

# Lecture: Future Systems: Services

Advanced Technology

Module Leader: Ilona Hay

Module Coordinator: Kenny Fitzmaurice

Technology Champion: Brian Murphy

Lecturer: Brian Murphy

Created: 22nd February 2019

Updated: 18<sup>th</sup> March 2019

Presented: Not

# Lecture: Future Systems: Services

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Created: 22nd February 2021

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# Quotes for the Day

- **Insulation Insulation Insulation:**
  - Fabric First, Eco Bling last (Renewable Energy)
- **Future Proofing**
  - Enable additions of (RE) Technology later
- **Airtightness:**
  - Build Tight (Services Penetrations), Ventilate Right (MVHR)
  - No insulation, without ventilation (PAS 2035)

# >40 years into 1 Hour won't go

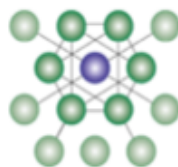
- So I am providing links to other information if you want to know more
- Question Everything
  - Use what you know, join up your thinking, keep learning and refining what you know
- Don't assume that I know everything
  - (I know a lot but not everything)
- Don't assume I have cherry picked the best bits
  - (new stuff keeps appearing)
- Don't assume what your being told is the whole story
  - Some will hide what they don't want you to know
  - And tell greenwash porkies
- Do your best with what you know
- When you know better
- Do better

# This Presentation on GBE:

- Find this file on GBE website at:
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- Schedule of related pages:
- <https://GreenBuildingEcyclopaedia.uk/?P=17699>

# UofH Part 1 Year 2 Schedule

# GBE




## Green Building Encyclopaedia

<https://greenbuildingencyclopaedia.uk/?P=17699>

Task	Topic	Lecture/CPD	Books	GBE Website pages
0	The Whole Year	Principles of Element Design (Lecture)	Architects Pocket Book	G#17699 (this page)
		Fixings Fastenings	Environmental Design Pocket Book (Book)	Pinterest Z20 Connectivity (folders)
		Adopt a material (Lecture)	Principles of Element Design (Book)	
		Future Systems	Designed to perform (Book)	
1	Site Survey	Site / Existing Building Survey Test Analysis (CPD/Lecture)	Survey Site Analysis (Navigation)	
2	Sustainable Strategy	HERACEY® (Jargon-Buster CPD)	TBH Designer's Handbook	HERACEY® (Jargon-Buster)
		Matrix (Navigation)	Building Regulations AD L- Conservation of fuel and power	Healthy (Jargon-Buster)
			PHPP Passivhaus & EnerPHit	Environmental (Jargon-Buster)
			AECB Carbon Lite & Retrofit	Resourceful (Jargon-Buster)
			CIBSE TM60 2018 Good Practice in the Design of Homes (Book)	Appropriate (Jargon-Buster)
				Competent (Jargon-Buster)
				Effective (Jargon-Buster)
				Yardstick (Jargon-Buster)
3	External walls and openings	Timber External walls External wall Opening Window Door (Lecture)	Principles of Element Design (Lecture)	Calculators (Navigation)
		Masonry External walls External wall Opening Window Door (Lecture)	IBO Passive Houses New Build	Elemental Building U value calculator
		Glass External walls External wall Opening Window Door (Lecture)	Designed to perform (Book)	Elemental Assemblies Spreadsheet
		Other External walls	Building Regulations	Windows (Checklist)

		External wall Opening Window Door (Lecture)	AD L- Conservation of fuel and power	
		Windows External wall Opening Window Door (Lecture)		Rooflights (Checklist)
		Doors External wall Opening Window Door (Lecture)		
		Rooflights		
		Solar Shading (CPD)		
4	Roof & Floor	Pitched Roof	Principles of Element Design (Lecture)	Calculators (Navigation)
		Flat Roof	IBO Passive Houses New Build	Elemental U value calculator
		Ground Floor	Designed to perform (Book)	Elemental Assemblies Spreadsheet
		Upper Floor	Building Regulations AD L- Conservation of fuel and power	
5	Access Stairs	Stairs Ramps Lifts Escalators (Lecture)	Building Regulations AD K	Checklist (Navigation)
	Stairs Ramps Balustrades Walkways	Stairs Ramps Lifts Escalators (Lecture)	Building Regulations AD K	
	Lifts Escalators	Stairs Ramps Lifts Escalators (Lecture)		
6	Internal Linings Elevations and Reflected ceiling Plans	(22) Internal partitions	Principles of Element Design (Lecture)	
		(23) Upper Floors	IBO Passive Houses New Build	
		Interior Linings	Designed to perform (Book)	
		(40) Finishes (CPD/Lectures)		
7	Axo, Build ups, thicknesses	Principles of Element Design (Lecture)	Principles of Element Design (Lecture)	Calculators (Navigation)
			IBO Passive Houses New Build	Elemental Building U value calculator
			Designed to perform (Book)	
8	Drawings + Model			Calculators (Navigation)
				Whole Building U value calculator
9	3D Design	Intro to BIM	BIM A Spec Writers Perspective (Shop)	GBE BIM (Jargon-Buster)
10	Wall Roof Junctions	Principles of Element Design (Lecture)	IBO Passive Houses New Build	Calculators (Navigation)
			Designed to perform (Book)	Psi value calculator
11	Wall Floor Foundation Junctions	(16.4) Foundation (Lecture)	Principles of Element Design (Lecture)	Calculators (Navigation)
		(16.4) Groundworks RC Raft Foundation (Lecture) G#2114	IBO Passive Houses New Build	Psi value calculator
			Designed to perform (Book)	
12	Model			







[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

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# Glass External Walls

(21.4) Curtain Walls

Another GBS CPD/Lecture file to download  
[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

<http://www.GreenBuildingEncyclopaedia.uk>

# (21) Timber External Walls

CI/SfB (21.1) Load-bearing  
(21.3) Non Load-bearing










[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (66) Transport Systems





Mechanical vertical and diagonal movement

[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (21) Masonry External Walls





CI/SfB: (21.1) Load-bearing  
(21.3) Non Load-bearing

[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (21) Masonry External Walls





CI/SfB: (21.1) Load-bearing  
(21.3) Non Load-bearing

<http://www.GreenBuildingEncyclopaedia.uk>

# (21) Timber Frame

Construction Critique












[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (21) Timber Frame

Construction Critique

<http://www.GreenBuildingEncyclopaedia.uk>

# (21) Other External Walls

CI/SfB (21.1) Load-bearing  
(21.3) Non Load-bearing






[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# BDA Illustrated Introduction to Brickwork Design

© Brick Development Association 1975  
TL Knight AADipl RIBA  
A shining example of how to communicate with Architects






<http://www.GreenBuildingEncyclopaedia.uk>

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A shining example of how to communicate with Architects








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# GBE GBS H21 Timber Cladding

Issues: Designers, Stewardship, Market  
Solutions: Expert system, Design Guide, Certification scheme, Definitive Specification







[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (24) Stairs Ramps +Slides

Diagonal circulation

[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# (22) Internal Partitions

G14 Light steel frame • G20 Light Timber framed • K10 Plasterboard  
• K30 Panel Partitions • K32 Cubicle Partitions







<http://www.GreenBuildingEncyclopaedia.uk>

# GBE GBS H21 Timber Cladding

Issues: Designers, Stewardship, Market  
Solutions: Expert system, Design Guide, Certification scheme, Definitive Specification



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[www.GreenBuildingEncyclopaedia.uk](http://www.GreenBuildingEncyclopaedia.uk)

# GBE GBS H21 Timber Cladding

Issues: Designers, Stewardship, Market  
Solutions: Expert system, Design Guide, Certification scheme, Definitive Specification



# Today's Lecture

- **Future Systems:  
M&E Services**





# “Future Systems: Services”

- Human intervention v Passive, Active, Mechanical/Artificial
- Ownership of Controls
- Water saving plumbing and sanitaryware
- RWH Rainwater Harvesting & Reusing
- Pressurised Irrigation Efficiency
- WWHR Waste Water Heat Recovery
- Wired v Wireless v Smart
- IoT Internet of Things
- Internet of Tanks
- ERS Electro-magnetic Radiation Screening
- BLR Blue Living Roofs
- GLW Green Living Walls
- SMRR Smart Metering Remote Reading/Control
- WHC Whole House Controls
- MMC Monitoring Metering Controls
- SEPCSE Smart Electrical Power Lighting Comms Security and Entertainment
- CWA Controls With Attitude
- SPHCA Smart Phone Home Control App
- SI Smart Ironmongery
- Decarbonising the energy mix v Halving Demand, Doubling Efficiency, halving the carbon, getting pupils to run building
- RE Renewable Energy
- WT Wind Turbines
- VAWT HAWT Vertical and Horizontal Axis Wind Turbines
- ST Solar Thermal
- PV Photo Voltaic
- PVT Photo Voltaic Thermal
- BIRE Building Integrated Renewable Energy or not integrated
- SHWC Solar Hot Water Cylinders
- Ground/Air/Water Source Heat Pumps (GSHP ASHP WSHP)
- MVHR SBP&BB Mechanical Ventilation with Heat Recovery, Summer Bypass and Boost Button
- SLX Smart Lifts/Escalators
- Centralised Vacuum Cleaning

# Human intervention v Passive, Active, Mechanical/Artificial

# Ownership of Controls

# Water saving plumbing and sanitaryware

# RWH Rainwater Harvesting & Reusing

# Pressurised Irrigation Efficiency v Gravity Inconsistency Inefficiency

# WWHR Waste Water Heat Recovery



# Wired v Wireless v Smart

# IoT Internet of Things

# Internet of Tanks

# ERS Electro-magnetic Radiation Screening

# BLR Blue Living Roofs

# GLW Green Living Walls

# SMRR/C Smart Metering Remote Reading/Control



# WHC Whole House Controls

# MMC Monitoring Metering Controls

# SEPCSE Smart Electrical Power Lighting Comms Security and Entertainment

# CWA Controls With Attitude

# SPHCA Smart Phone Home Control App

# SI Smart Ironmongery

# Decarbonising the energy mix

- v Halving Demand,
- Doubling Efficiency,
- halving the carbon,
- getting pupils to run building



# RE Renewable Energy

# WT Wind Turbines

# VAWT HAWT Vertical and Horizontal Axis Wind Turbines

# ST Solar Thermal

# PV Photo Voltaic

# PVT Photo Voltaic Thermal

# **BIRE Building Integrated Renewable Energy or not integrated**



# SHWC Solar Hot Water Cylinders

# Ground/Air/Water Source Heat Pumps (GSHP ASHP WSHP)

# **MVHR SBP&BB Mechanical Ventilation with Heat Recovery, Summer Bypass and Boost Button**

# SLX Smart Lifts/Escalators

# Centralised Vacuum Cleaning

# Design & Detail Guidance

- Building Regulations (legal minimum)
- Zero Carbon Hub/The Buildings Hub
  - Briefing Design & Detailing Failures/  
Guidance (including services)
- Tom Dollard Book: Design to Perform an illustrated guide to delivering Energy Efficient homes (including services)
- TM\_\_ : CIRIA Guide

# Key Building Regulations

Legal minimum > But 'the Performance Gap' suggests we don't meet this minimum very often

The Building Regulations 2010

## Fire safety

### APPROVED DOCUMENT

**B**

#### VOLUME 1 – DWELLINGHOUSES

- B1** Means of warning and escape
- B2** Internal fire spread (linings)
- B3** Internal fire spread (structure)

The Building Regulations 2010

## Site preparation and resistance to contaminants and moisture

### APPROVED DOCUMENT

**C**

- C1** Site preparation and resistance to contaminants
- C2** Resistance to moisture

The Building Regulations 2010  
The Building (Approved Inspections etc) Regulations 2010

## Resistance to the passage of sound

### APPROVED DOCUMENT

**E**

- E1** Protection against sound from other parts of the building and adjoining buildings
- E2** Protection against sound within a dwelling-house etc

The Building Regulations 2010

## Conservation of fuel and power

### APPROVED DOCUMENT

**L1A**

L1A Conservation of fuel and power  
... ..

THIRD EDITION

# PRINCIPLES OF element design



Peter Rich &  
Yvonne Dean



ARCHITECTURE/DESIGN

# PRINCIPLES OF element design

THIRD EDITION

Peter Rich & Yvonne Dean



- Unique in its approach to detail design
- Invaluable for both students and practising architects, builders and surveyors
- Completely updated in a convenient reference sheet format

The construction of buildings is learnt through experience and the inheritance of a tradition in forming buildings over several thousand years. Successful construction learns from this experience which becomes embodied in principles of application. Though materials and techniques change, various elements have to perform the same function. **Principles of Element Design** identifies all the relevant elements and then breaks these elements down into all their basic constituents, making it possible for students to fully understand the given theory and principles behind each part. As all building projects are subject to guidance through the Building Regulations and British Standards, this book gives an immediate reference back to relevant information to help practitioners and contractors identify key documents needed.

**Peter Rich** AIA, BSc, Architect, started his career with 14 years' experience as a qualified architectural technician. He then joined the AA School of Architecture, working with Bill Allen and John Bickerdike after his graduation, later becoming a partner of Bickerdike Allen Rich and Partners. He also taught building construction at the Bartlett School of Architecture, University College London, and architectural design at the Polytechnic of North London. He now acts as a Consultant.

**Yvonne Dean** BA, (Hons) BA (Hons) BSc, is an architect, energy consultant and materials technologist. She also has 15 years' experience as a lecturer, travels widely and is a guest lecturer at many universities. She pioneered an access course for Women into Architecture and Building, which has been used as a template by others, and has been instrumental in helping to change the teaching of technology for architects and designers.



**Architectural Press**

An imprint of Butterworth-Heinemann  
<http://www.bh.com>

ISBN 0-7506-3113-9



9 780750 631136



# Zero Carbon Hub ZCH/ The Buildings Hub TBH

- Performance Gap and Overheating
  - 10 years of Gov. funding: surveys and guidance
  - But never really understood the main cause of overheating
  - Briefing Design & Detailing Failures/Guidance
- Free to download PDFs
  - ZCH Builders' Book
  - ZCH Thermal Bridge Guide
  - ZCH Services Guide
  - ZCH SAP untangled
  - ZCH Ventilation in New Homes
  - TBH Designer's Handbook
- [www.zerocarbonhub.org](http://www.zerocarbonhub.org)
- [www.thebuildingshub.org](http://www.thebuildingshub.org)



## BUILDERS' BOOK



An illustrated guide to building energy efficient homes



### ZERO CARBON HUB BUILDERS' BOOK

#### DOOR THRESHOLD

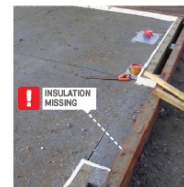


3.0

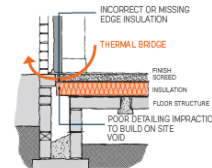


#### PROBLEM TO AVOID

#### MISSING EDGE INSULATION



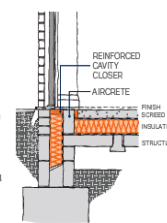
SCREED BRIDGING THRESHOLD



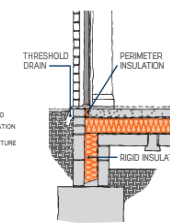
#### WHAT TO DO?

- Follow the detail drawing or speak with Architect / technical team
- Install a thermal break at the threshold – at least 25mm high performance insulation
- Install damp proof membrane, gas membranes and separating layer as necessary
- Overlap door with cavity by at least 50mm
- Ensure airtight seal under door

#### OPTION 1 REINFORCED CAVITY CLOSER



#### OPTION 2 INSULATION AT DOOR THRESHOLD



#### GOOD PRACTICE

50mm thick insulation at door threshold or reinforced cavity closer

Please print and use in your site office, for further information [www.zerocarbonhub.org](http://www.zerocarbonhub.org)



## SERVICES GUIDE

An illustrated guide to building services in new homes



## THERMAL BRIDGING GUIDE

An introductory guide to thermal bridging in homes



## COST EFFICIENCY GUIDE

A step-by-step guide for SME housebuilders on building energy efficient homes cost effectively



## SAP UNTANGLED GUIDE

An introductory guide to SAP for new homes



## VENTILATION IN NEW HOMES

A report of site visit findings





# DESIGNER'S HANDBOOK

Designing comfortable  
low energy homes  
that perform as intended

21/11/19

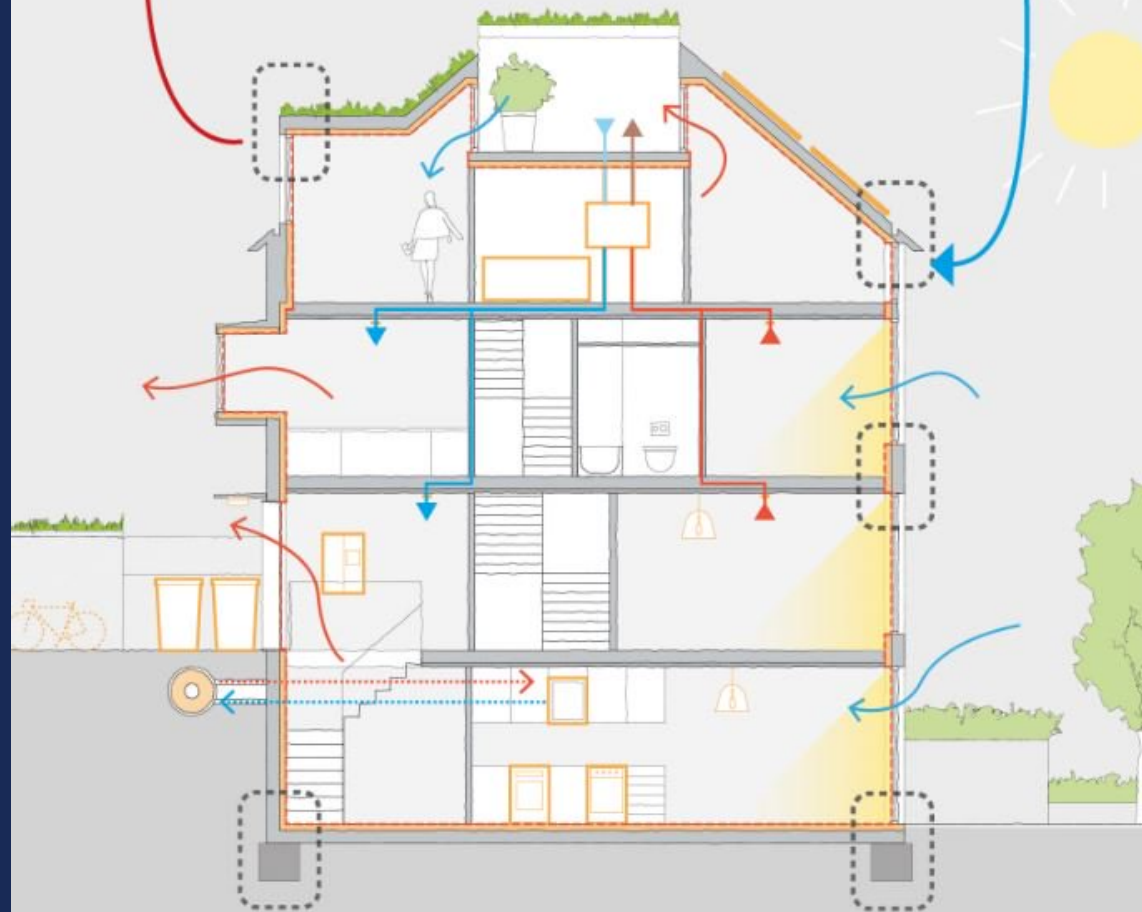


# Tom Dollard Book:

- Design to Perform an illustrated guide to delivering Energy Efficient Homes
  - RIBA Publishing
  - ISBN 978-1-8946-996-5
- Brian Murphy proof read early draft
- Builds on the work of ZCH
- The Performance Gap: how to reduce it
- How to Detail thermally efficient envelopes
- Addresses services failures too

# DESIGNED *to* **PERFORM**

AN ILLUSTRATED GUIDE TO DELIVERING  
ENERGY EFFICIENT HOMES



# Energy and related design standards

- Building Regulations Approved Document L
  - Will eventually meet carbon targets but not now
  - Most new buildings will need to be retrofit by 2030-2050
- Energy (exceeding Building Regulations)
  - AECB Bronze, Silver, Gold and Platinum Standard
  - Super E (Canadian; means to sell their softwood)
  - Passivhaus (German) PHPP Software
    - Indoor Air Quality and Thermal Comfort conditions driven
    - Minimise air leakage, minimise thermal bridges
    - EnerPHit (Passivhaus Retrofit)
  - Minergie (Swiss)
  - Carbon Lite (UK AECB)
    - Passivhaus interpretation for UK climate and energy mix
    - Carbon Lite Retrofit (CLR)

# Retrofit Design & Detailing

- **TSB Retrofit for the Future:**
  - funded 85 buildings 80% Carbon reduction 17kgCO<sub>2</sub>/m<sup>2</sup>/year
  - EnerPHit Standard Passivhaus Retrofit
  - Website with case studies and EST 2 years of monitoring
  - Residential Retrofit Book 20 Case studies Marion Baeli
- **Sustainable Traditional Building Alliance (STBA)**
  - STBA Guidance Wheel
  - No insulation, without ventilation (PAS 2035)
- **Trustmark, Quality Mark, Guarantee scheme**
- **Risk Assessment: 3 approaches, 3 levels of risk**
  - BS 5250 Condensation risk Assessment (Static: inadequate)
  - BS 7913 Historic Significance Assessment
- **Publically Available Specification**
  - PAS 2030:2019:Installation (publication imminent)
  - PAS 2035:2019:Design (publication imminent)



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IBO - Austrian Institute for Building and Ecology (Ed.)

## Details for Passive Houses: Renovation

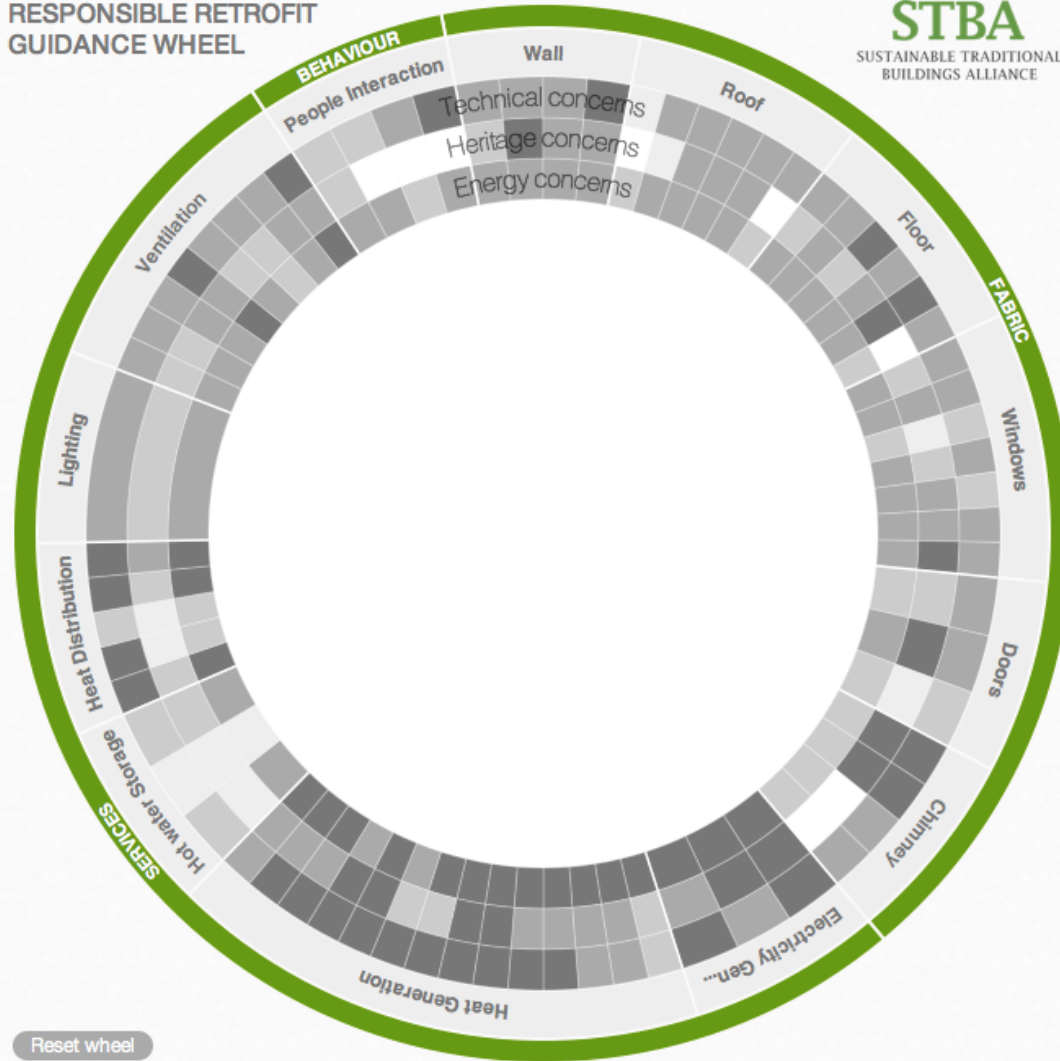
A Catalogue of Ecologically Rated Constructions



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## RESPONSIBLE RETROFIT GUIDANCE WHEEL



Reset wheel

GETTING STARTED

ABOUT

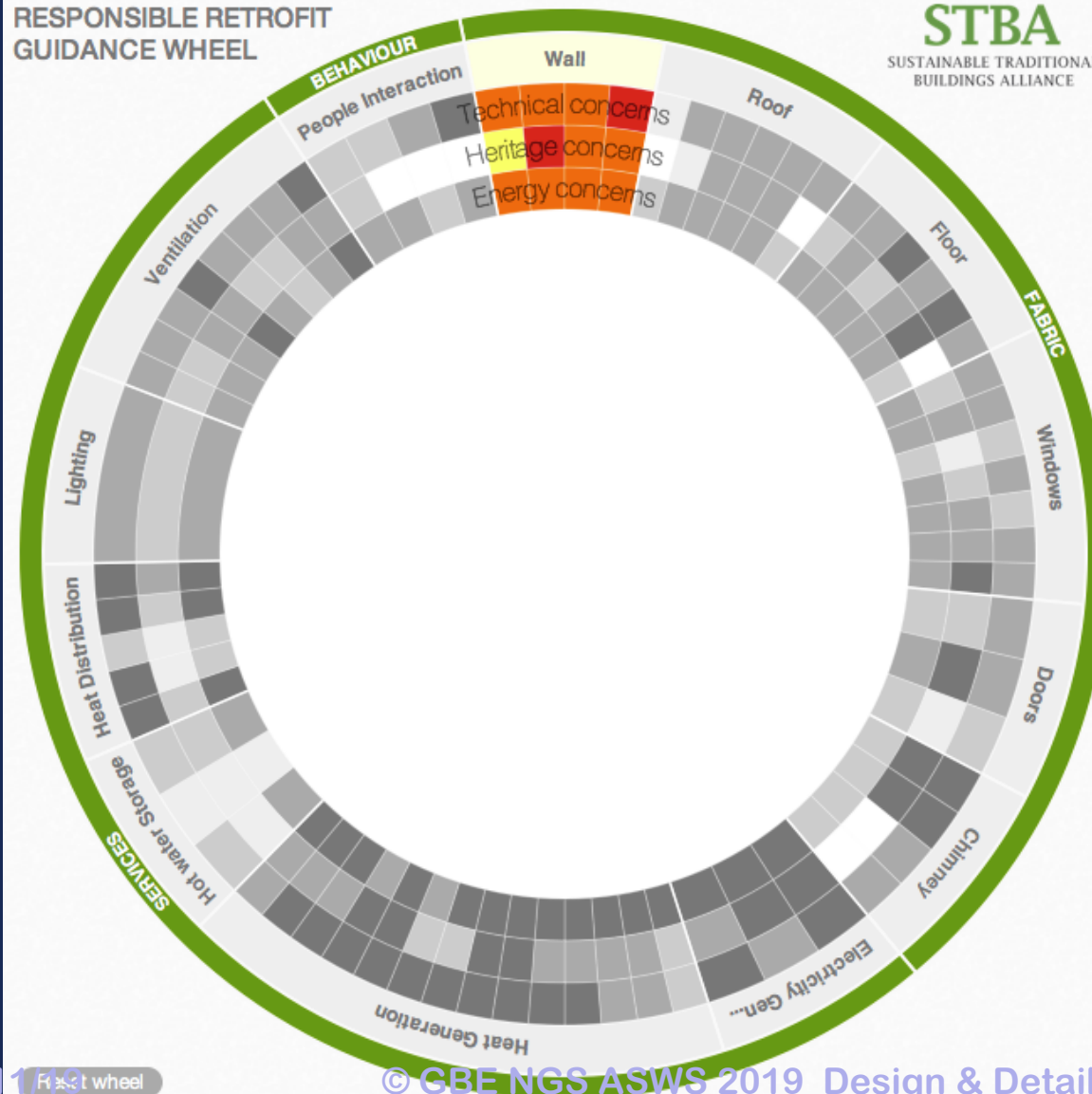
GLOSSARY

REPORT

► Colour key

► Building context

## RESPONSIBLE RETROFIT GUIDANCE WHEEL



STBA

SUSTAINABLE TRADITIONAL  
BUILDINGS ALLIANCE

GETTING STARTED

ABOUT

GLOSSARY

REPORT

### ► Colour key

### ► Building context

#### Wall

Wall measures look at the introduction of insulation in traditional wall construction. The options look at alternative positions of the insulation layer within the wall: within a existing cavity, external or internal to a solid wall construction or within a framed wall construction. Depending on context different solutions may be considered for different building elevations.

#### Cavity Wall Insulation

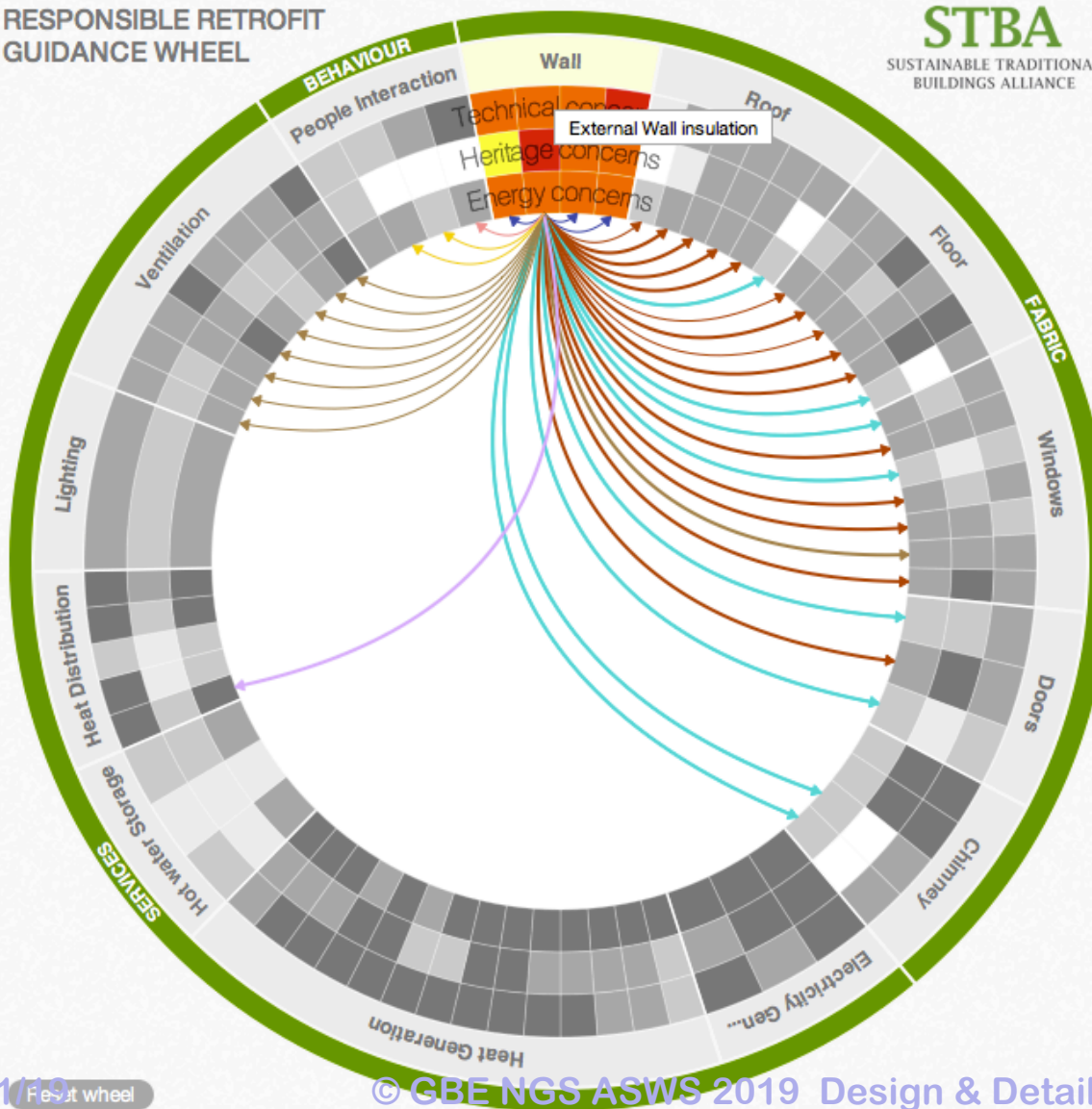
#### External Wall insulation

#### Internal Wall insulation

#### Frame infill insulation

CLOSE CATEGORY

## RESPONSIBLE RETROFIT GUIDANCE WHEEL



### ► Colour key

### ► Building context

#### Wall

### External Wall insulation

Application of an insulation material and a weather-protective finish to the outside of the wall

ADD TO LIST

CLOSE MEASURE

### ► Advantages

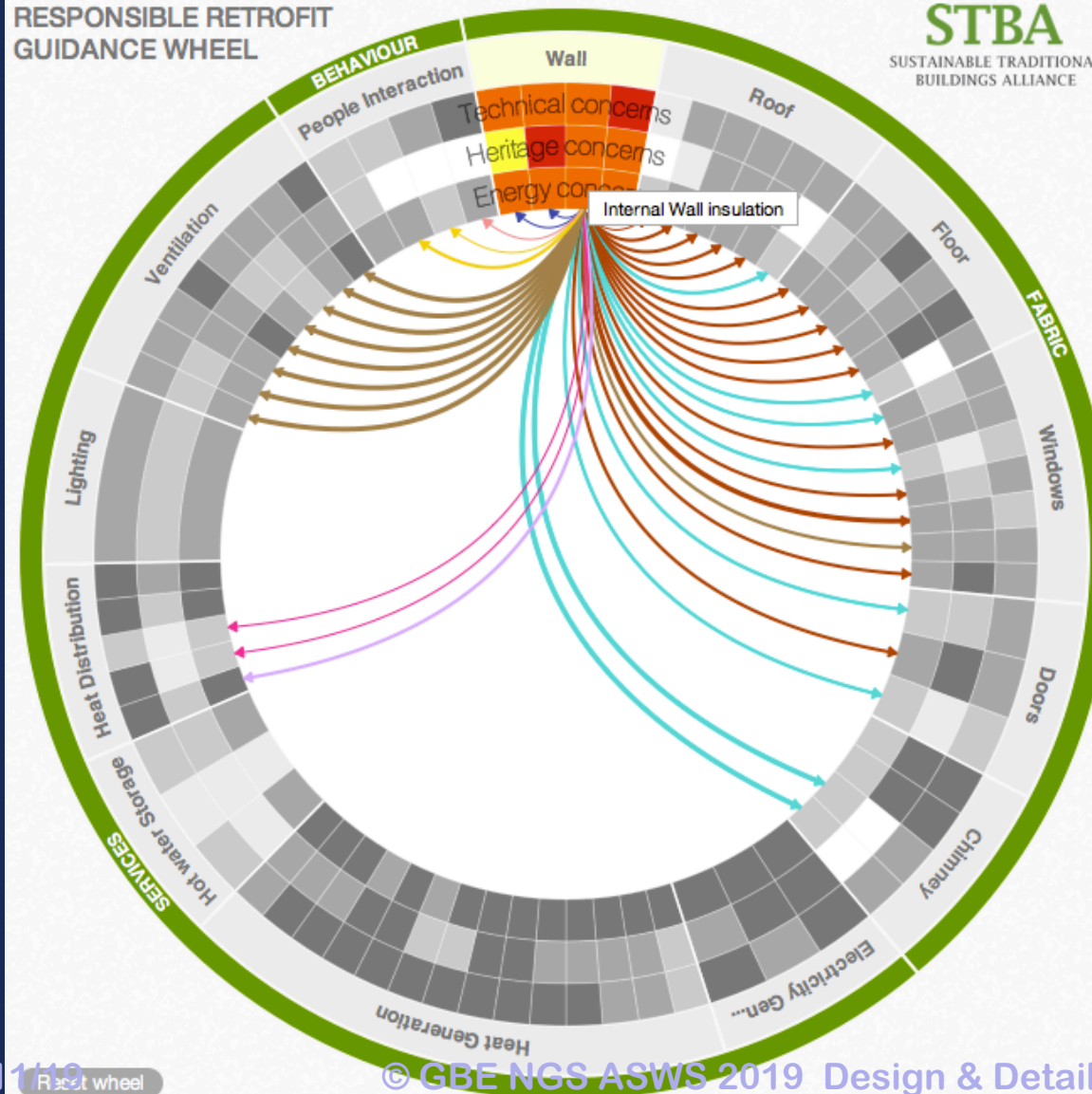
### ► 7 Technical Concerns

### ► 3 Heritage Concerns

### ► 3 Energy Concerns

### ► Related measures

## RESPONSIBLE RETROFIT GUIDANCE WHEEL



## STBA

SUSTAINABLE TRADITIONAL  
BUILDINGS ALLIANCE

GETTING STARTED

ABOUT

GLOSSARY

REPORT

### ► Colour key

### ► Building context

#### Wall

### Internal Wall insulation

Insulation material is fixed to the inside surface of external walls and new internal finishes applied or insulation is blown behind existing linings

ADD TO LIST

CLOSE MEASURE

### ► Advantages

### ► 8 Technical Concerns

### ► 3 Heritage Concerns

### ► 3 Energy Concerns

### ► Related measures

# Whole House Plan

- Don't set out to refurbish in stages
  - and then find something you did early has to be undone and redone
  - Boilers and radiators first
    - Take them off again
    - then add internal insulation
    - and rehang the boiler and the radiators



# Trigger points:

- if you are re-rendering apply insulated rendering in one go
- If you are repairing a bathroom leak change the sanitaryware to low water consumptions and insulate the external wall

# Phased/room by room refurbishment

- Plan the final layout
- Plan the room temporary functions
- Plan the decanting of one room to enable the refurbishment of it
- Plan the temporary storage of possessions
- Plan the reinstatement of possessions into a smaller room

# Future proofing:

- **Allow for Renewable energy to be fitted later by making provision for it at an early stage**



# Plan the Journey

- Know your destination
- Then your meanderings all lead to the same destination
- Without detours and dead ends
- Without going round in circles
- Without treading the same path twice

# Whole House Plan

- Showing the final insulation regime
- Modify the services installations with the final insulation regime in mind
- Avoid servicing > undoing services > insulating > re-servicing
- Or avoid services and insulation in the same place or insulate first
- Radiators not on the external wall
- Insulate in patches then services
- Insulate wall then boiler
- Insulated underfloor heating and no radiators

## Plan

External wall

External wall  
Thermal insulation  
Thermal bridges  
Through ducts &  
Party wall  
Internal party wall  
thermal insulation  
Duct Space  
insulation

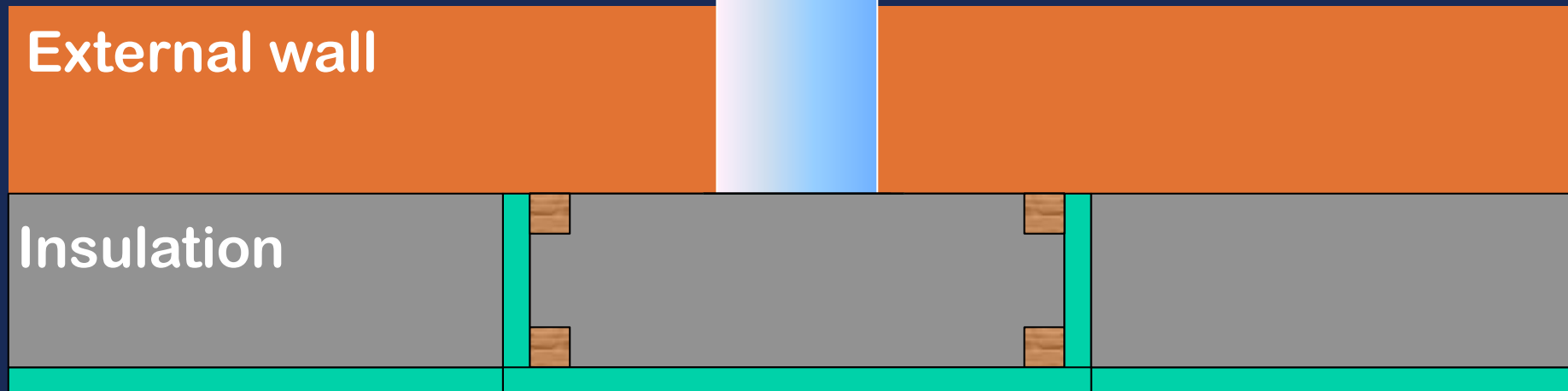
Party Wall  
chimney breast

Limited access  
to services  
To connect  
To insulate  
To make air tight  
To maintain  
To fix leaks  
To replace

21/11/19

not pipe lagging

## Plan



External wall  
Thermal insulation  
must be first

If Boiler replaced  
early

Out of sequence  
working

Framing, Insulation  
& Linings

Then Boiler

Access to services  
To connect  
To fire proof  
To make air tight  
To insulate

Avoid removing and  
refitting boiler and  
pipes to new  
insulated lining later

Later Phase

# © GBE 2019

- Brian Murphy BSc Dip Arch (Hons+Dist)
  - Technician and Architect by Training
  - Specification Writer by Choice
  - Environmentalist by Actions
- Greening up my act since 1999
- Founded National Green Specification 2001
- Launched [www.greenspec.co.uk](http://www.greenspec.co.uk) 2003
- Created: GBE at <https://greenbuildingencyclopaedia.uk> 2015
- E [BrianSpecMan@icloud.com](mailto:BrianSpecMan@icloud.com)
- Twitter: <http://twitter.com/brianspecman>
- LinkedIn: [BrianSpecMan](#)
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