacement						
Budget PVC	£691.36	£696.94	£733.98	£1,197.35	£1,286.31	£1,593.24
Replica PVC	£1,150.00	£1,156.94	£1,191.99	£1,361.52	£1,842.97	£1,980.52

Note: all figures subject to final publication

To conclude…

Worth keeping for their heritage value

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Thermal performance can exceed building regulation requirements

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Cheaper to repair, upgrade and maintain

than it is to replace

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Replacement is not justified by conservation, sustainability, environment or cost

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Sustainability means looking after what you already have…

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Retain don’t replace

Repair if you care

Maintain for gain

Conserve don’t consume

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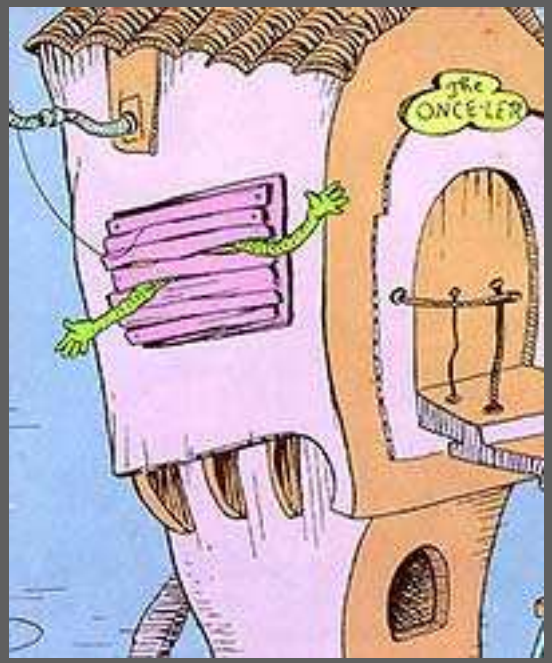
…because there is no miff-muffered-moof



and don’t forget…

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timber windows can be recycled too

Coming back to thermal performance…

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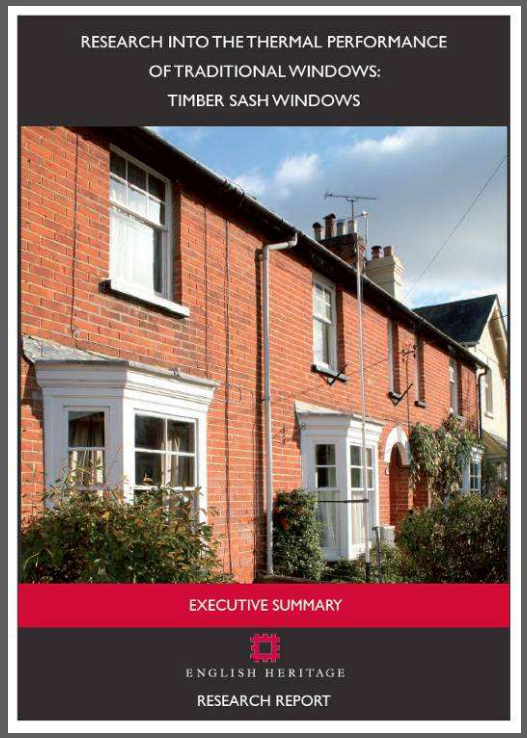
Traditional Sash Windows

Thermal Performance:

2009 research study with Glasgow Caledonian University

www.climatechangeandyourhome.org.uk



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Traditional Sash Windows

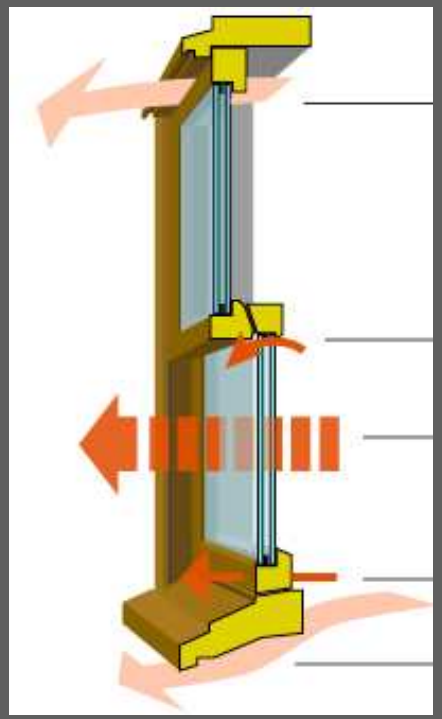
Heat Transfer:

Conduction & Convection through glass and frame

Infra-red radiation absorbed from the room

c.60%

Air leakage – cold in and warm out



Thermal Performance

The Chamber:

GCU Environmental test chamber

Exterior:

-20ºC to +30ºC

20% to 90% rh

Interior:

+10oC to +40oC

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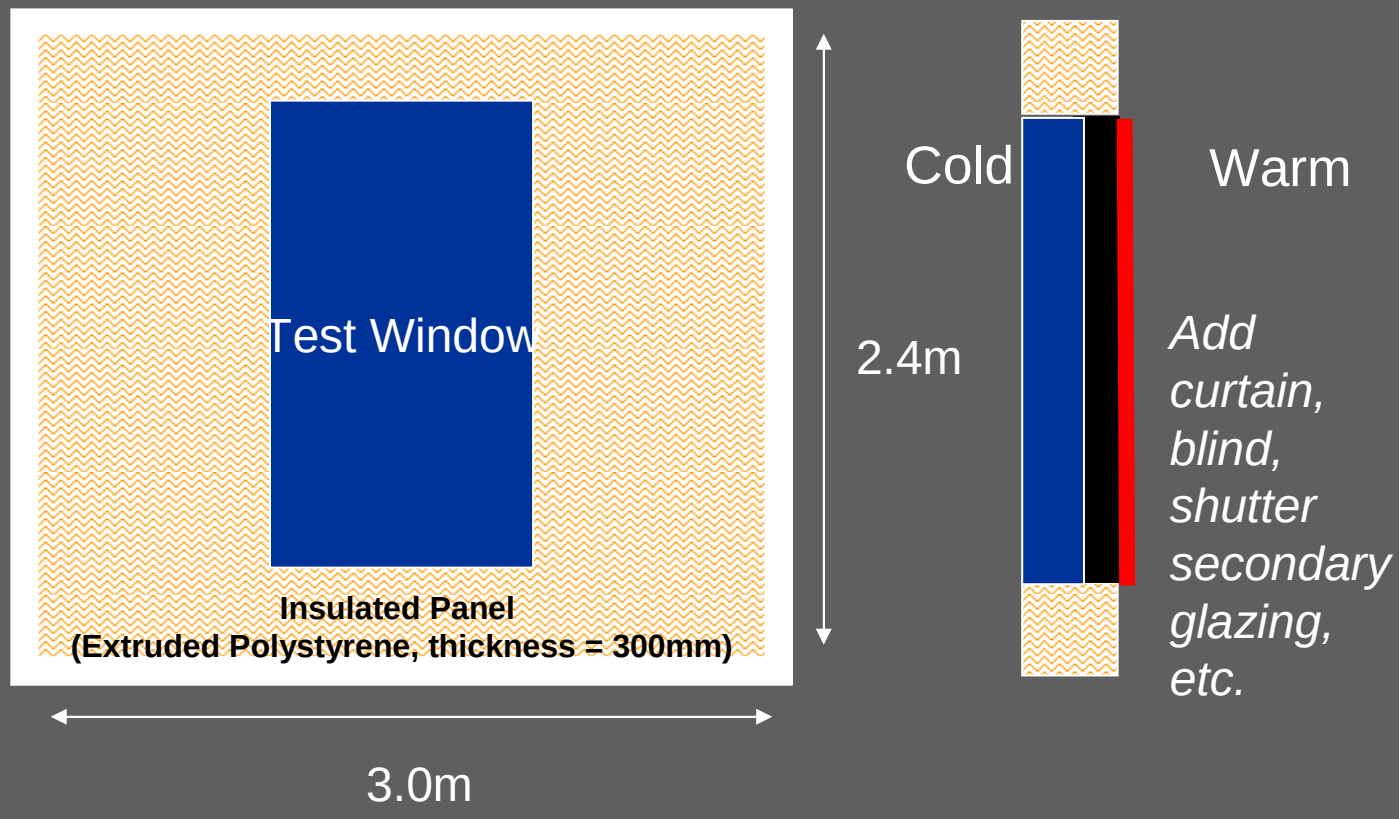
Thermal Performance

The Aperture:



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Thermal Performance

As found:

U-Values

Glazing 5.3

Whole window 4.3

Thermal Performance

After Repair:

U-Values
Glazing 5.3
Whole window 4.3

Air infiltration -34%

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Thermal Performance

Test Kit:

Thermisters

Heat flux sensors

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Thermal Performance

Heavy Curtains:

U-Values
Glazing 3.3
Whole window 2.5

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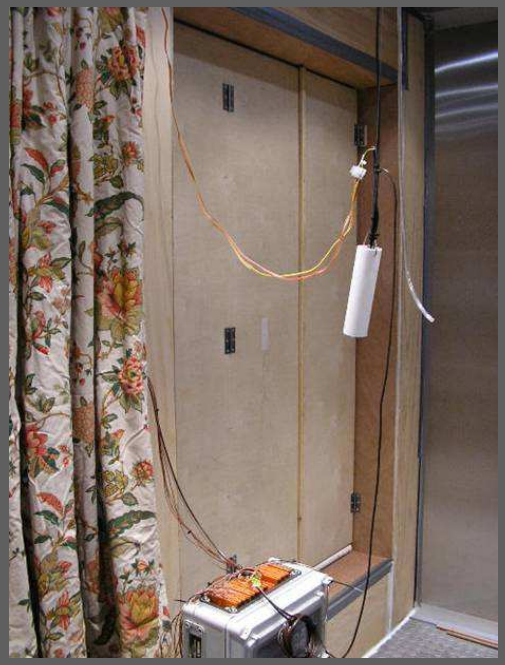
Thermal Performance

Timber Shutters:

U-Values
Glazing 2.0
Whole window 1.7



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Thermal Performance

Roller Blind:

Plain:
U-Values
Glazing 3.4
Whole window 2.7

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Thermal Performance

Roller Blind:

Reflective: (out facing)
U-Values
Glazing 1.8
Whole window 1.9

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Airtightness

Pressure test:

As found

183 M^3/h at 50Pa

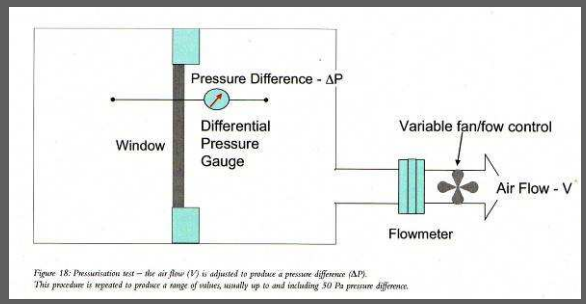


Figure 18: Pressurisation test – the air flow (V) is adjusted to produce a pressure difference (ΔP). This procedure is repeated to produce a range of values, usually up to and including 50 Pa pressure difference.

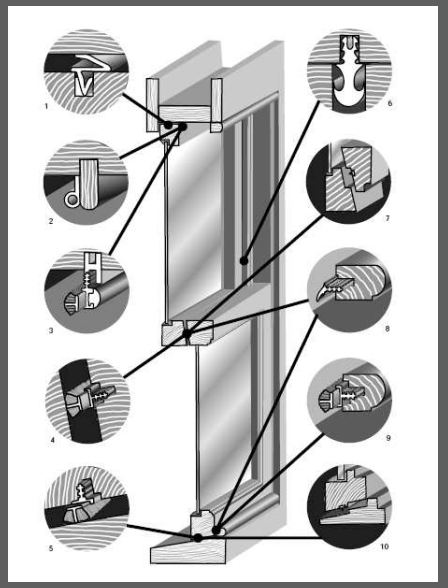
Airtightness

After:

120 M^3/h at 50Pa after repair
- 34%

26 M3/h at 50Pa after draughtproofing
- 86%

8 M3/h at 50Pa adding secondary glazing
- 96%



Summary

Estimates of whole window U-value and reduction in total heat loss through window with various options :

Option:	Reduction in heat loss:	U value W/m²K:
Whole window with single glazing	-	4.5
Heavy curtains	41%	2.5
Shutters	58%	1.8
Modern roller blind	38%	2.7
Roller blind with low-E film	57%	1.9
'Honeycomb' blind	51%	2.1
Secondary glazing	58%	1.8
Secondary glazing and shutters	62%	1.6

And other upgrades…

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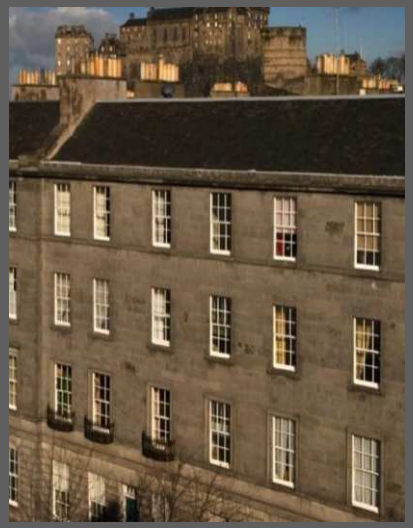
Upgrading

Changeworks:

Study for Lister Housing
March 2009 – April 2010

Secondary Glazing
(Storm)

Draughtproofing
(Ventrolla)



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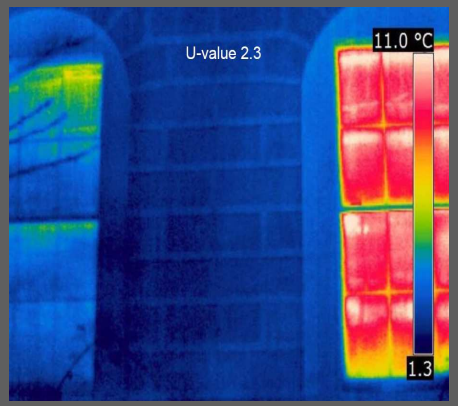
Upgrading

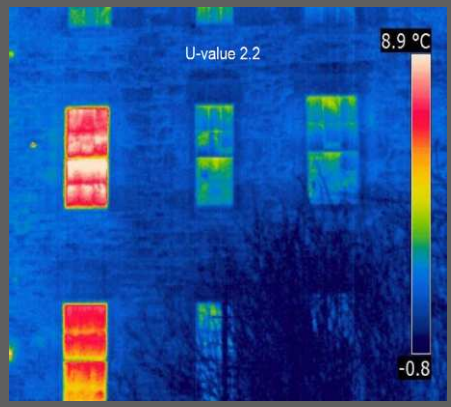
U Values:

5.5 existing single glazed

2.3 with secondary glazing

2.2 timber shutter + draughtproofing





Double Glazing

Changeworks:

Comparative study

Thermal performance

Embodied Energy

Aesthetics

Technical
(longevity maintenance cost carbon saving social)

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Double Glazing

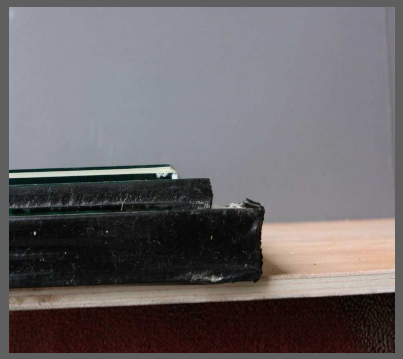
Types Included:

Spacia
(Pilkington EnergiKare Legacy)

Slimlite

Supalite

Histoglass



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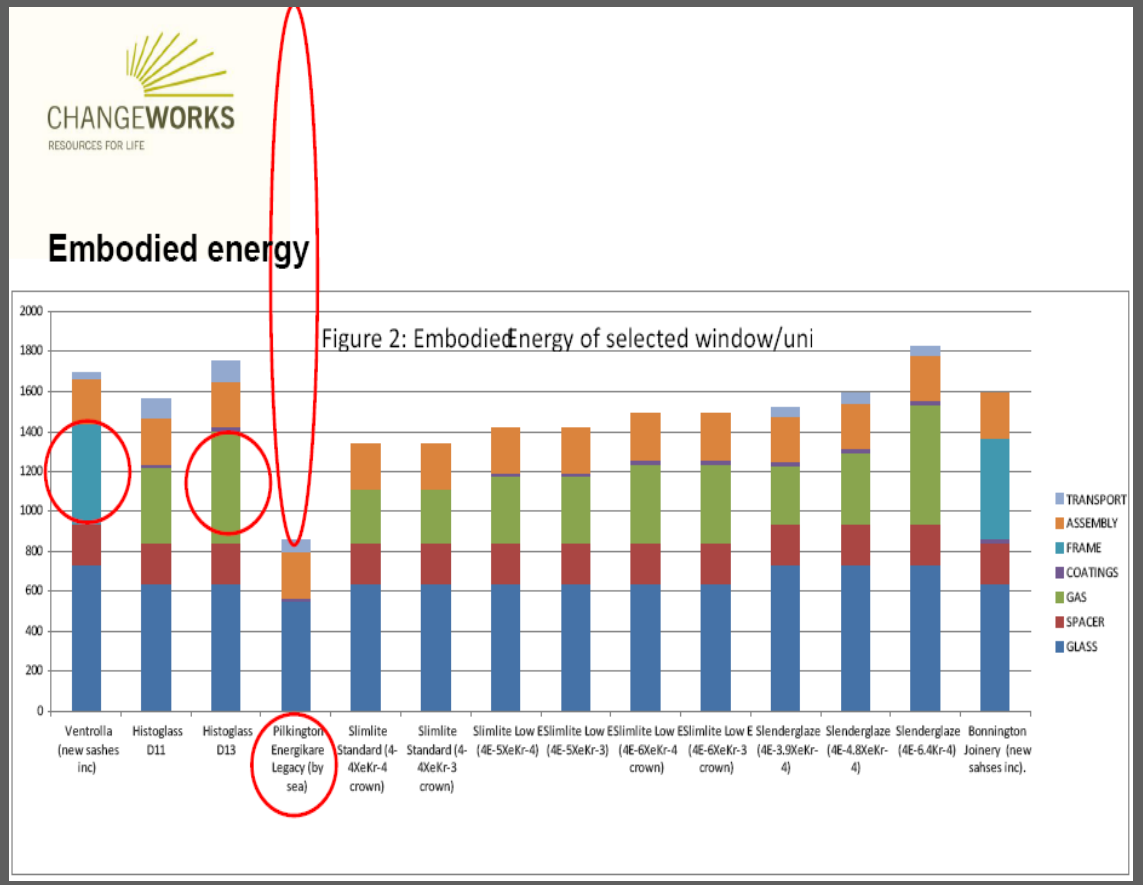
Double Glazing

Embodied Energy of DG alone:

Slimlite 3Km

vs.

Spacia 10,100Km



Double Glazing

Embodied Energy of whole window units:

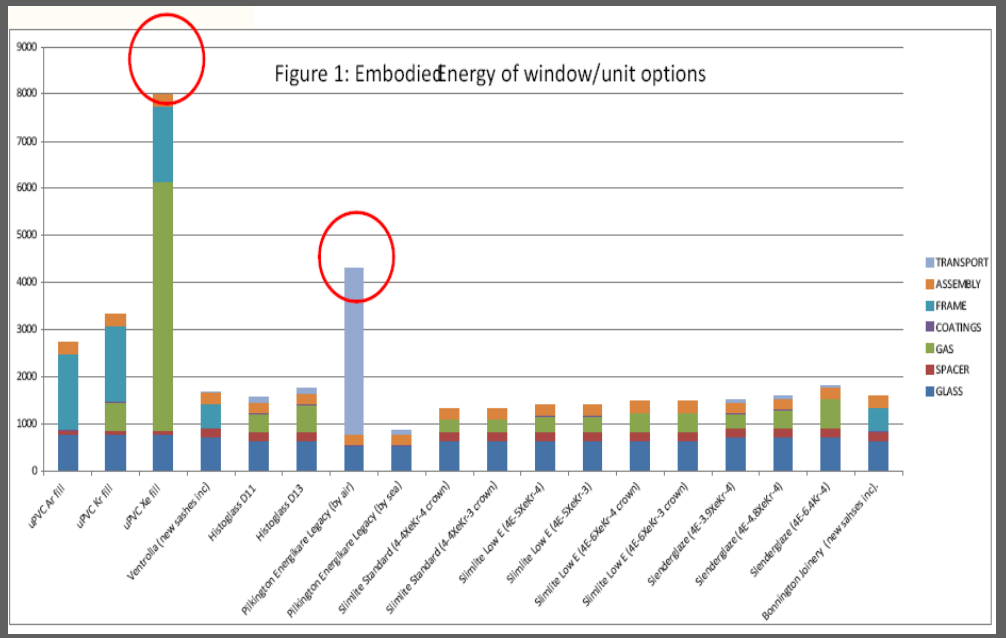
UPVC (xenon) Highest

Shipped ‘Spacia’ lowest

Vacum air argon krypton

Many x lifetime pay-back

Xenon never !



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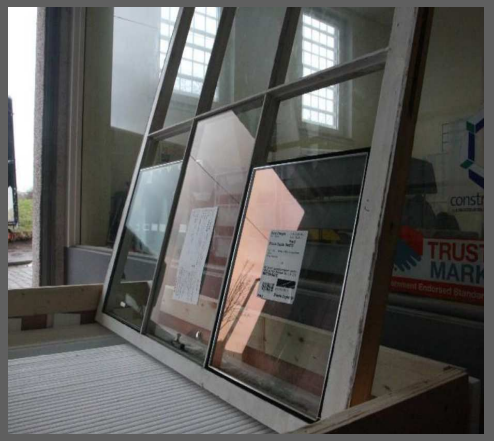
Double Glazing

Aesthetic:

Spacer-bar colour

Vacum extract stud

Reflectance



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Double Glazing

Aesthetic:

In-situ visual impact

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Double Glazing

Technical Performance:

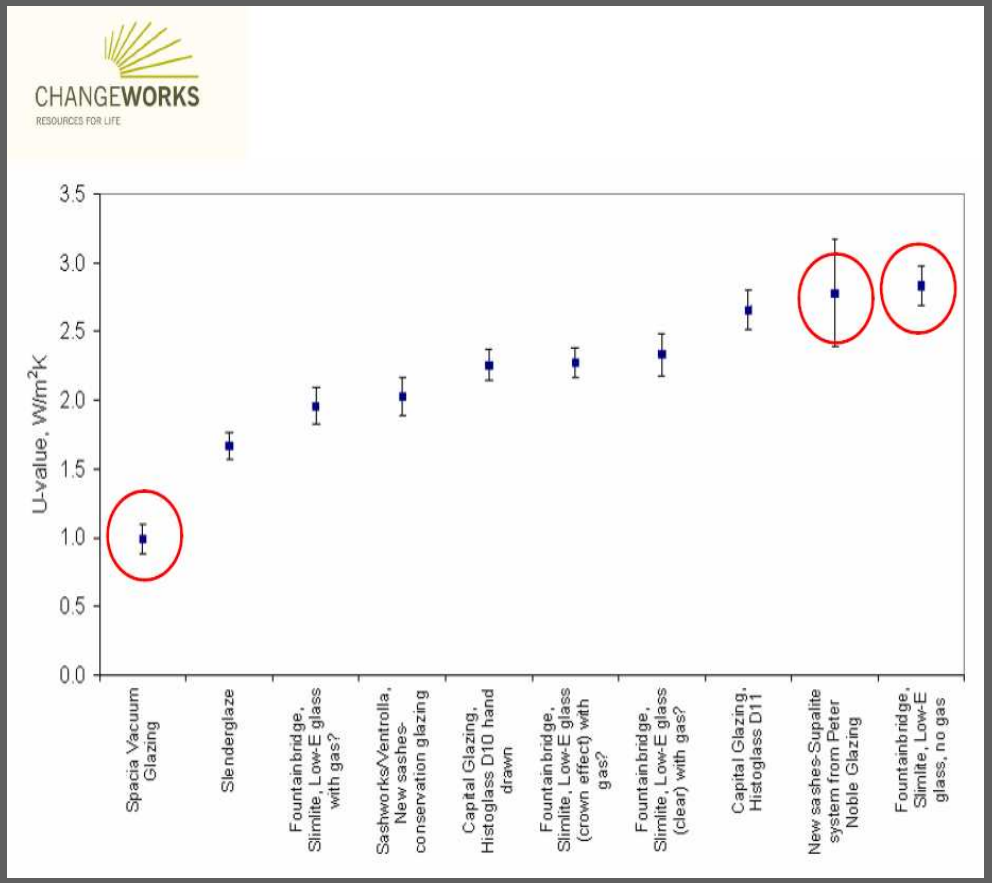
Centre pane U value

1.0 Spacia

1.7 Slenderglaze

2.3 Histoglass

2.4 Slimlite



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Double Glazing

Historic Scotland:

Technical Paper 9
September 2010

Added whole window assessment and secondary glazing to previous Changeworks study

HISTORIC SCOTLAND

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Double Glazing

Whole window:

6-over-6

Values for slender DG glazed windows 1.9 (Spacia) to 3.4 (air)

2.0 with secondary glazing

2.5 if using best gas DG

Double Glazing

Whole window:

1-over-1

Values for slender DG glazed windows 1.4 (Spacia) to 3.0 (air)

2.1 with secondary glazing

2.0 if using best gas DG

Conclusions

Performance:

Vacum dg delivered by ship
Lowest embodied energy
Best U value

Secondary Glazing
Matches or betters U value of all slender gas dg

61% improvement for 6-over-6
59% improvement for 1-over-1

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Conclusions

Embodied Energy:

Secondary Glazing
Lowest embodied energy

Vacum dg delivered by ship
Lowest slender DG

Inert gases high embodied energy especially Xenon

Thanks for listening…

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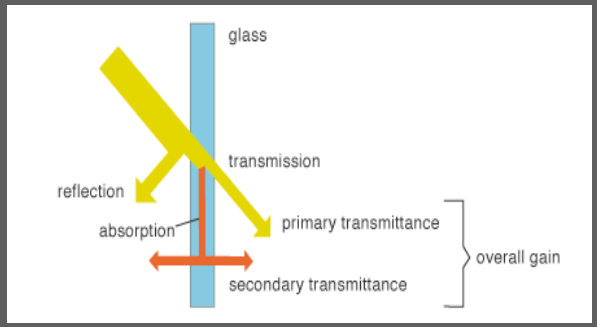
And a few final thoughts…

Heat gain

Heat is also absorbed through glazing:



Solar gain directly transmitted (primary transmittance) through the glazing

Energy absorbed by the glazing and subsequently transferred inwards by convection and radiation (secondary transmittance).

Though the general balance in the UK is for windows to lose heat, they also, to a varying degree absorb heat and in some instances of high performance windows, there can be a net gain.

Secondary Glazing

Cat factor:

Can be removed in Summer

Can be adjusted to moderate the season changes

Long-life

Secondary Glazing

Upgrade:

Select the right system

Allows retention of existing window

Comparable thermal performance

Improved acoustic performance

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Shutters

But I don’t want to be in the dark:

Night peak heat loss

Occupancy

Retain solar gain

DG

Lifecycle:

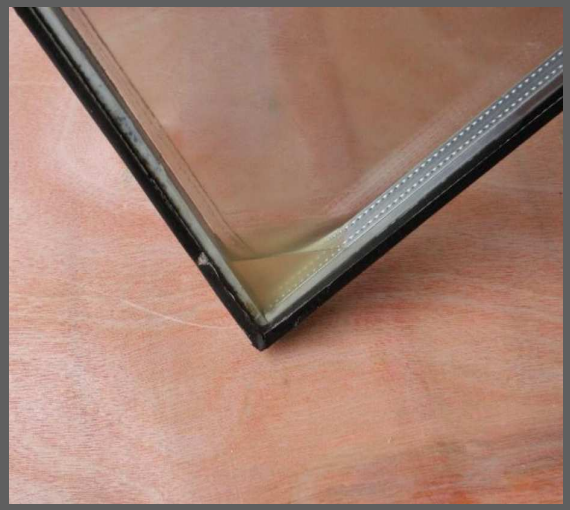
1 in 10 fail within 10yrs

Thermal bridging

Bonded systems

Edge-cover – butyl seals

Glass - Low-e / Non-reflective / Low iron



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Where we are at

with climate and heritage…

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What's all the fuss about…

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The scary bit

We all know the context don’t we?

The scary bit

Past increases in regulatory requirements for energy performance of building fabric have been offset by increases in consumption of energy …we've spent what was saved.

Domestic energy consumption continues to grow unchecked, up from 24% in 1970 to 31% a generation later in 1996

The cost of fuel is set to increase 60% in the next decade, but the rising cost of energy has not quelled our appetite.

We are increasing our number of households at twice the rate we are increasing the UK population.

In 2007 56% of the nations existing housing stock has basic defects costing an average of £1820 per dwelling to fix – a massive £40 Billion or half the cost of the NHS !

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The scary bit

Only 1/3 of homes in use by 2050 will have been built this century – the majority therefore already exist

– *Homes for the Future 2007*

'Adaptation is the only response available for the [climate change] impacts that will occur over the next several decades before mitigation measures can have an effect'.

- *The Stern Review*

There is a need for unprecedented levels of investment to be sustained over many years in difficult financial conditions and against a background of increased risk and uncertainty

– *Ofgem Project Discovery*

To achieve our carbon reduction targets we must upgrade all of our existing homes – at a rate of c.11k per week until 2050

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But surely its not all bad…

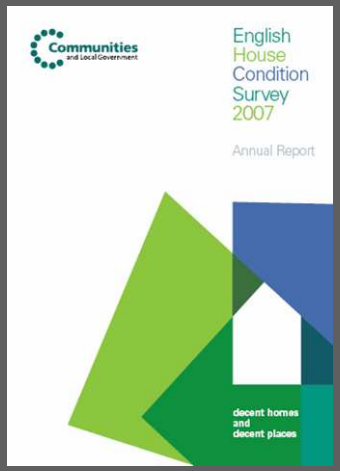
According to the English House Condition Survey:

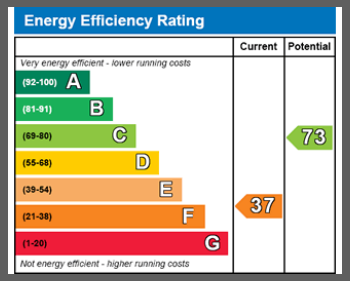
Average SAP ratings for dwellings have risen from 42 to 50 in just a decade

Houses with an Energy Efficiency Rating of D or better have doubled from 19% to 40%

Over 90% of homes could benefit form upgrading measures of less than £1500 each to achieve a 10 point improvement equating to a 22% carbon reduction.

Average EER (SAP) rating of pre-1919 is already over 40





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We’re making progress aren’t we?…

We have already reduced emissions by 19% from 1990 levels – *ONS*

In environmental terms, the continued use of existing building stock, whether or not of particular architectural merit or historic interest, coupled with measures to improve energy efficiency, is a global priority. New build construction, by comparison, is a major user of non-renewable resources and energy.’

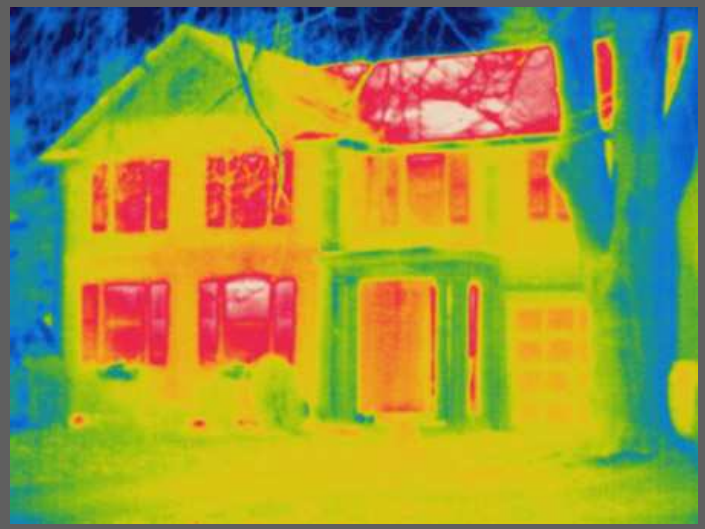
- BS7913 Guide to the Principles of Conservation of Historic Buildings 1998

WWF state £4Bn per year is all that is needed to upgrade existing homes by 2050 – a mere 10% of the of the annual DIY & Repair market

How it is

We have spent the past generation seeking to consistently improve the thermal performance of newly built dwellings and have achieved an enormous difference in a small proportion of our future homes.

…we still have to upgrade the majority



How it is

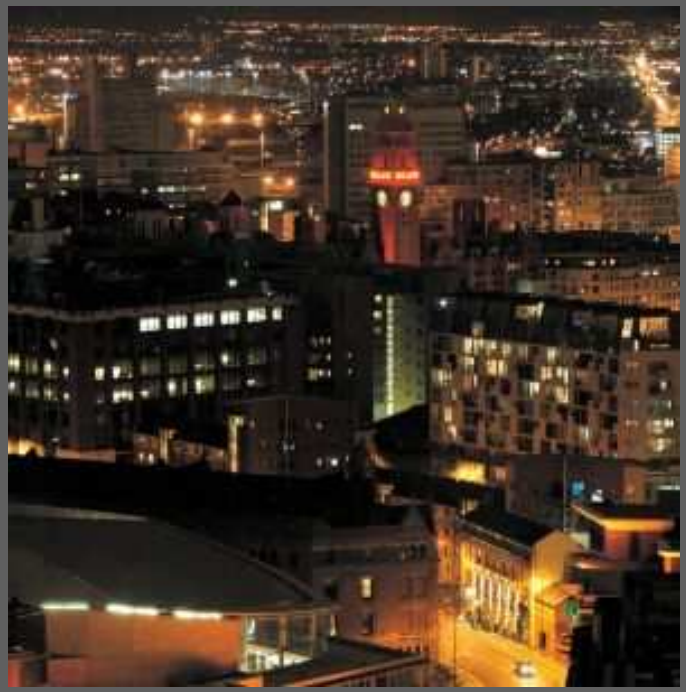
As a proportion of GDP we have spent less on renewing and updating our energy infrastructure than any past generation

…we still have to green our supplies

How it is

We have been spoilt by the easy availability of energy and profligate in our ever increasing demand

…we still need to change our behaviour



What's it got to do with English Heritage…

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English Heritage

Government's advisors

Range from landscapes to wrecks

Consulted on most important historic buildings

Advice & guidance to local authorities, specifiers, etc

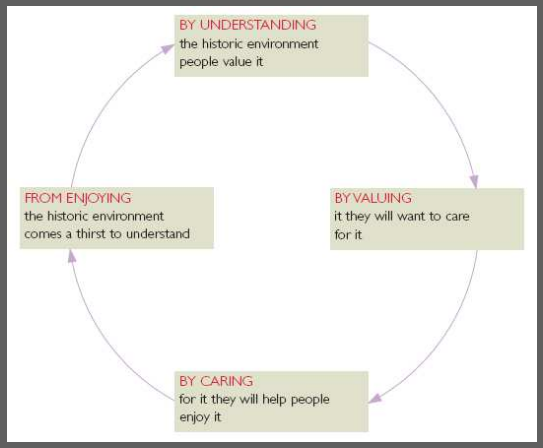
Supportive….

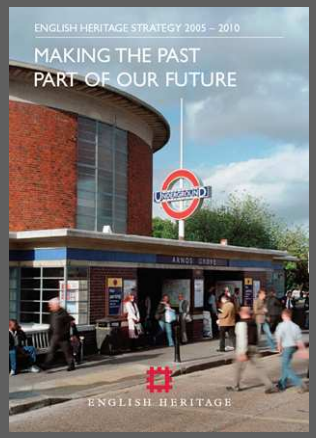
English Heritage

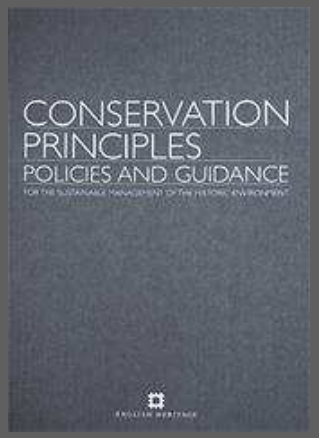
Aims:

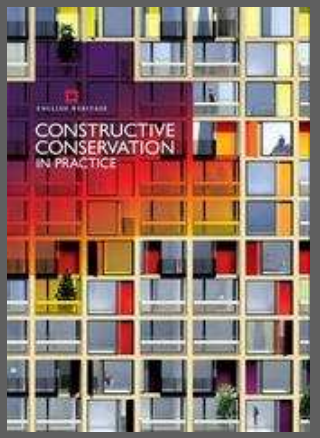
Understanding Valuing Caring Enjoying

Positive management of change rather than simple protection









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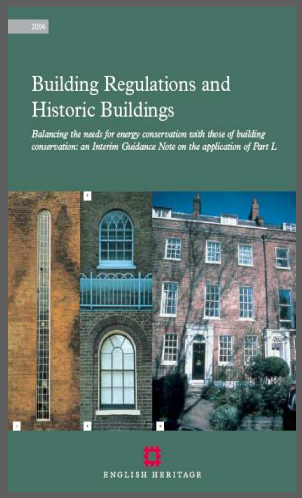
English Heritage

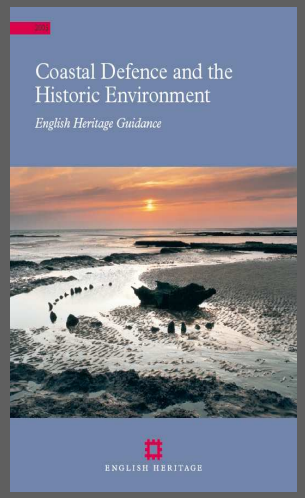
Not many of our buildings are occupied – but our work impacts much that is

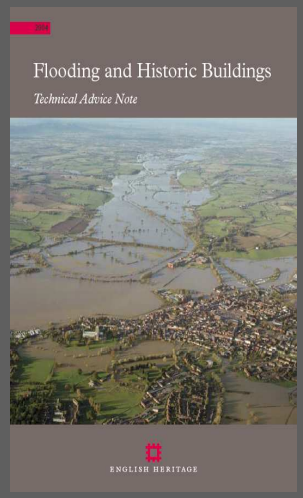
Research and understanding

Regulations

Statutory control







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English Heritage

Climate Change and Your Home

Guidance and advice

www.climatechangeandyourhome.org.uk

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Questions

Exploring the myths:

Presumption that all old buildings are energy inefficient

Are old buildings worth keeping?

To what extent are you improving – and from what base point…

Is it actually environmentally better to replace?

Assumptions about the performance of elements

Things look a little different from our perspective…

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Think again…

Source of draughts & dampness or natural stack effect ventilation?

Think again…

Poorly performing thermal element or an improved solar collector?

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Think again…

Un-insulated wall or mass thermal store?

Think again…

Failed material or simply ready for re-cycling?

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This is not a new agenda…

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New themes or old…

Rain-screen cladding

New themes or old…

External Insulation

New themes or old…

Green Roofs and Walls

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New themes or old…

Thin joint masonry systems

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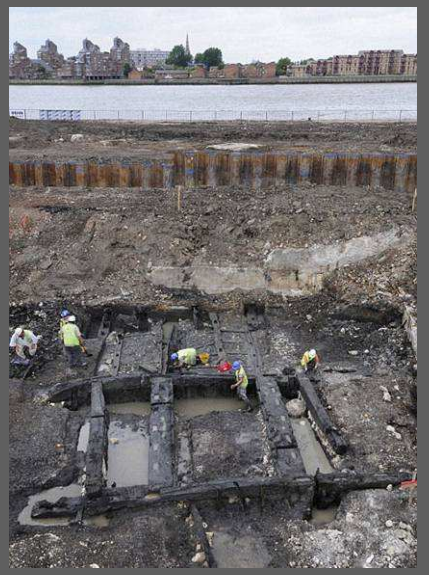
New themes or old…

Air-tightness

New themes or old…

Renewable energy



We have been low carbon before…

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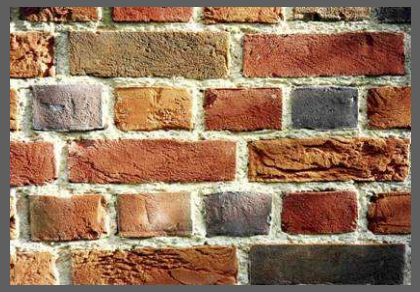
Low Carbon

Materials:

Low waste
Minimal processing
Porous
Hygroscopic
Flexible
Low embodied energy
Locally sourced
Renewable



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Low Carbon

Construction:

Good thermal mass

Natural moisture control and dissipation

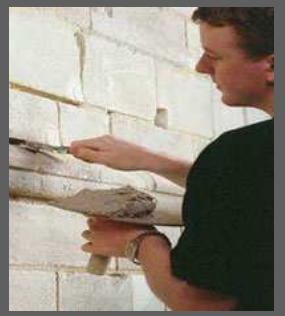
Low site impact

Manual

Loose fit

Tried & tested

Simple technology



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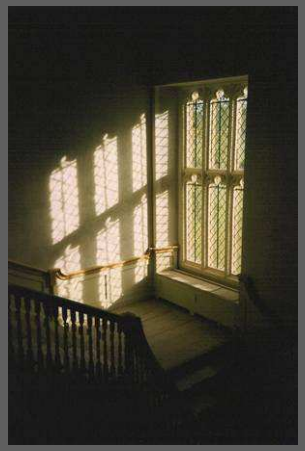
Low Carbon

Building forms:

Passive
Solar gain
Maximise natural light / ventilation
Use lower grade heat
Cellular Plan
Buffer spaces – attic/cellar/larder
Window seats
Inglenooks
Terraces



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Low Carbon

Renewable Technologies:

Wind
Water
Gravity
Manpower

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And we simply had to be sustainable…

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Sustainable

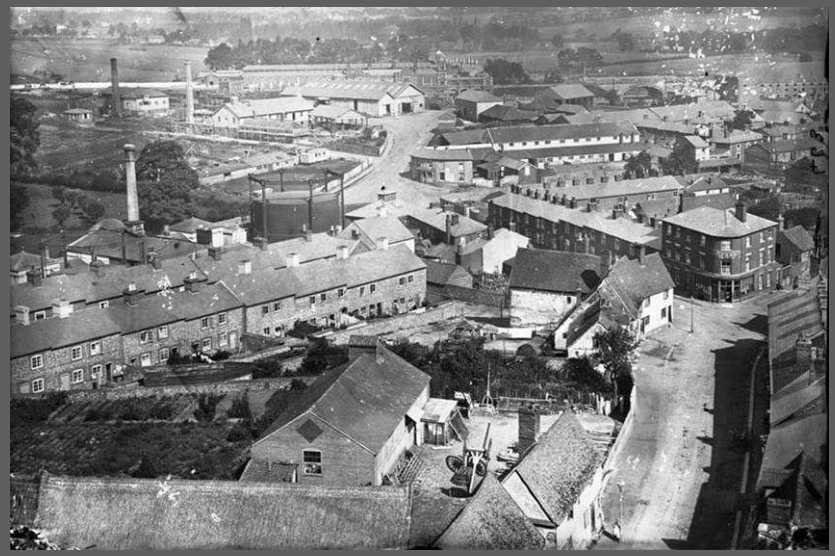
Demonstrably:

Long service life
Adaptable
Repairable
Recoverable
Recyclable

Sustainable

Beneficially:

Culturally significant
Socially important
Economically valuable



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There’s nothing new under the sun…

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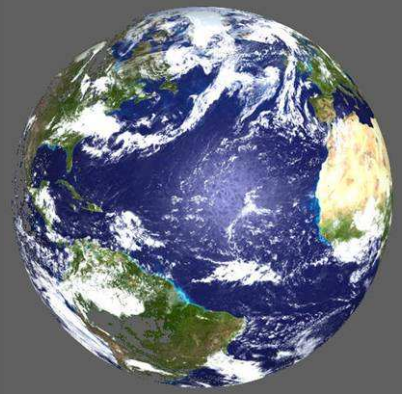
The conservation of our buildings and our environment are the same thing…



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Consider a few issues…

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Still low carbon?

Brick:

We make around 3Bn bricks in UK annually and place 1.5Bn in landfill…

Local raw material

Lower firing temperature

Recoverable (used with lime mortars)

Recyclable

Long life

Still low carbon?

Lime:

10% of global CO_2 production is from cement

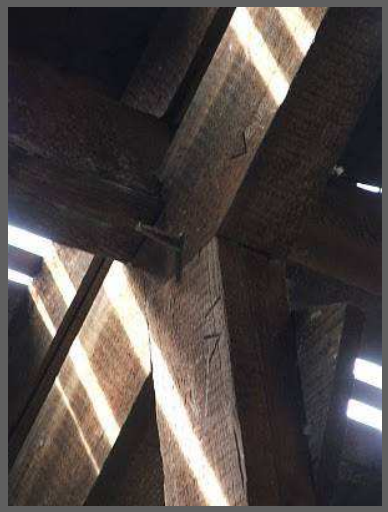
Burnt at 900-1100ºC
Cement is twice burnt at 1200-1500ºC
Low grade fuel
Locally produced
Half as dense – 30-50% less energy
Reabsorbs some CO_2
Recoverable
Recyclable

Still low carbon?

Timber:

30% of global CO_2 emissions relate to tropical deforestation yet we import 80% of our construction lumber

Flexible
Durable
Biodegradeable
Non-toxic
Regenerates
Re-useable
Adaptable
Recyclable



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Regulatory Requirements…

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Planning Policy

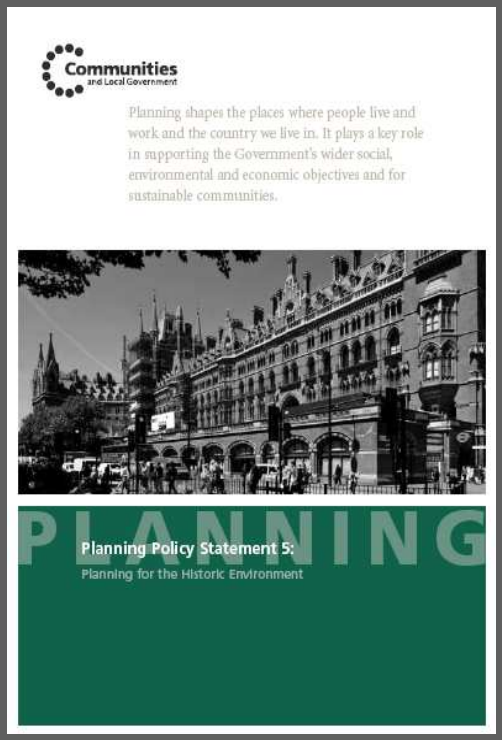
PPS5:

Policy HE1 – Heritage Assets and Climate Change

Requirement to identify opportunities to mitigate and adapt to climate change including:

“ …where appropriate, the modification of heritage assets so as to reduce carbon emissions…”

to identify alternative measures where there is adverse effect on significance



Planning Policy

And:

Where conflict exists to weigh the carbon benefit against heritage impact…

Planning Policy

And so...

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Any questions?

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