

# What will it take to get to net zero?

## Identifying appropriate technical solutions.

Chris Morgan – John Gilbert Architects

Lori McElroy – University of Strathclyde



# Scottish Government's 2045 Vision

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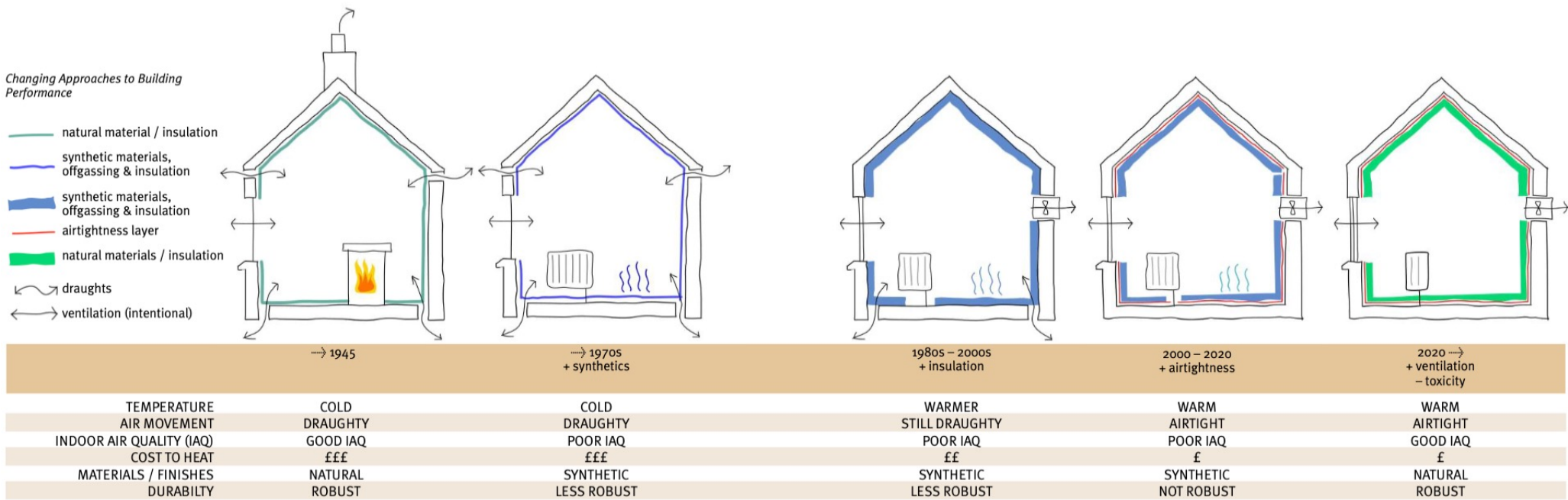
Scotland's homes are net-zero carbon by 2045 and this is achieved in a way that is socially and economically sustainable, through a Just Transition:

- by 2032 - 94% of non-domestic buildings' and 80% of domestic buildings' heat will be supplied using low carbon heat technologies;
- all homes to achieve EPC Band C at point of sale from 2025 (subject to consultation);
- EPC Band C for all homes by 2033;
- removal of public subsidy for new or replacement fossil fuel boilers, immediately – phasing out by 2025 (off gas) 2030 (on gas);
- all new homes use zero emissions heating by 2024;
- all homes achieve net zero by 2045



Retrofit with ground source heat pump by John Gilbert Architects  
Lumphinnans, Fife.

# What will it take to reach net zero?





# 107 Niddrie Road Glasgow

## Tenement EnerPHit Passivhaus Retrofit

1. Top up insulation up to 450mm thick

2. Lower area of slates removed to check for timber decay and ensure insulation wraps over wall head to meet EWI

3. Two smaller windows knocked into one larger window for more light and heat gain into living areas

4. New high performance triple glazed windows and doors

5. External wall insulation to rear and gable walls, extended below floors, into window reveals, all downpipes replaced

6. Mechanical ventilation with heat recovery unit in bathroom ceiling removes almost all outgoing heat keeping flats warm with lots of fresh air

7. Wastewater heat recovery from baths and showers

8. Internal wall insulation to front elevation, walls stripped back to stone, wood fibre insulation and lime plaster added

9. Street side stone wall repaired with stone repair and repointed using lime

10. First floor joists removed from wall to avoid decay, allowing for continuous insulation and airtightness

11. Layout altered for better space planning

12. Ground floor insulated along with careful airtightness measures



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Southside  
HOUSING ASSOCIATION





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## BRE Retrofit House





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## 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.

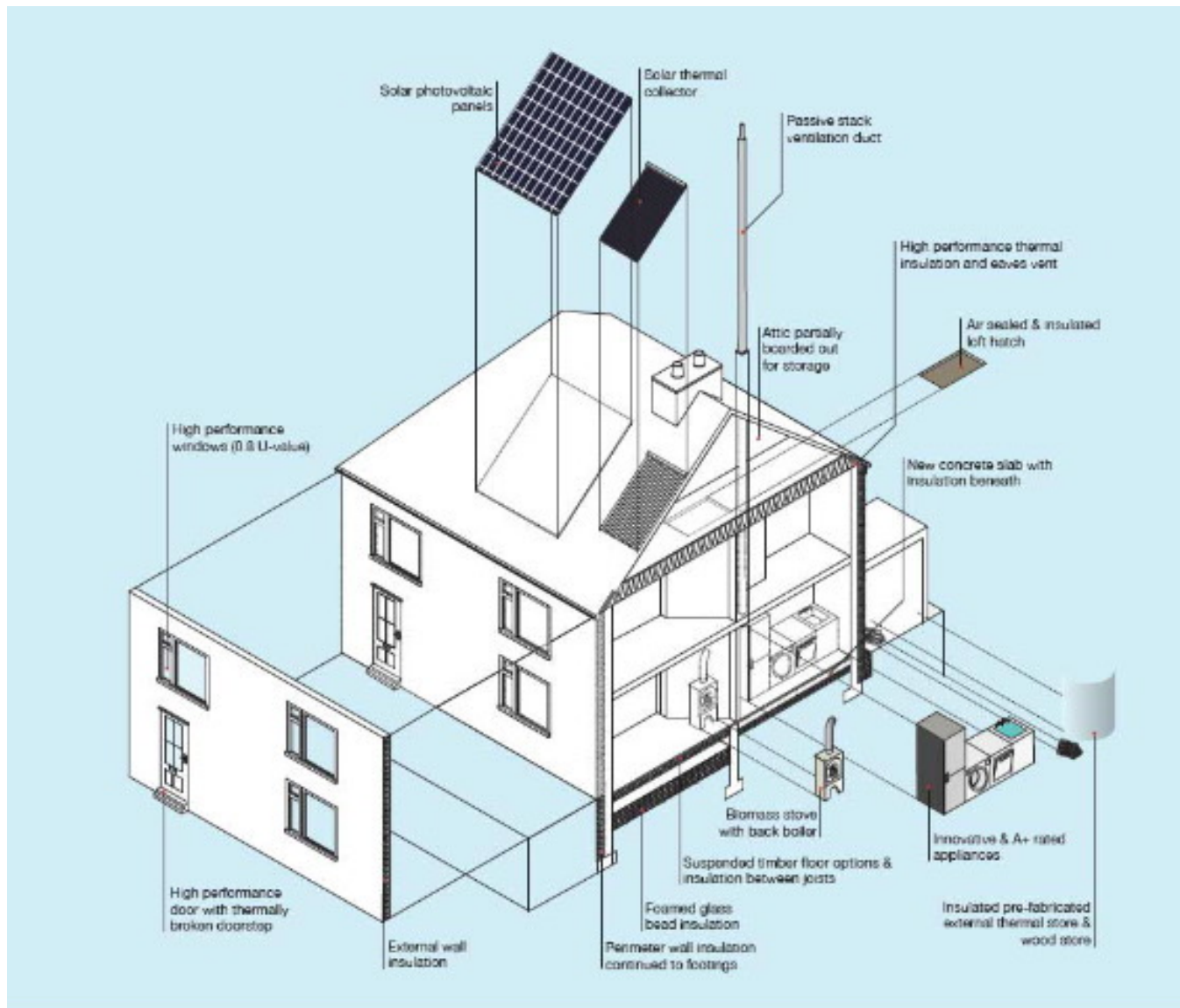
This is crucial for successful dissemination of the project findings into practice.

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



F2	Upper Cottage Flat RHS
<b>Scenario</b>	Decant / Void
<b>Target</b>	SAP 83 / Silver (2015 Pass) / EPC Band B
<b>Approach</b>	Internal Fabric Improvements / No Gas Scenario
<b>Measures</b>	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 F2

### Technologies applied:

- Air Source Heat Pump with Radiators
- 2kW Solar PV Array and Solar Thermal panels
- Cavity Fill, Moisture Buffering Internal Insulation & Lining, Loft and loft-hatch insulation
- 6.04 q50 Air Tightness
- MVHR System
- Super Low Energy Windows & Door
- Feed in Tariff Income



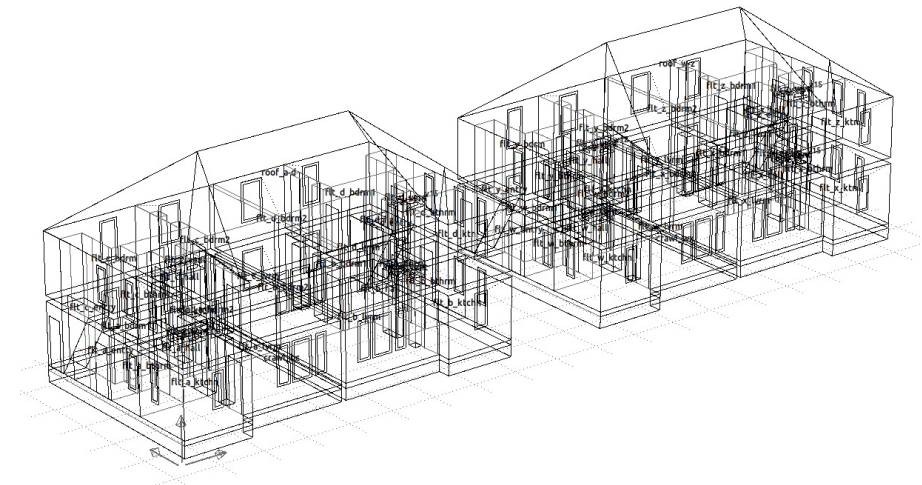
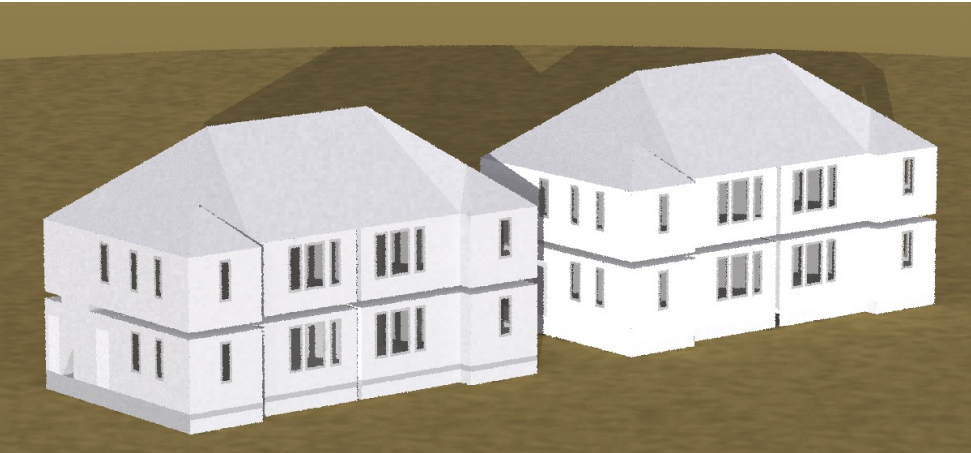








# Dynamic Simulation Modelling

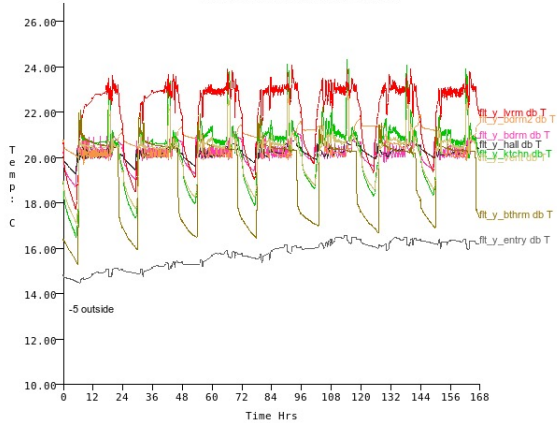


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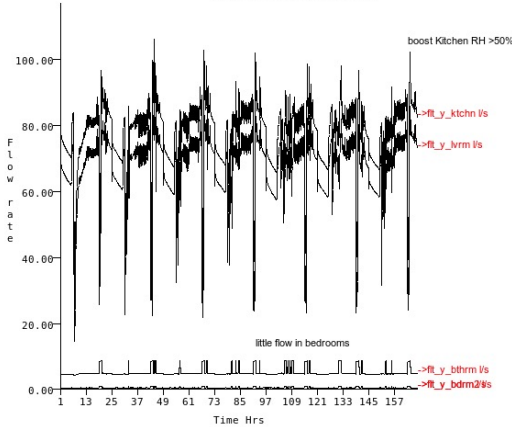


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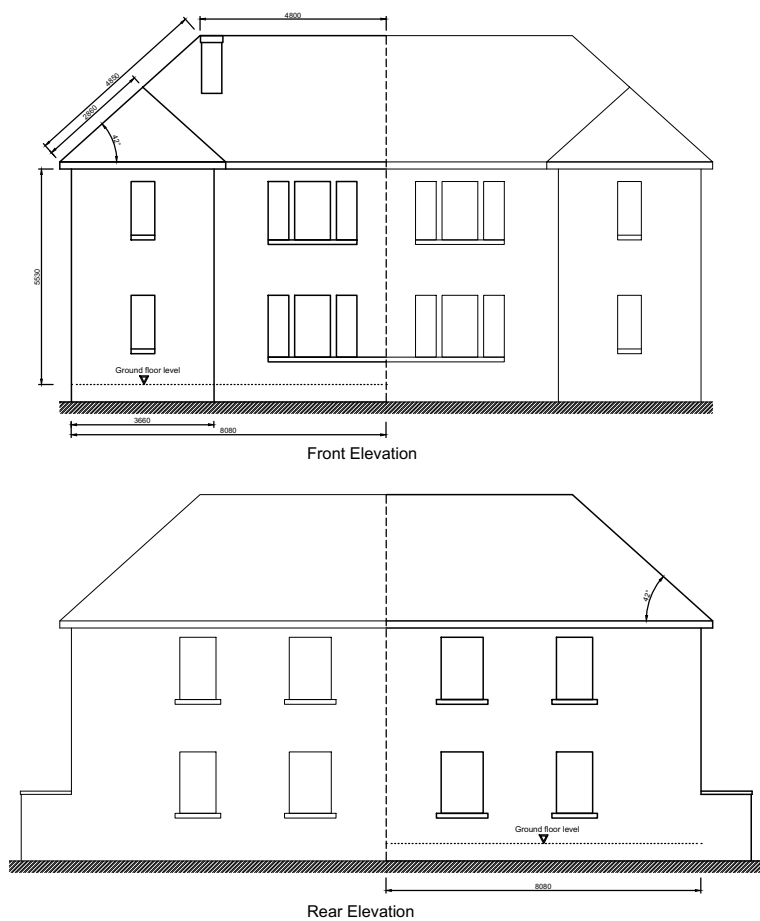
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Period: Tue-09-Jan@00h03(2007) to Mon-15-Jan@23h57(2007) : sim@06m, output@06m  
Zones: flt\_y\_entry flt\_y\_bdrm flt\_y\_hall flt\_y\_bdrm2 flt\_y\_kitchn flt\_y\_lvrn flt\_y\_bthrm flt\_y\_vent  
Dry bulb T in flat Y for cold winter week



Lib: RC 4naBlock trial enh ctf c.mfr: For RC 4naBlock enh ctf  
Period: Tue-09-Jan@00h03(2007) to Mon-15-Jan@23h57(2007) : sim@06m, output@06m  
Fresh air entering rooms in flat Y



# Renfrewshire Council and John Gilbert Architects



107-109 Blackstoun Oval  
PA3 1LT  
Archetype: REN 6025

Drawing No:	6025-EL-1	Date:	MAY 2018
Scale:	NTS	Drawn by:	MS
Renfrewshire Council			







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EV = EXTRACT VENT  
OF = OVERFLOW  
AB = AIR BRICK  
SP = SOIL PIPE ENTRY  
SVP= SOIL VENT PIPE  
RWP= RAIN WATER PIPE

 RENDER 01  
 RENDER 02  
 BRICK SLIPS  
 CONCRETE TILE

Existing structural and services arrangements are indicative. Full detail investigations to be completed and any discrepancy notified to the architect prior to works commencing.

All insulation to be mineral wool (non-combustible) with sole exception of below ground level. See arch. details for further information. To achieve u-values as noted in spec.

Existing roof finishes to be stripped back to decking, and any rotten decking to be replaced in suitable treated SW to match existing. New breather membrane and suitable treated SW battens installed to accommodate new conc. tiles and PV panels. Dimensioned to engineers' assessment.

Existing damaged or loose render to be stripped and patch repaired to match adjacent.

Mineral wool fire breaks to be included indicated to comply with Euroclass A1

underpin works 05/01/2004 A10004 A10004

Any required movement joints to be set out by architect.

New canopies to be fitted above external door heads to architects' spec and details.

External stair to have balustrade will safely removed above step level and existing finishes stripped and repaired required, refreshed to match existing, prepared for attaching new weather finished metal handrail to external face including stainless weather-proof fixing

Services for re-use to be safely disconnected and carefully removed for re-fitting to new material surface following completion of external works.

All existing extract vents to be removed

Defunct services, including aerials and wiring, to be removed and penetrations blocked up to achieve same u-value as air-tightness as adjacent fabric.

Boiler flues to be extended to accommodate GWT thickness.

Any proposed services penetrating roof finishes to have suitable weather seal terminal to ensure against water ingress.

All works to services to be undertaken suitable qualified and certified persons and necessary certification and paper work supplied to client.

**IN Q-**  
 All rules to be read in conjunction with architectural specification and client procedural documents.

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**ARCHITECTS**

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Client:  
**Renfrewshire Council**

Project:

30-36 Blackstoun Oval
Title Elevations Proposed
Project Status Warrant

Job No.	State of Ill
<b>03995</b>	<b>1:50</b>
Drawn by	Date of Issue
<b>HT</b>	<b>28.11.18</b>

Case	Commentary	Date
A	Updated in line with client comments	12.12

Org. No. [PE]04 Rev. A

# Renfrewshire Council and John Gilbert Architects

