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Retrofit for Health and Well-being

Dr David Kelly, Group Director BRE

Other relevant research themes

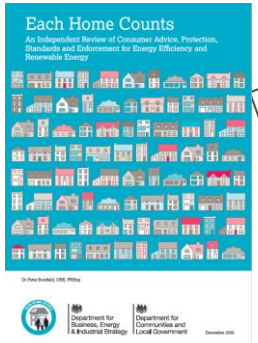
- **Centre for Resilience**
  - **Flooding, climate change, energy resilience**
    - **Research, guidance, tools, standards, innovative tech.**

BRE CENTRE FOR RESILIENCE

- **National Solar Centre**
  - delivering **independent, research led knowledge** and **guidance** about solar and related technology
  - Supports **growth & innovation** in the UK solar market

BRE NATIONAL SOLAR CENTRE

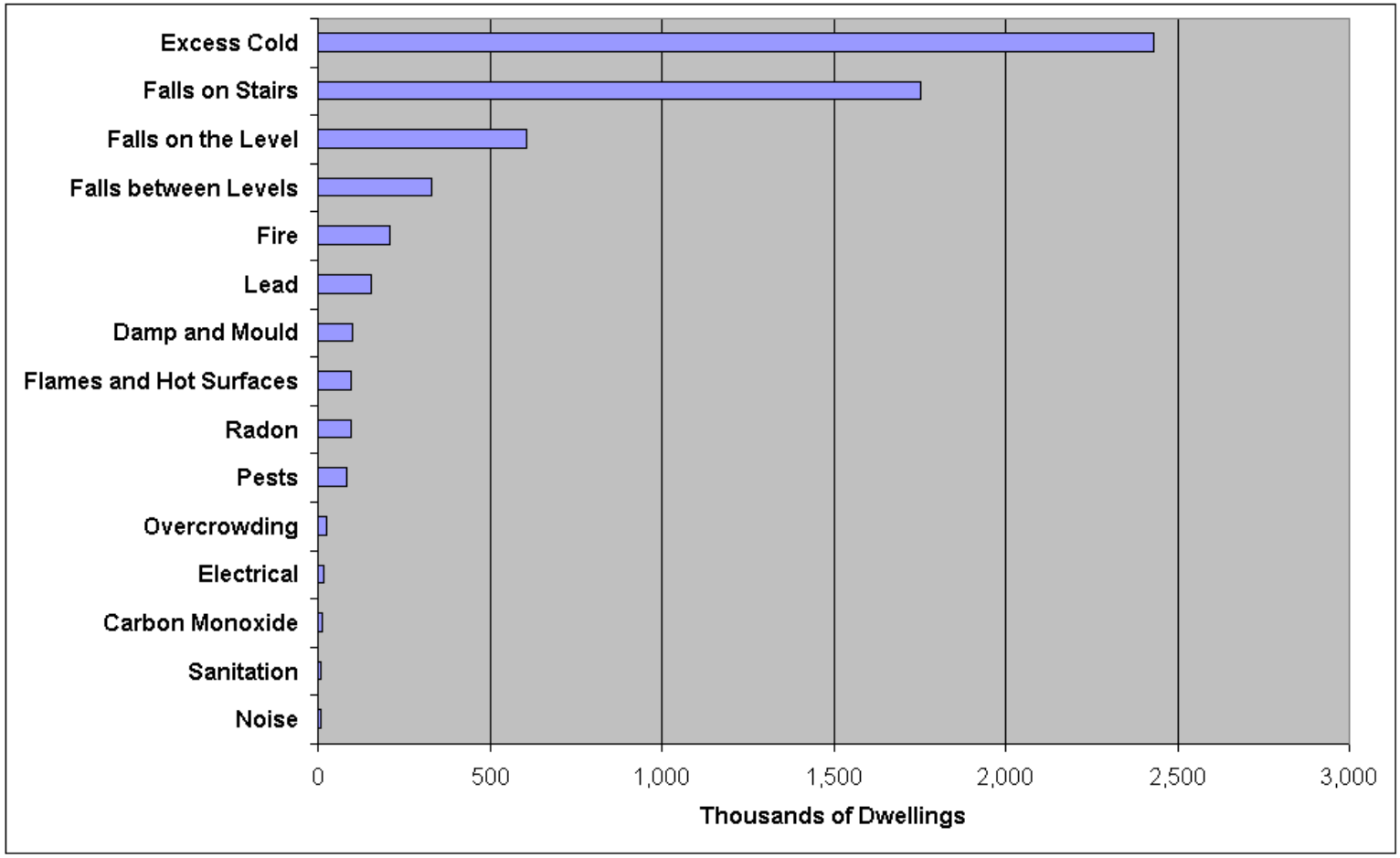
- **Retrofit – Each Home Counts**
  - this is an area in which we have always had an interest, but which was brought to the fore through the Each Home Counts Review



What is the impact of poor housing?

Physiological - Excess Cold, Damp

Occurrence of HHSRS Cat 1 hazards - 2006 EHCS



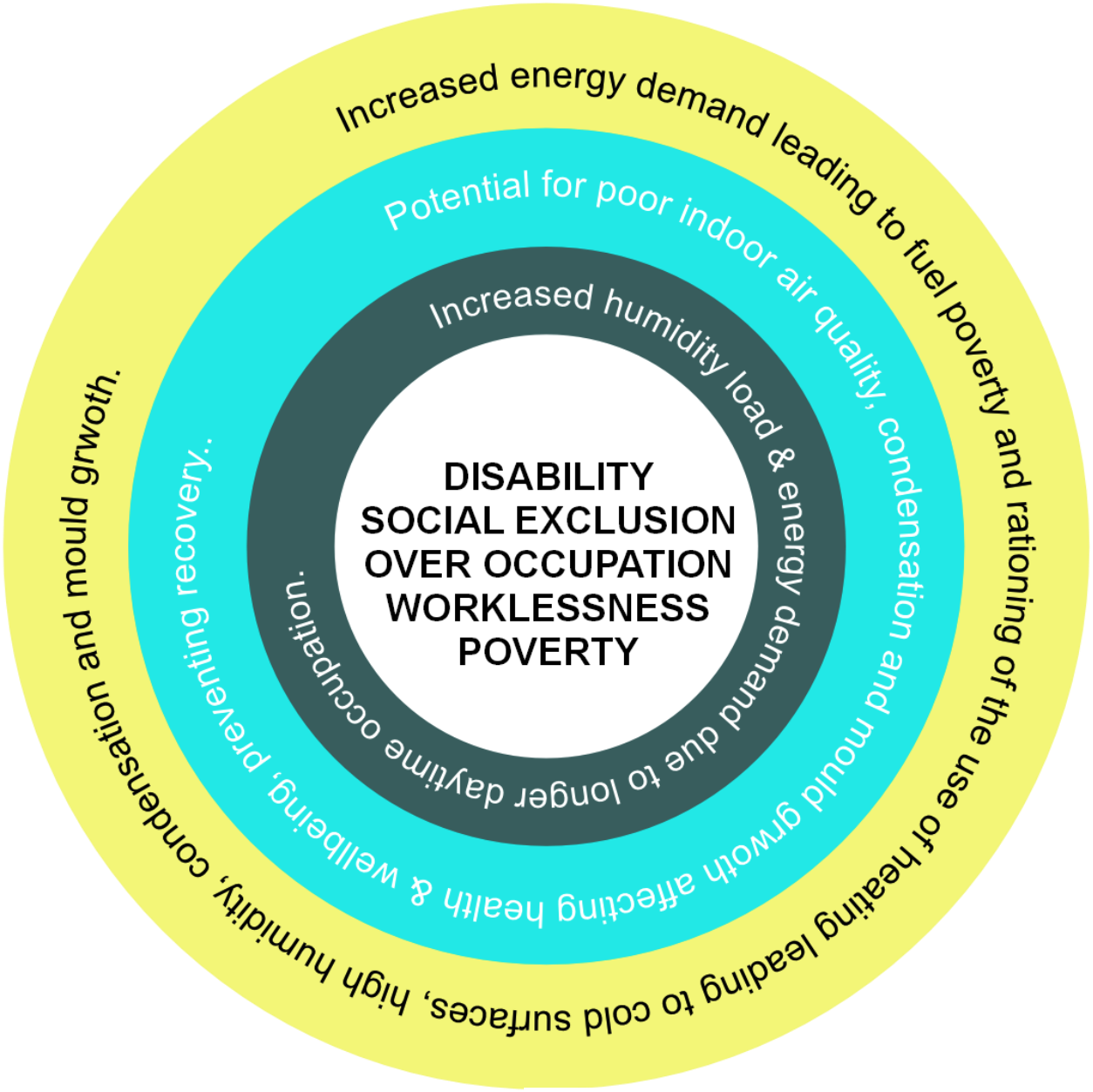
BRE Innovation Park Ravenscraig


bre

BRE Retrofit/ Dementia House

How to tackle the problem of retrofit

- adopt a blanket ‘area-based’ approach to investment?
- ‘fabric first’ or technology based?
- strategic, based on house type?
- or a ‘construction-based’ rather than ‘house type’ approach?
- ‘top down’, or ‘bottom up’ with a community based approach addressing behavioural and attitudinal change?


Increased energy demand leading to fuel poverty and rationing of the use of heating leading to cold surfaces, high humidity, condensation and mould grwoth.
Potential for poor indoor air quality, condensation and mould growth affecting health & wellbeing, preventing recovery..
Increased humidity load & energy demand due to longer daytime occupation.
DISABILITY
SOCIAL EXCLUSION
OVER OCCUPATION
WORKLESSNESS
POVERTY

Our 4 in a block project is a 'retrofit R&D laboratory'

Project Partners:

BRE, Scottish Government, Edinburgh Napier University, Historic Scotland

Developer	-	**Cruden Building & Renewals**
Architects	-	**Kraft Architecture**
Engineers	-	**Hannah Reed Consulting Engineers**

and an integrated supply chain for the project and follow-on commercialisation activity.

Edinburgh Napier University undertook monitoring of the four units over an extended period including simulated occupancy impacts.

Project aim – to demonstrate ‘market ready upgrade packages'

The project uses a common Scottish Housing typology, a generic ‘4 in a block’ which is found all over Scotland in different contexts as the test bed.

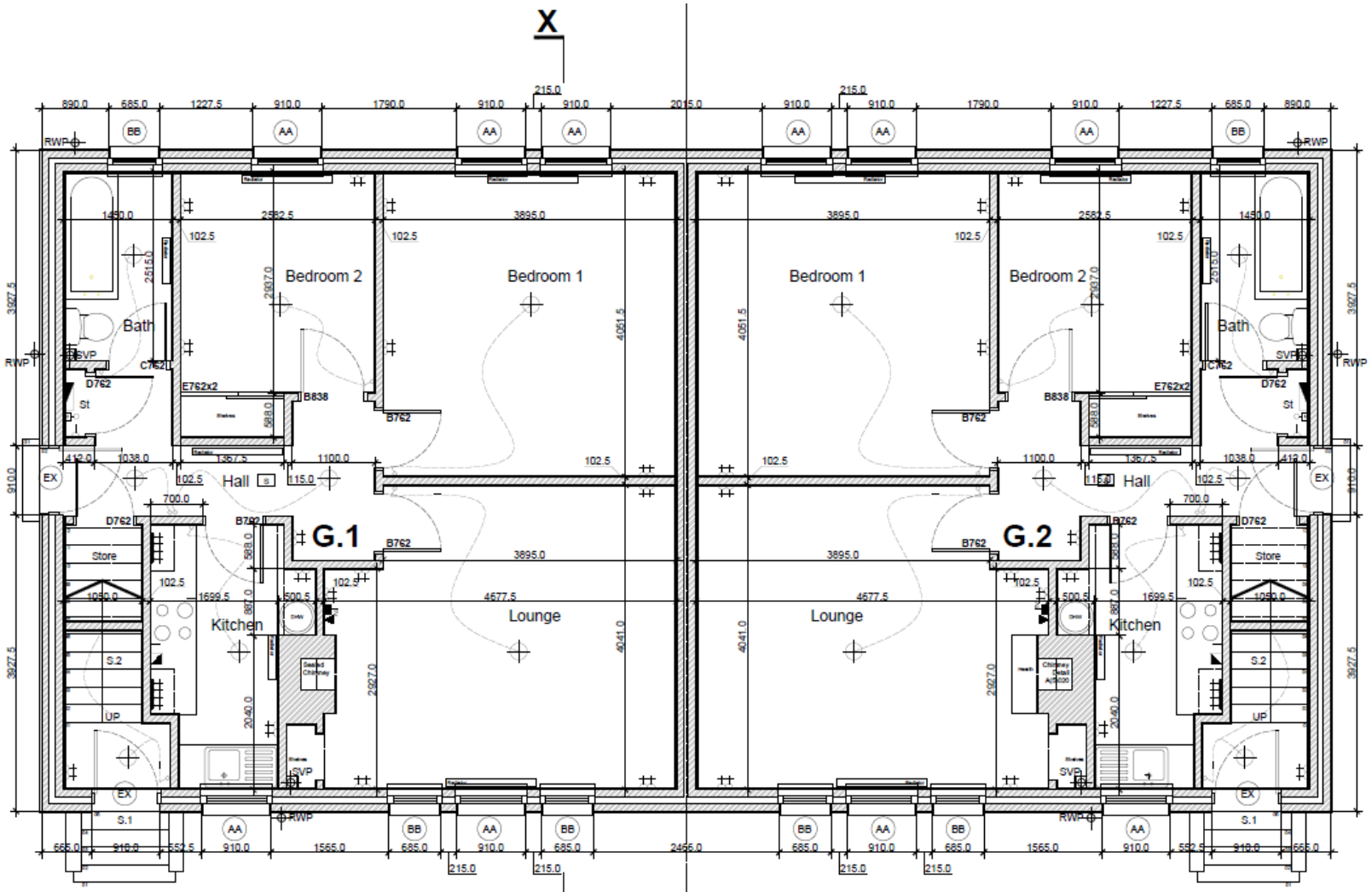
Four approaches were demonstrated, based on market ready and tested technologies.

An APP was also developed to allow users to adapt the approach to suit their budget and to understand the associated risks and opportunities.

The project offers first hand experience of different technologies within the practical and commercial reality of available funding model parameters.

This is crucial for successful dissemination of the project findings into practice.

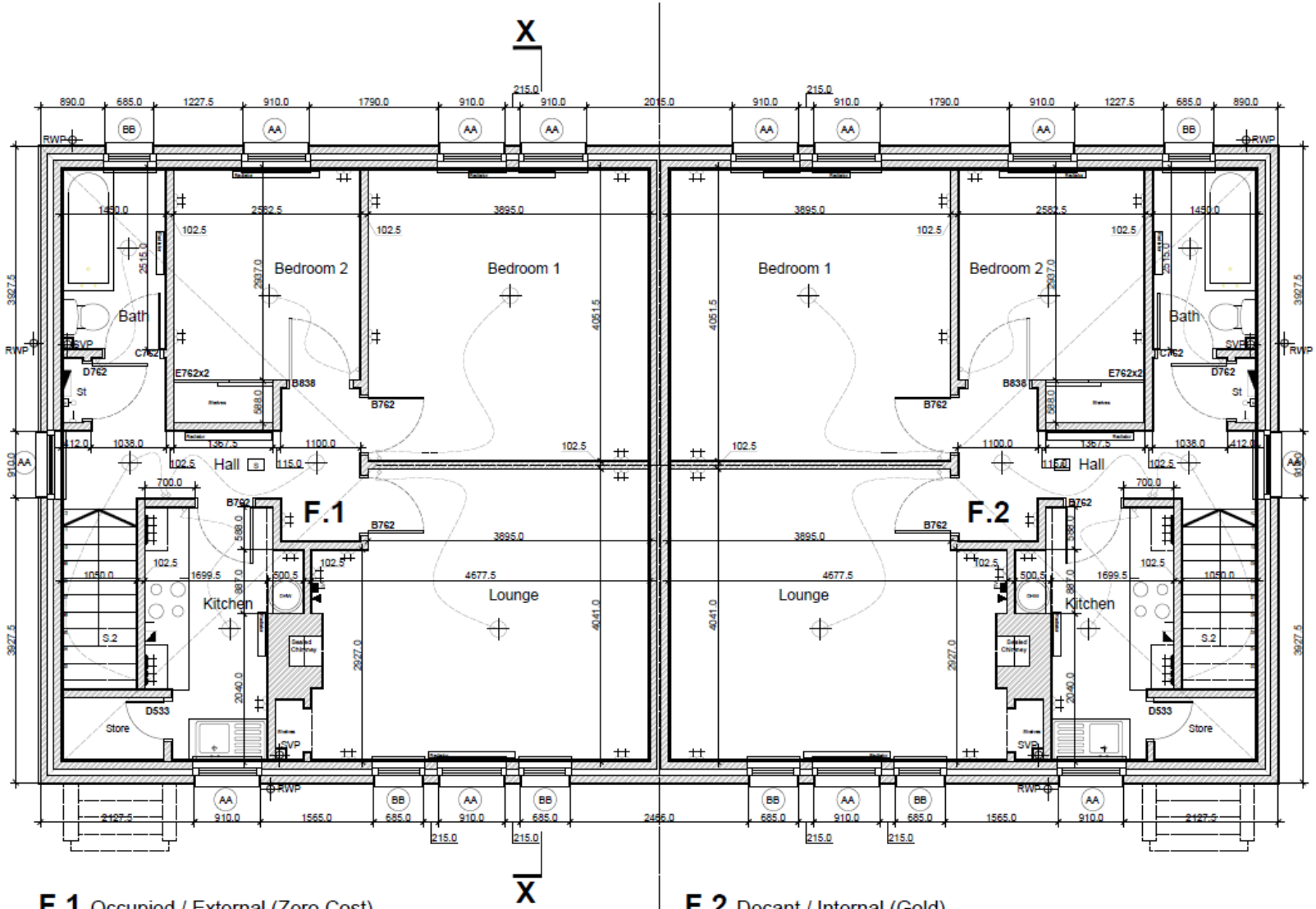
	‘Four in a Block’ Baseline Model
Ground Floor	Un-insulated Suspended Timber Floor
External Wall	Un-insulated Cavity Wall Construction with existing render coat & internal lining
Windows & Doors	Replacement UPVC
Separating Floor	22mm flooring on solid joists, un-insulated between joists
Separating Wall	Un-insulated Cavity Wall Construction with existing parge coats
Roof	Cold roof with 100mm insulation
Space Heating	Storage / Panel Radiators.
Hot Water	70 Litre Single Immersion Cylinder
Ventilation	Individual Intermittent Fans / Sealed Hearth Chimney
Airtightness	15q50 (backstop assumed)



G.1 Occupied / External (S7 Silver)

G.2 Decant / Internal (Passive)

Ground Floor



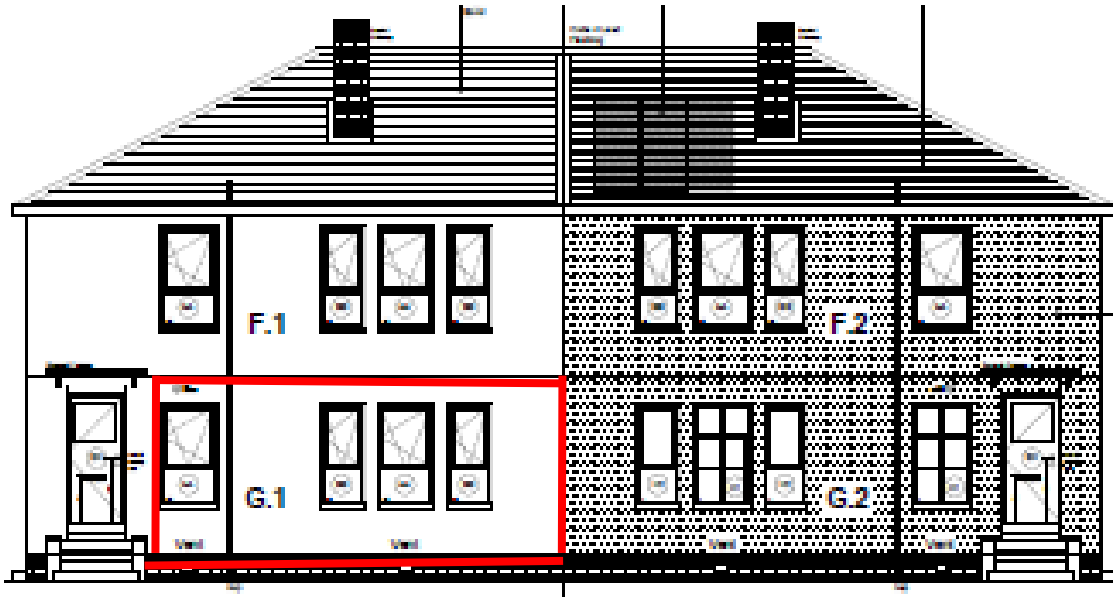
F.1 Occupied / External (Zero Cost)

F.2 Decant / Internal (Gold)

Upper Floor

Flat G1 – Occupied - From SAP 50 to 76

Flat G1 – from SAP 50 to 76 using traditional technologies – based on minimum disruption in occupied flat



G1	Ground Floor Flat LHS
Scenario	Occupied / Minimal Disruption
Target	SAP 76C
Approach	External Fabric Improvements / Basic Heating Upgrade
Measures	Gas Combi Boiler with Gas Flue Saver Technology
	Cavity Fill / EWI Insulation
	Low Energy Individual Mechanical Extract Fans
	6.53 q50 Air Tightness
	Low Energy Timber Windows & Door
	Independent Living / Adaptations

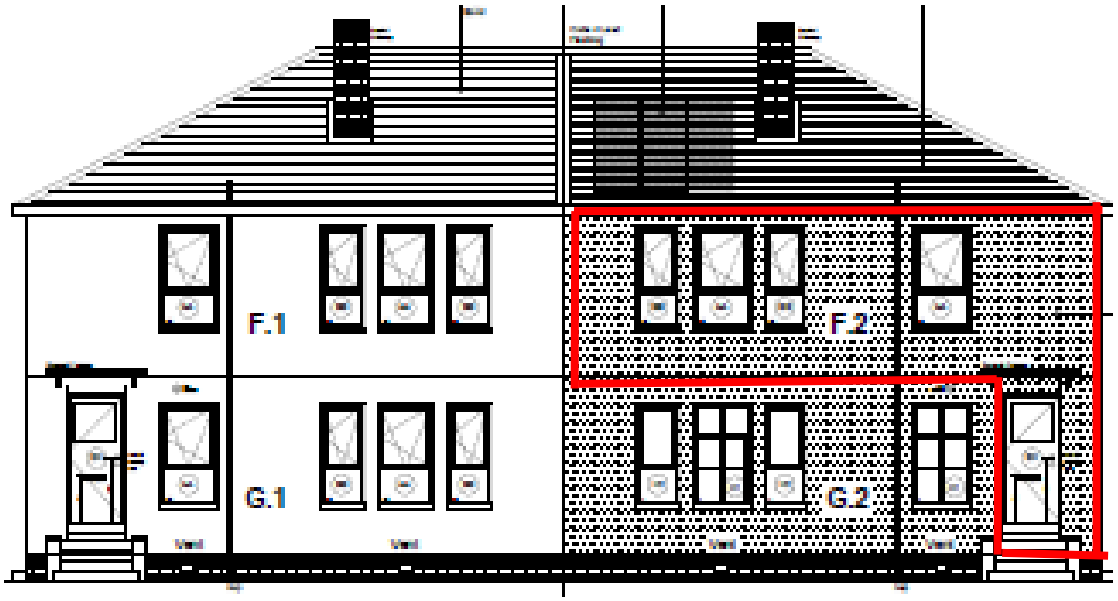
Flat F1 – Occupied - From SAP 50 to 82

Flat F1 – to Bronze Standard (2010) – based on minimum disruption in occupied flat

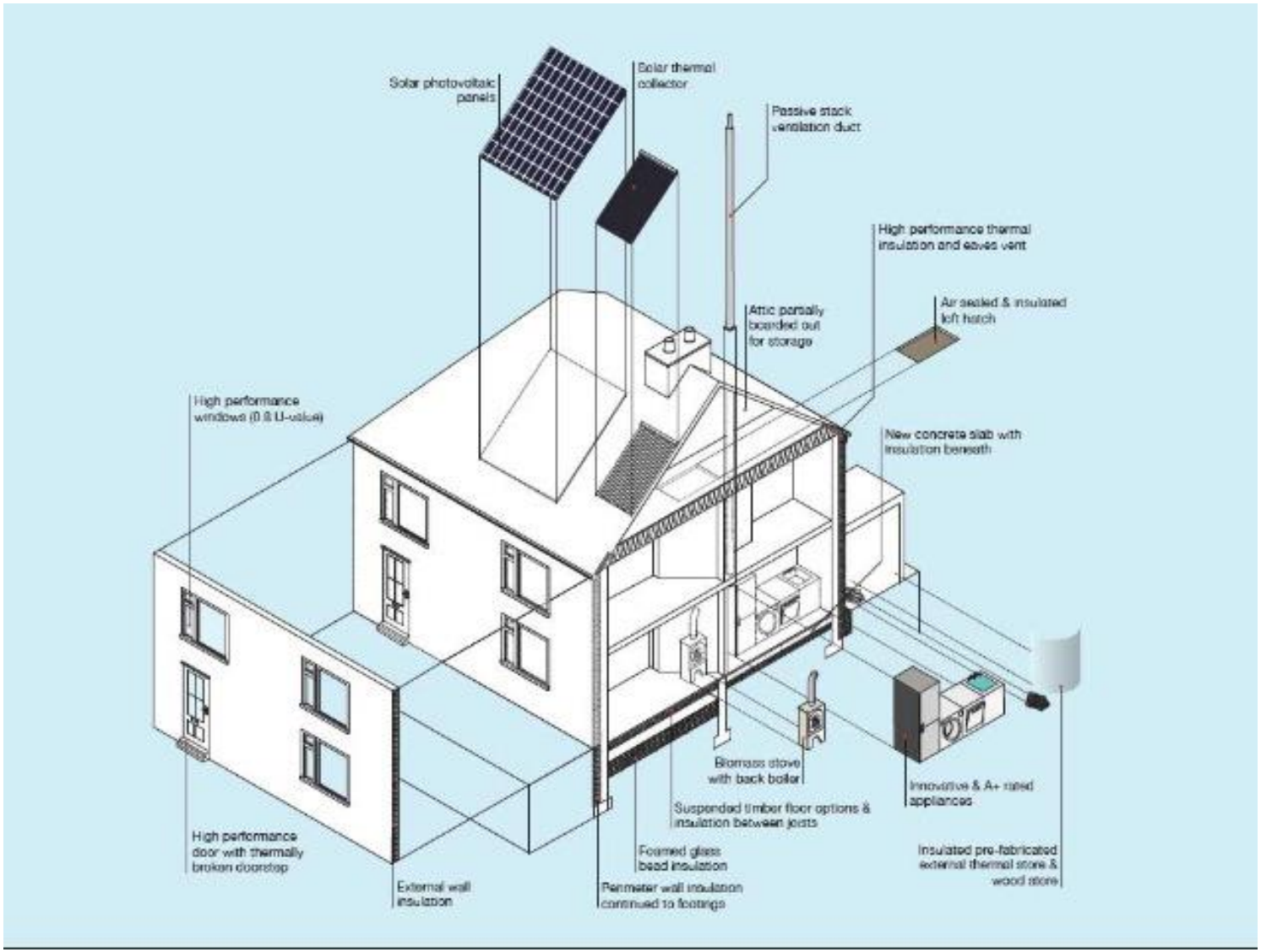
F1	Upper Cottage Flat LHS
Scenario	Occupied / Minimum Disruption
Performance	SAP 82 / Bronze (2010 Pass)
Approach	External Fabric Improvements / Full Heating Upgrade
Measures	SedBUK A GAS System Boiler
	4m^2 Solar Thermal System & 210 Litre Cylinder
	Cavity Fill / External Insulation
	Basic Additional Loft Insulation
	Positive Input Ventilaton (Loft)
	7.53 q50 Air Tightness
	Low Energy Timber Windows & Door

Flat F2 – Occupied - From SAP 50 to 83

Flat F2 – to Silver Standard (2015) – based on ability to de-cant occupants – unoccupied flat



Flat F2 Technologies applied



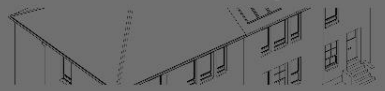
F2	Upper Cottage Flat RHS
Scenario	Decant / Void
Target	SAP 83 / Silver (2015 Pass)
Approach	Internal Fabric Improvements / No Gas Scenario
	Air Source Heat Pump with Radiators
	2kW Solar PV Array and Solar Thermal panels
	Cavity Fill, Moisture Buffering Internal Insulation & Lining, Loft Insulation
	6.04 q50 Air Tightness
	MVHR System
	Super Low Energy Windows & Door
	Feed in Tariff Income

Flat G2 – Un-occupied - From SAP 50 to 85

Flat G2 – from SAP 50 to SAP 85 – Highest Standard achieved - based on ability to de-cant occupants – supported by HES

G2	Ground Floor Flat RHS
Scenario	Decant / Void
Target	SAP 85
Approach	Internal Fabric Improvements / Heritage / No Gas Scenario
Measures	Electric Combi Heat Store / Underfloor Heating
	Cavity Fill / Moisture Buffering Internal Insulation & Lining
	Insulating Ground Floor
	New Acoustic Ceiling & Separating Wall Treatments
	6.11 q50 Air Tightness
	Heritage Timber Windows & Door
	Intermittent Room Only Heat Recovery

Scenario Summary



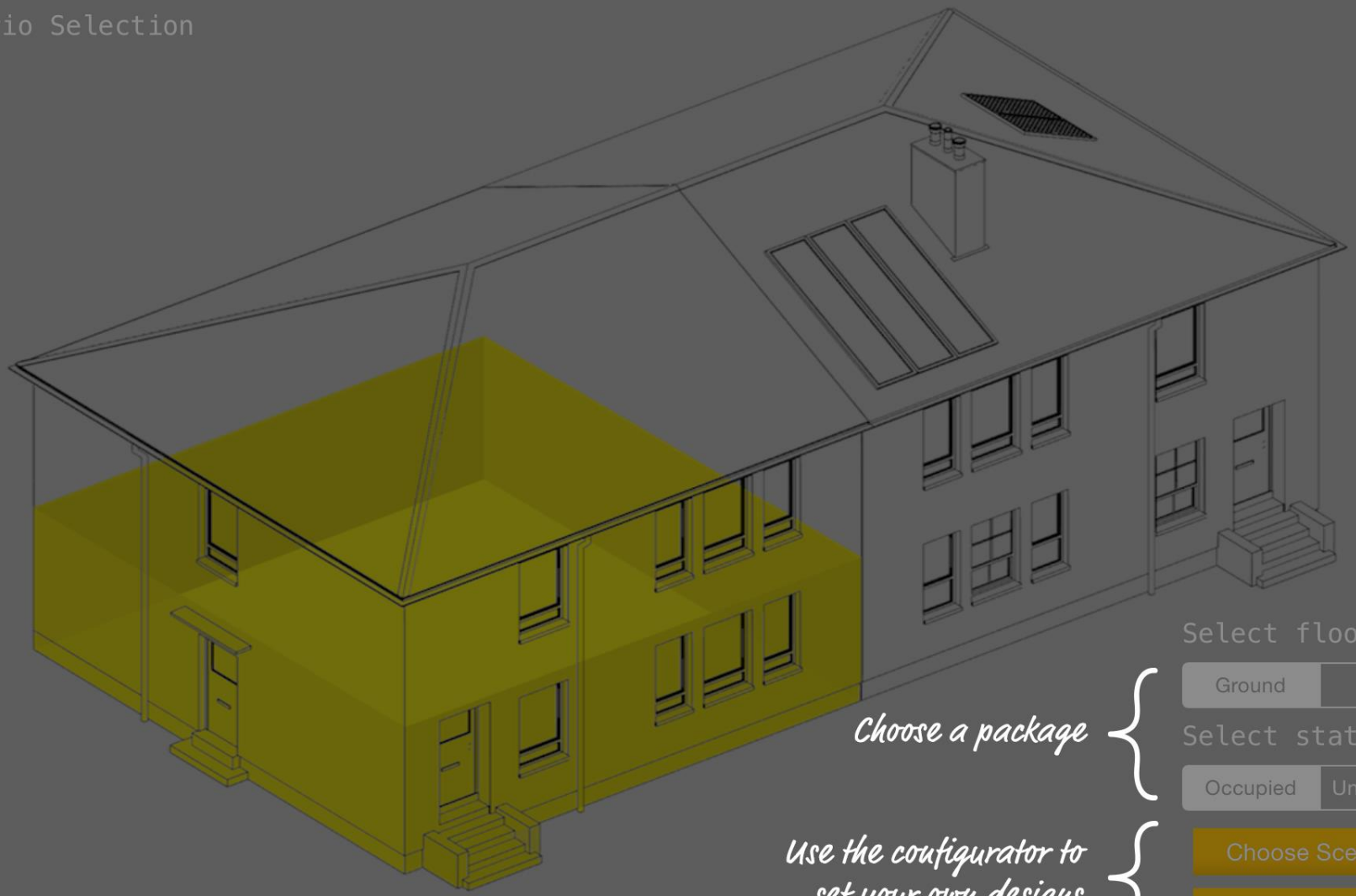
About this scenario:

Occupied flat with measures chosen to minimise disruption and maximising a fabric first performance approach using external wall insulation to reduce cold bridging, new high performance windows to improve thermal performance, thermal comfort and reduce maintenance requirements. A new efficient gas combi heating system with Gas Flue Saver technology and examples of adaptations for an ageing population.

Floor: **Ground**
Status: **Occupied**

Scenario Summary

Scenario Selection



Select floor

Ground | First

Choose a package

Select status

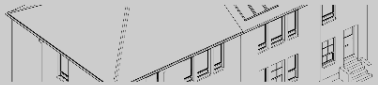
Occupied | Unoccupied

Use the configurator to set your own designs

Choose Scenario

Choose Baseline

Scenario Summary



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Floor: **Ground**
Status: **Occupied**

Different scenario

External Insulation	Cavity Insulation	Internal Insulation	Loft Insulation	Windows	Ground Floor	Heating	Ventilation	Renewables
No measure	No measure	No measure	No measure	No measure	No measure	No measure	No measure	No measure

Semi-rigid Batt

100mm Mineral Fibre 0.035W/mk applied & fixed to existing masonry leaf and finished with a proprietary silicone based render system or brick slip finish. Care should be taken to ensure that if a masonry cavity construction, this has been properly treated to avoid thermal bypass of the external insulation.

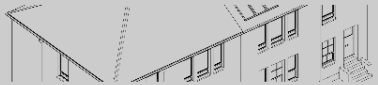
Remove measure

EWI should only be considered after ventilated wall cavities have been fully treated with either cavity fill and/or full sealing of cavity edges to prevent thermal bypass and heat loss.

Capital Costs	Running Costs	DER	Energy Use	SAP
£0	£1,429	90	13714	E
£ Capital	£ Annual Cost	0 200 kg/m2/yr	0 20000 kWh/yr	

Fully Improved

Scenario Summary



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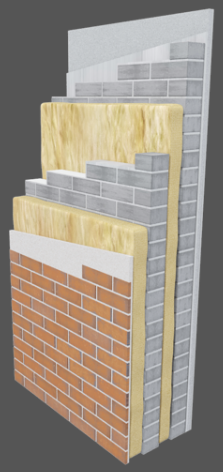
Floor: **Ground**
Status: **Occupied**

Different scenario

External Insulation	Cavity Insulation	Internal Insulation	Loft Insulation	Windows	Ground Floor	Heating	Ventilation	Renewables
Semi-rigid Batt	Cavity Fill Blown Bead	No measure	No measure	Double Glazed Timber or Aluclad Windows	No measure	Gas Combi Boiler with Gas Flu Saver Technology	DMEV Decentralised Mechanical Extract Ventilation	No measure



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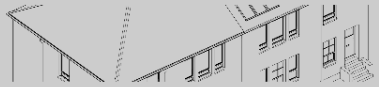
Capital Costs	Running Costs	DER	Energy Use	SAP
£24,462	£564	11	7663	A
£ Capital	£ Annual Cost	0 – 200 kg/m2/yr	0 – 20000 kWh/yr	

Save Measures
View Unimproved
Reset

Scenario Summary



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Floor: **Ground**
Status: **Occupied**

Different scenario

£ Capital	£ Annual Cost	DER (kg/m2/yr)	Energy Use (kWh/yr)	SAP	
£24,462	£564	11 (0–200)	7663 (0–20000)	A	Test: View Measures / Set as Baseline
£12,195	£766	23 (0–200)	10456 (0–20000)	A	Test1: View Measures / Set as Baseline
£24,462	£564	11 (0–200)	7663 (0–20000)	A	Test1: View Measures / Set as Baseline
£24,462	£564	11 (0–200)	7663 (0–20000)	A	Test1: View Measures / Set as Baseline

Capital Costs	Running Costs	DER	Energy Use	SAP	
£24,462	£564	11 (0–200)	7663 (0–20000)	A	Full Package Improvement
£ Capital	£ Annual Cost	kg/m2/yr	kWh/yr		

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