CIVIC HOUSE RETROFIT

ARCHITECT
Collective Architecture

LANDSCAPE ARCHITECT
ERZ

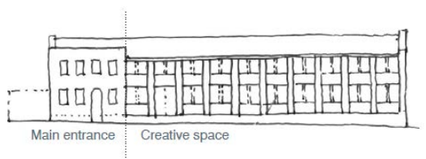
CLIENT
Agile City

CURRENT COST
£450,000

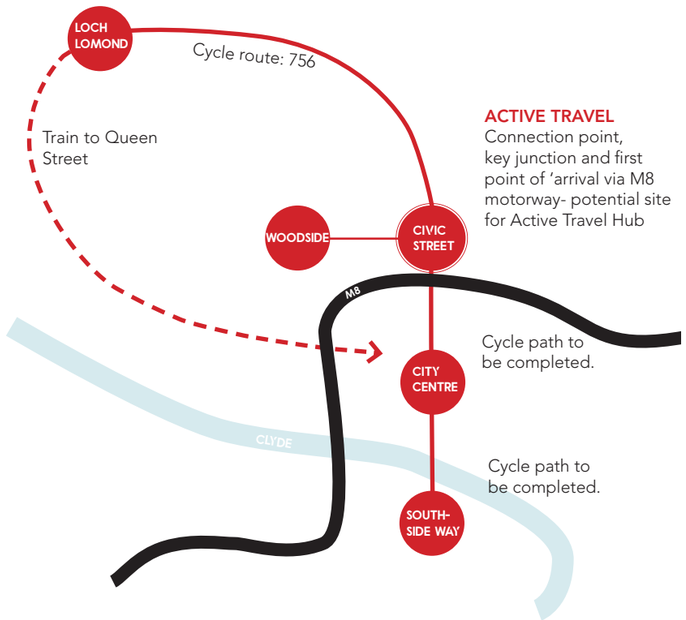
COMPLETION
Phase 1 - 2020
Phase 2 - 2021

Civic House, originally constructed in 1920 as a printing press, is now a workspace, venue and canteen that supports a community of people working across social, cultural and green enterprise. Collective Architecture was commissioned by Agile City to undertake the refurbishment and thermal upgrade of the early 20th century industrial warehouse located in the north of Glasgow.

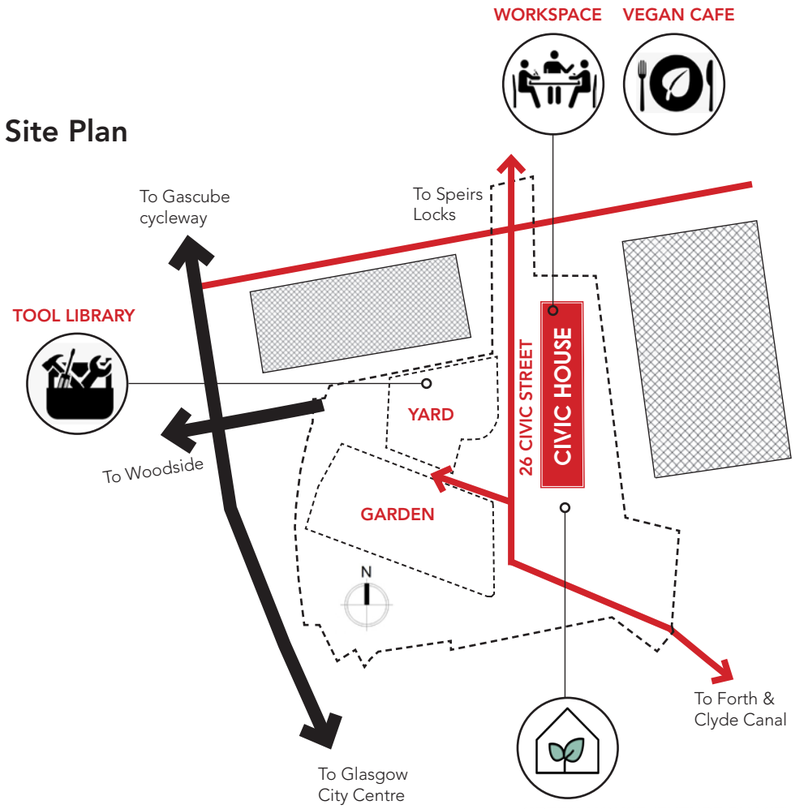
The core principle of the project is to create a leading example that demonstrates carbon reduction innovation as Scotland's first retrofit **'PassivWareHaus'**.



Context



Site Plan



Historical Timeline

1920

CIVIC PRESS, NO 26 CIVIC STREET

'The printing works was a survivor of the radical activity so characteristic of early 20th-century Glasgow. This shows the frontage of the building, which was built in the early 20th century of rendered brick, probably to resemble the fashionable concrete buildings of the period. Note the large number of windows, probably to facilitate hand composition of type. As can be seen in this view, the building was originally surrounded by tenements. These were cleared away in the late 1960s, leaving the building isolated.'

- canmore.org.uk

1960

SOCIAL AND ECONOMY CHANGES IN GLASGOW

A combination of major social, economic and spatial changes contributed to a dramatic remodeling of the area's urban form in the late 20th century. Industries closed, the tenements were cleared and the local population was dispersed. (Left) Whilst the park was lost during the construction of the M8 motorway.

Pinkston Power station (Right) built in 1901 for electrification of the Corporation tramways demolised in 1977.

2017

BUILDING ACQUISITION

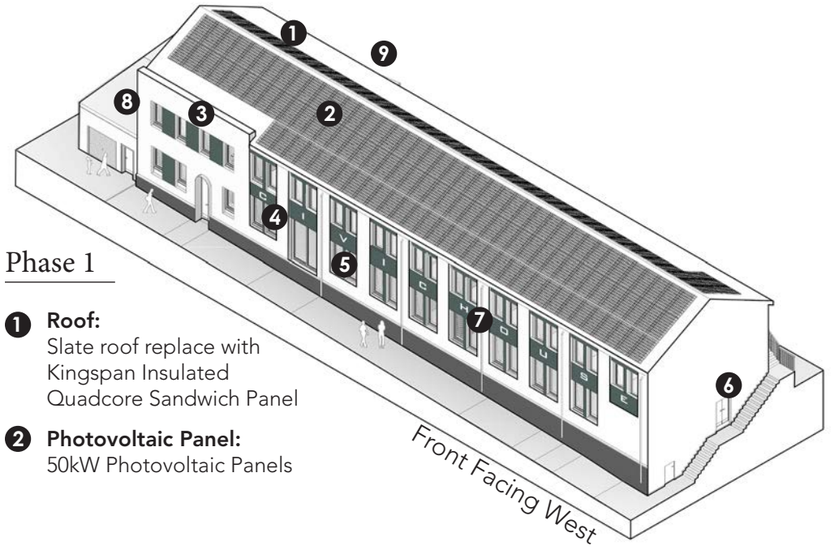
The site was left abandoned for years, attracting high-level of anti-social behavior and negative perceptions- compound by derelict land and lack of safe public spaces. Historic lack of maintenance and repair has resulted in damage to the elevations and subsequent water ingress. The main parapet cope has been particularly affected with feature stone capitals previously replaced painted plywood likely for safety reasons. In 2017, the building was acquired by non-profit community interest company Agile City. Since then, Agile City have cleared the majority of overgrown grass and bushes from the site, seeded wild flowers and opened it up creating clear public access.

2018

INITIAL INTERNAL WORKS

Funded by Scottish Government Regeneration Capital Grant Fund, Agile City commenced an internal refurbishment work to convert its use into a public venue, canteen and workspace. The internal partition walls have been stripped out to expose the timber roof structure, providing an open plan studio for events.

Step-By-Step Retrofit: EnerPHit as Design Tool

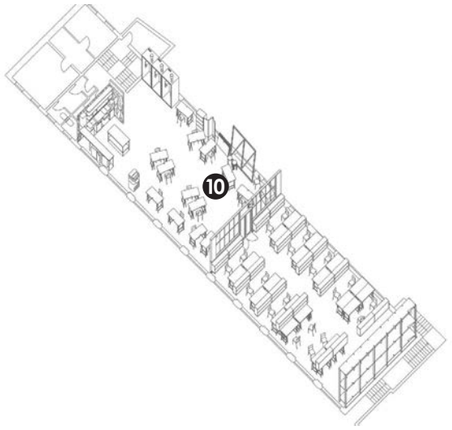


Phase 1

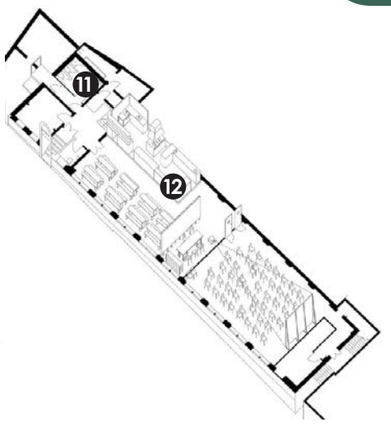
1. **Roof:** Slate roof replace with Kingspan Insulated Quadcore Sandwich Panel
2. **Photovoltaic Panel:** 50kW Photovoltaic Panels

Phase 2

3. **External Wall Insulation:** StoMix Therm Eco External Insulated Render System bonded the existing brick and render
4. **Airtightness Layer:** Airtight continuity between walls/ windows/doors, walls to roof, service penetrations. Any redundant opening or cracks are properly sealed. Pro Clima range Airtightness Liquid membrane used over tape edge.
5. **Triple Glazed Window:** Existing windows to be replaced with high performance triple glazed units.
6. **High Performance Door:** Existing doors to be replaced and carefully detail forming part of the thermal envelope
7. **Rainwater Downpipe Fixings:** Spiral anchor EJOT spiraldubel for fastening of attachments. No thermal bridging.
8. **Mechanical Heat Recovery System (MVHR):** Installation of MVHR to ensure good ventilation and heat recovery throughout the building with minimum 80% efficiency.
9. **Air Source Heat Pump (ASHP):** Installation of ASHP and electric radiator



Ground Floor Plan



First Floor Plan

Early sketches by Agile City showing internal space planning with an open plan layout.

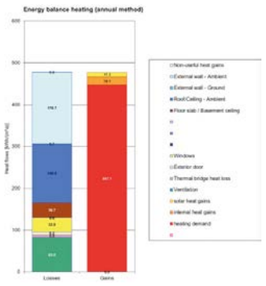
10. Installation of energy efficient LEDs
11. Installation of Aerated Water Taps
12. Installation of WIFI enabled Thermostat Controls

2018 | **2019** | **2020** | **2021**

01.SITE INVESTIGATION

In 2017, Collective Architecture was appointed by Agile City to facilitate an energy analysis and feasibility study to define the scope of retrofitting the existing building.

The necessary energy efficient improvement works are identified through site investigation work.



02.ENERGY MODELLING

Building energy models are developed using PHPP to determine the most appropriate and effective energy improvement measures

The most appropriate sequence for implementing improvements in a step-by-step approach is formulated.

03.INSULATED ROOF PANEL & PV PANEL

During Phase 1, the dilapidated slate roof has been replaced with a thermally efficient and air-tight insulating composite metal roof in preparation of 50kW PV array.

04.EXTERNAL WALL INSULATION, AIRTIGHTNESS STRATEGY AND HEAT RECOVERY SYSTEM

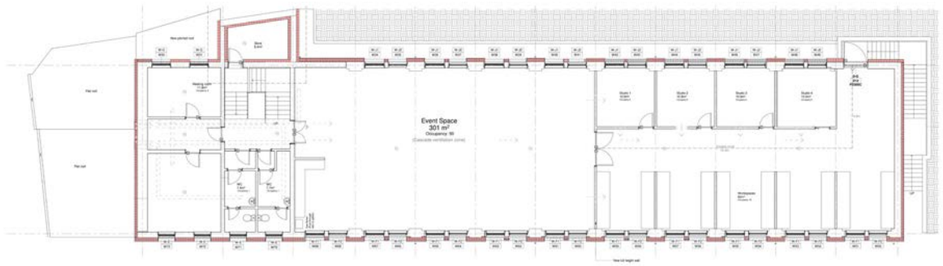
Phase 2 scope of works include installation of the 50kW PV roof array in March 2020 with completion of external fabric efficiency works (airtightness/ insulation), installation of high-performance windows and doors and Mechanical Ventilation with Heat Recovery (MVHR). Wider list of works by Agile City are installation of Air Source Heat Pump (ASHP), upgrade the T8 fluorescent lighting to energy efficient LEDs which will be further enhanced by the installation of motion sensors throughout, installation of aerated taps to reduce the volume of water produced throughout the building and installation of WIFI enabled thermostat controls to create controllable zones that respond to different types and volume of use throughout the different spaces.

05. AIR TESTING, COMMISSIONING AND MONITORING

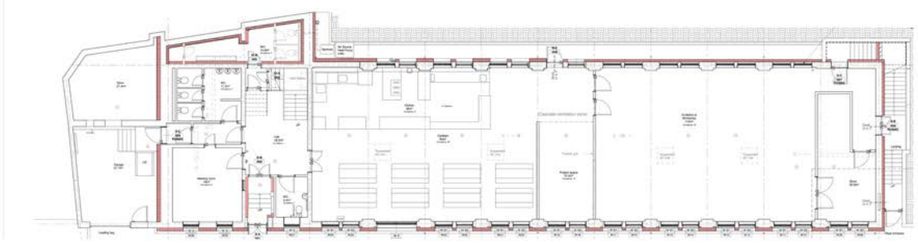
Air Pressure testing and smoke test to identify air leakage at key stages during the works. Commissioning and balancing of all ventilation & heating equipment to optimise performance.

Performance monitoring to ensure modelled performance is delivered and maintained through life.

Architectural and Urban Response



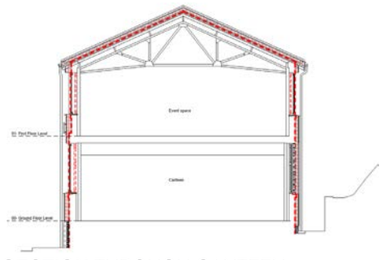
FIRST FLOOR PLAN



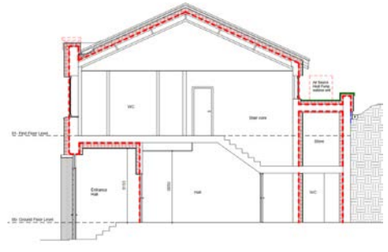
GROUND FLOOR PLAN

EXISTING WEST ELEVATION

PROPOSED WEST ELEVATION



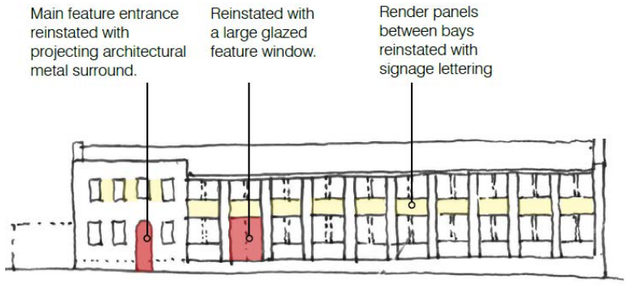
SECTION THROUGH CANTEEN



SECTION THROUGH FRONT ENTRANCE

STEP 1

SITE INVESTIGATE AND REVIEW EXISTING BUILDING CONDITION



Early sketch

Civic Press Historic View

HISTORICAL REFERENCE

Historically the front elevation has been predominantly painted brick with feature panels between windows expressed in wet dash render. The wet dash render is continued onto the side and rear elevations providing full coverage for economy and weather proofing the solid wall construction.

Key details such as the main entrance surround and weathering details such as projecting copes and window sills are formed in concrete. Historic lack of maintenance and repair has resulted in damage to the elevations and subsequent water ingress. The main parapet cope has been particularly affected with feature stone capitals previously replaced painted plywood likely for safety reasons.

To attempt to reinstate these features over the proposed external wall insulation would at best be a pastiche of the original design.

Instead the proposals seek to build on the key architectural characteristics of the original industrial form and enhance the dominant features of massing, rhythm and repetition to provide a contemporary interpretation of the historical form. The street elevation comprises main entrance block containing cellular spaces and the open plan creative space with cafe.

The main entrance block is retained in scale with feature panels of deep aggregate between windows renewed.

New PPC aluminium window sills connect across the feature panels in reference to the original window sills. The main entrance form is enhanced with a vibrant colour palette referencing the original and a new architectural surround.

The creative spaces form the remainder of the front elevation. The rhythm of windows and columns are expressed and the feature green panels between bays reinstated with signage.

To provide connectivity between street level and café area on the raised ground floor, a former loading bay opening is to be reinstated with a large glazed feature window to ground floor level. This sits on a robust plinth spanning the front elevation which helps to connect the building to the public realm and adjacent pavement both physically and visually.

Energy Modelling & Whole Life Carbon Performance Data

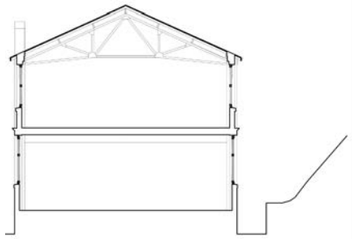
STEP 2 **ENERGY MODELLING**

EXISTING ANNUAL HEATING DEMAND

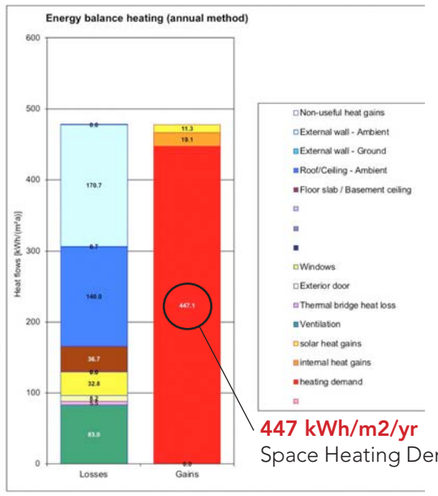
To maintain the builidng at a comfortable 20°C throughout the year. The estimated space heating demand would be around 450kWh/m2/a. Utilising existing mains gas as primary fuel source at 4p per kWh would equate to £13230 per year heating cost.

U-value
External walls - 2.46 W/m2K
Roof - 2.87 W/m2K
Windows - Installed 1.8W/m2K*
Doors - Installed 3.0 W/m2K*
Air tightness - 7.0 ACH@50Pa*

Naturally ventilated



* - Conservative estimate based available information



447 kWh/m2/yr
Space Heating Demand

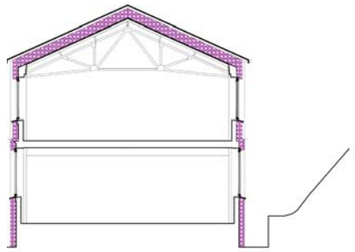
PROPOSED ANNUAL HEATING DEMAND

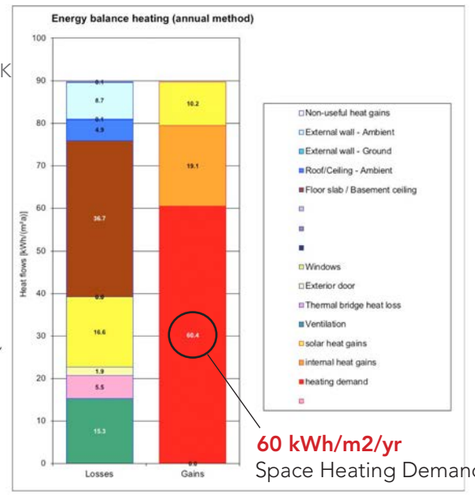
By utilising a fabric first approach it is possible to reduce the heating demand by around 90%. The current proposal has a space heating demand of 60kWh/m2/a. Utilising existing mains gas as primary fuel source at 4p per kWh would equate to £1764 per year heating cost. This is without insulating the ground floor.

87%
Reduction in space heating demand

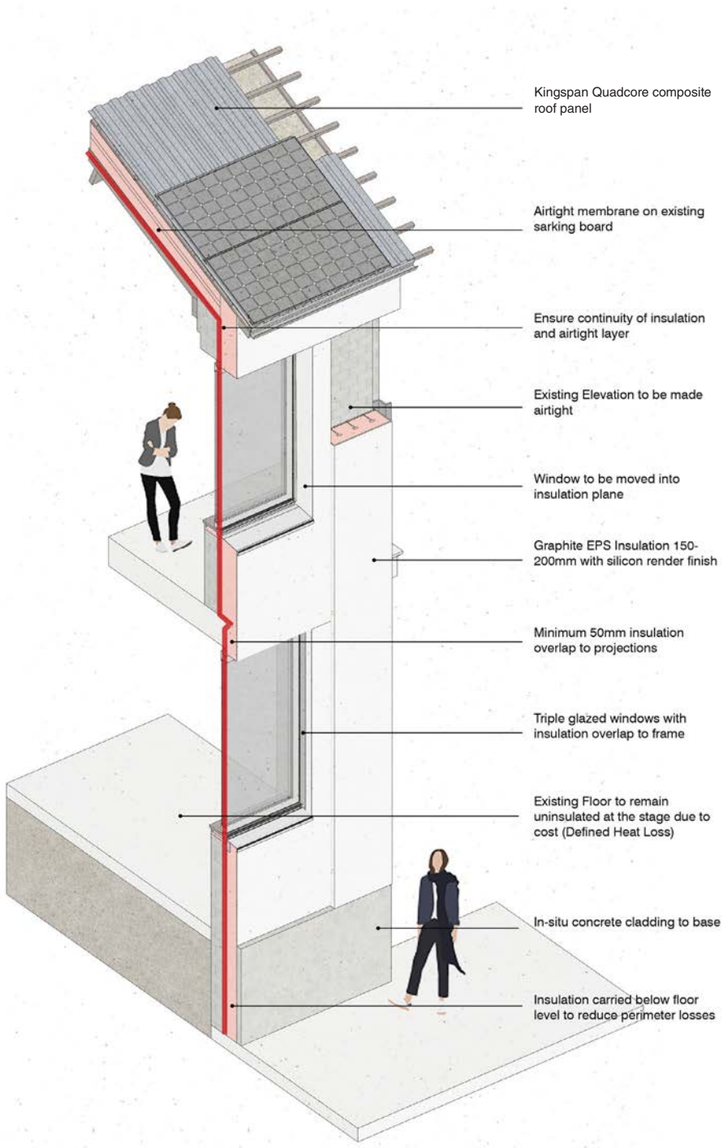
U-value
External walls - 0.12 W/m2K
Roof - 0.1 W/m2K
Windows and Doors- Installed 0.9 W/m2K
Air tightness - 1.0 ACH@50Pa

MVHR- Efficiency approx. 80%





60 kWh/m2/yr
Space Heating Demand



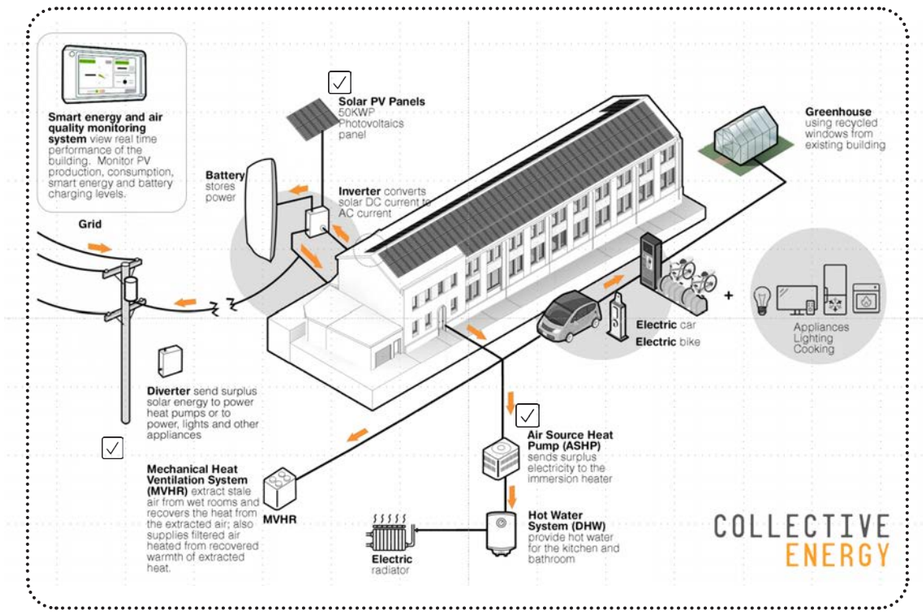
STEP 3

DEVELOP STEP WISE RETROFIT STRATEGIES

Retrofit steps:																		1	2	3									
Assemblies	Last renewal	1950	1955	1960	1965	1970	1975	1980	1985	1990	2000	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030	2035	2040	2045	2050
Render facade																		X							
Facade decoration																		X							
Exterior door																		X							
Front entrance door																		X							
Pitched roof covering																X									
Flat roof (rear elevation)																			X						
Photovoltaic PV panels																		X							
Windows																	X								
Ceiling																									
Ventilation																		X							
Heating system																		X							
Drainage works																									
Airtightn. test: X, Leakage search: (X)																									

Initial condition
X Retrofit dates
Main-tenance
Smaller repairs
Extensive repairs
Immediate replacement

ACTIVE UTILISATION OF SOLAR ENERGY AND OPTIMISE SELF-CONSUMPTION



SEQUENTIAL RETROFIT OF BUILDING COMPONENTS

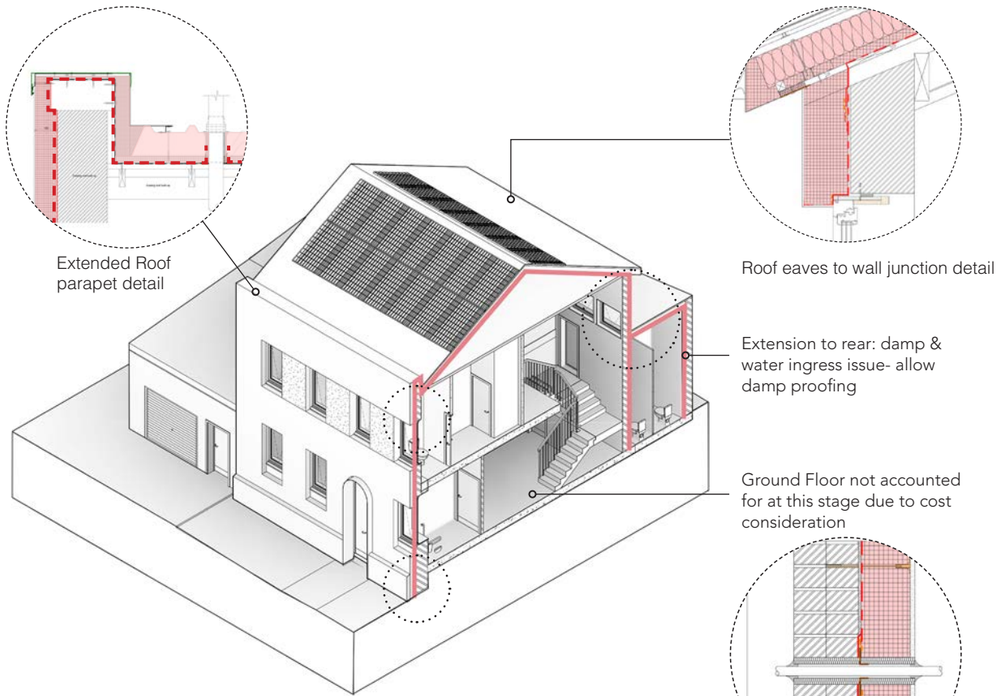
EXISTING BUILDING **1**

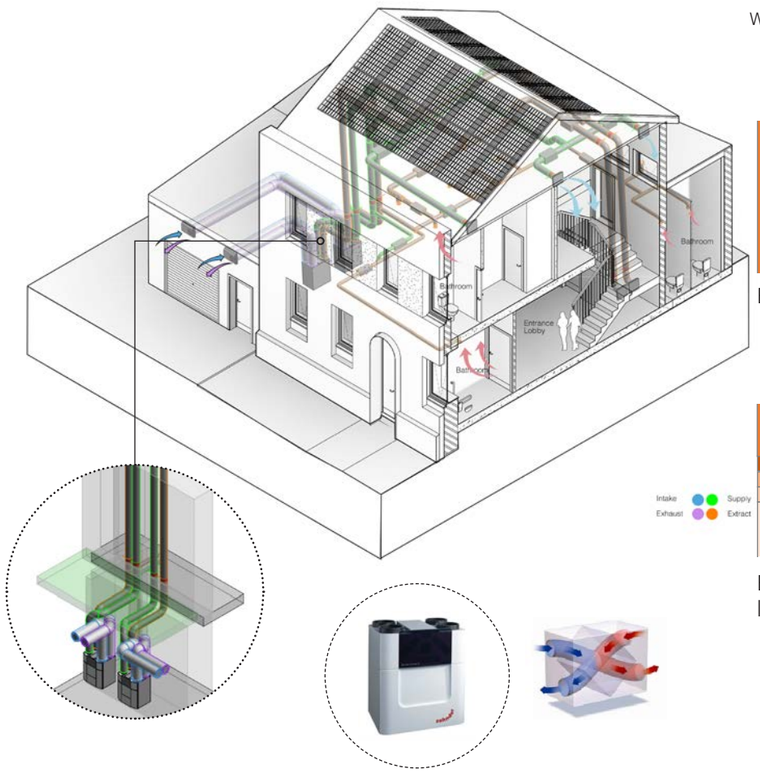
WINDOWS + AIRTIGHTNESS + VENTILATION **2**

INSULATION **3**

HEATING SYSTEM **4**

Build, Test and Commission





40cm

1.75ach

40cm

Equivalent Leakage Area @50Pa

40cm

<1.0ach

Pipework penetrations

Opening to rear undercroft

Door to garage

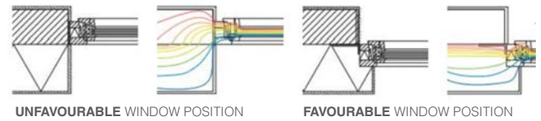
Front door to be replaced

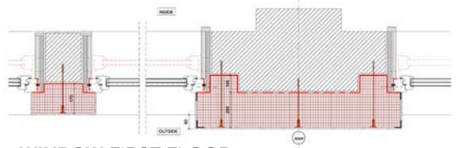
40cm

Easily identifiable residual leaks yet to be tackled.

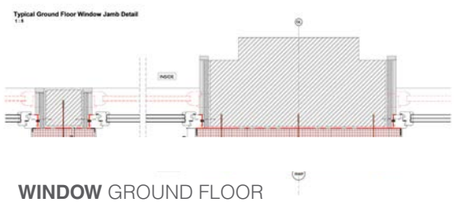
STEP 4

DEFINE THERMAL ENVELOPE, WORKING ON THERMAL BRIDGE AND AIRTIGHTNESS DETAILS





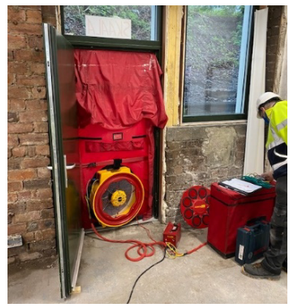
WINDOW FIRST FLOOR



WINDOW GROUND FLOOR

STEP 5

INTERIM AIRTIGHTNESS TEST & SMOKE TEST (April 2021)

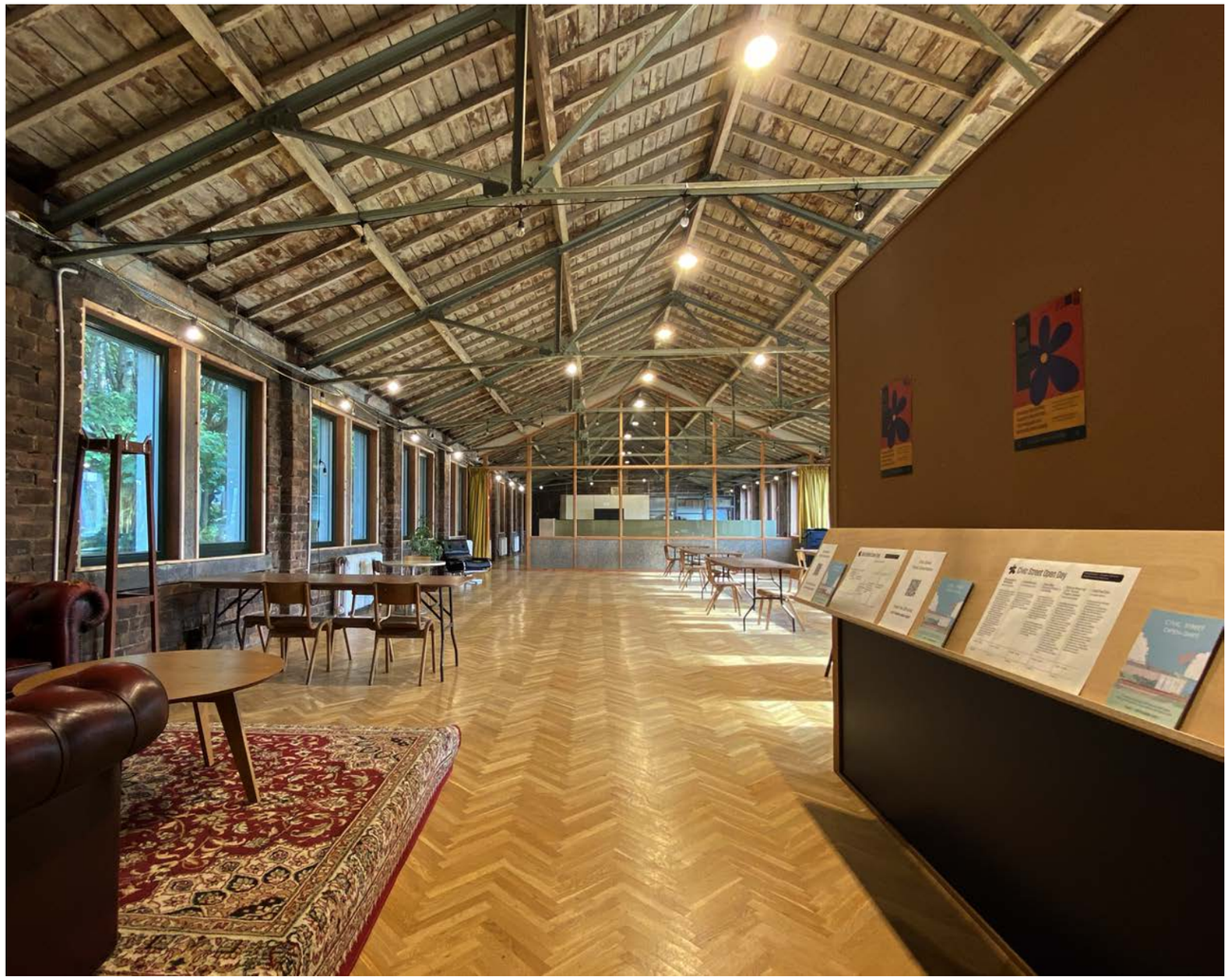


The roof works have been completed in 2019. The installation of windows completed in January 2021 and the EWI is to follow in February 2021. At the time, we thought it would be a good opportunity to undertake a fault finding airtest. This precedes the EWI works intentionally as we would like to investigate the permeability of the external walls if at all possible.

The building is pressurised to 60-70 Pascals, and fill it with smoke internally, and video leakage points from the outside. As smoke will travel through the easiest points, by careful set-up and monitoring, we could determine qualitatively if there was significant leakage through the mortar joints or other aspects of the wall.

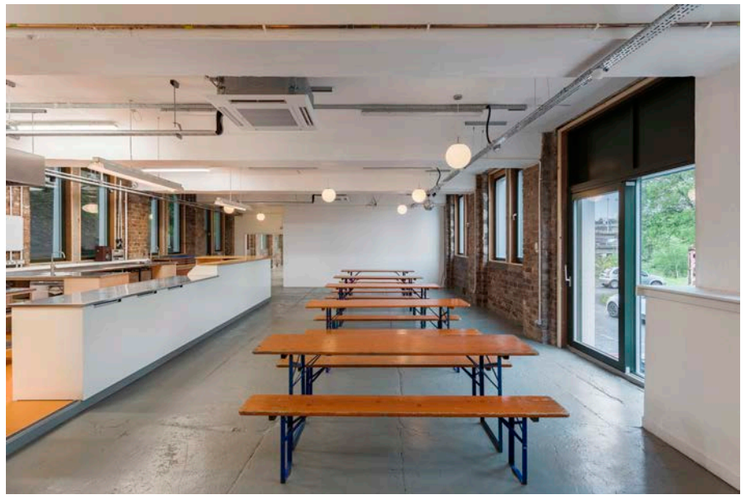
The result of the interim airtightness test is an average of 1.75 air changes per hour (ach).

CIVIC HOUSE RETROFIT | BUILDING IN USE



'At over 100 years old, we believe Civic House can be an inspiring prototype of how we can retrofit our post-industrial assets to support a low carbon, climate ready future. In essence, factories that once supported industrial growth can support new green industries and knowledge exchange, and become the 'micro-power stations' of energy and ideas for the future.'

Rob Morisson, Agile City



'Our aim is to create a leading example that demonstrates the potential of post-industrial buildings in carbon reduction innovation'

Emily Ong,
Collective Architecture