# Cockcroft Building, University of Brighton

## a retrofit case study

**presentation to Constructing Excellence Sussex Club**

**18th June 2015**

**John Moakes**

FraserBrownMacKennaArchitects

FraserBrownMacKennaArchitects

## facts & figures

- eleven storey building (ten occupied floors plus plant rooms at roof level)
- faculty of science and engineering (pharmacy and biomolecular sciences; computing, engineering and mathematics; school of environment and technology)
- construction completed 1963
- concrete frame, no internal columns, façade is structural
- floors 1-8 to be retrofitted (10,400$m^2$)
- building to remain in use with floors retrofitted two or three storeys at a time

FraserBrownMacKennaArchitects

FraserBrownMacKennaArchitects

## envelope failings

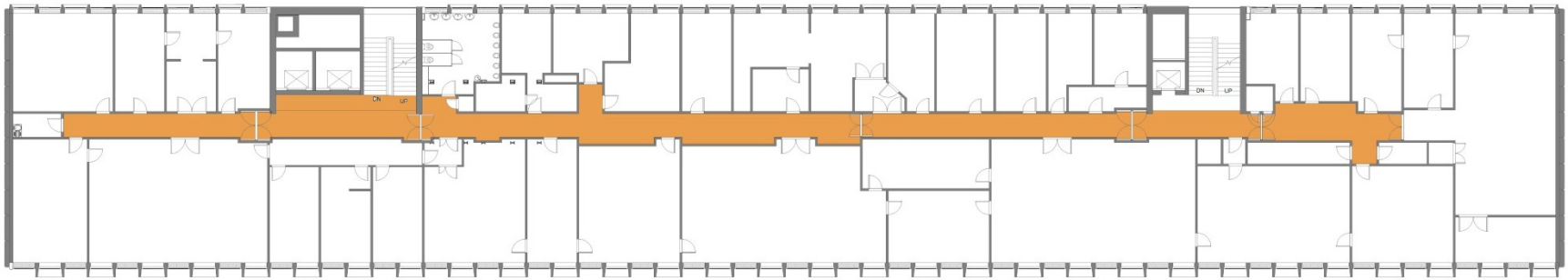
- poor thermal performance
- very high energy usage
- overheating and glare to south elevation

# envelope failings

- single glazed steel frame windows
- uninsulated concrete frame
- no roof insulation

## internal failings

- poor space planning and accessibility
- existing services need complete replacement
- poor environment for teaching and research



FraserBrownMacKennaArchitects


NO SMOKING

## demolish or retrofit?

- planning permission for a similar sized new building in same location unlikely
- full decant to temporary accommodation impossible to achieve
- cost of new-build and temporary accommodation would be prohibitive

# why retrofit buildings?

**improves environment & thermal performance of existing buildings**

- enhances teaching & research, reduces energy consumption and emissions
- vitally important given quantity of existing stock and low rate of new-build

**embodied energy of existing building retained**

- and additional embodied energy of new building avoided

**cost effective**

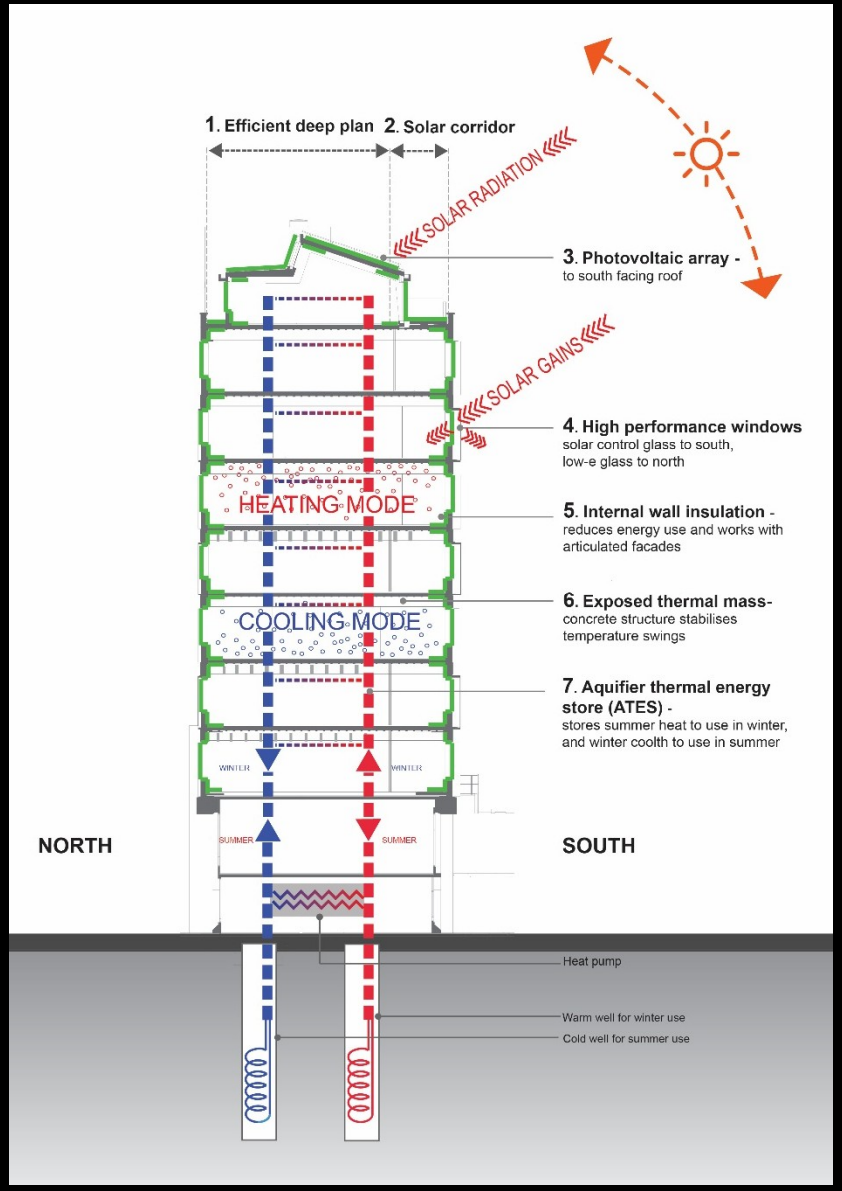
- cheaper, faster, less disruptive, than demolition and new-build

**improves appearance**

- aesthetics and perception are changed

# retrofit proposals

- fabric – comprehensive upgrade
- services – full replacement with low-energy, low consumption fittings
- space planning – total re-plan to improve academic & environmental performance
- structure – repair and expose
- fit-out – designed to enhance & complement other measures
- renewables – large-scale solar and ground sources



# structure

# structure

- repairs required to maintain fire integrity
- paint light grey to enhance lighting levels
- repairs, marks, dents give the structure a patina that contrasts with sharp, clean lines of fit-out

# structure

# structure

## envelope

- full upgrade of envelope delivers best value energy savings over any other measure
- it's passive & low maintenance
- windows – 1.8 W/m$^2$K (0.35 g-value to south elevation)
- walls – 0.3 W/m$^2$K
- roof – 0.18 W/m$^2$K
- external over-cladding not viable due to highly articulated facade

# envelope - internal cladding

# envelope - internal cladding

pros & cons:

- viable solution for highly articulated facades and listed buildings or buildings in conservation areas
- minimal planning risk – not visible externally, even window replacement can be classified as ‘maintenance’
- thermal bridges cannot be eliminated
- external structure remains exposed to elements and seasonal temperature variations
- risk of interstitial condensation as air-permeability & vapour control difficult to control

# internal cladding - design issues

window & internal cladding:

- thicker frames to allow thicker insulation to reveals
- internal cills can form cold bridge
- consider location of airtight line and how seal is formed

intermediate floors:

- insulate the perimeter of the floor & soffit
- use raised access floor to create insulation zone - gives servicing flexibility, but consider effect on stairs and lifts
- avoid lights or ductwork in soffit insulation zone

space planning & services:

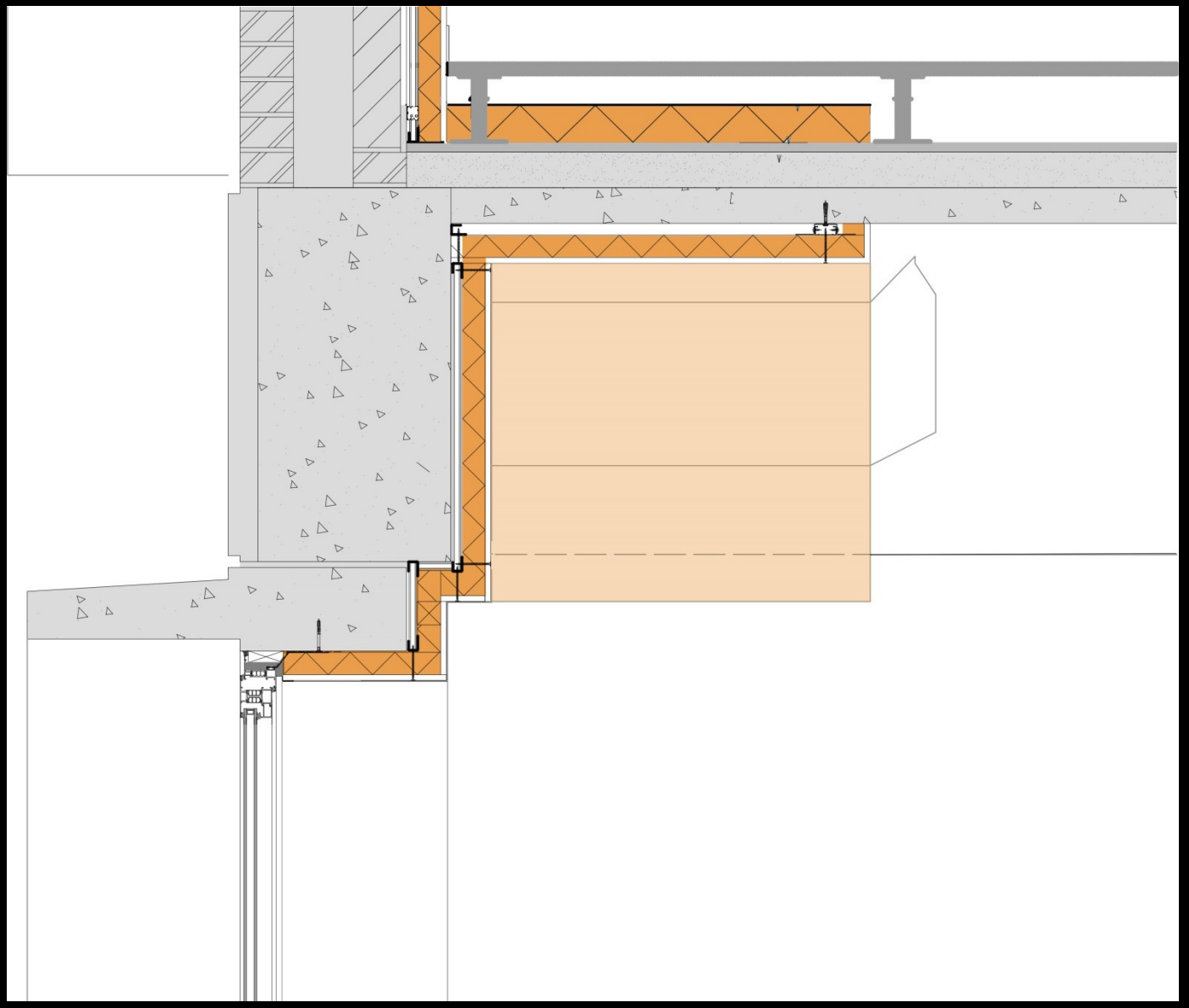
- minimise sockets on external wall - use floorboxes, or surface-mounted trunking
- no desks or benches against external envelope – use as circulation zone?

# internal cladding – detail design

FraserBrownMacKennaArchitects

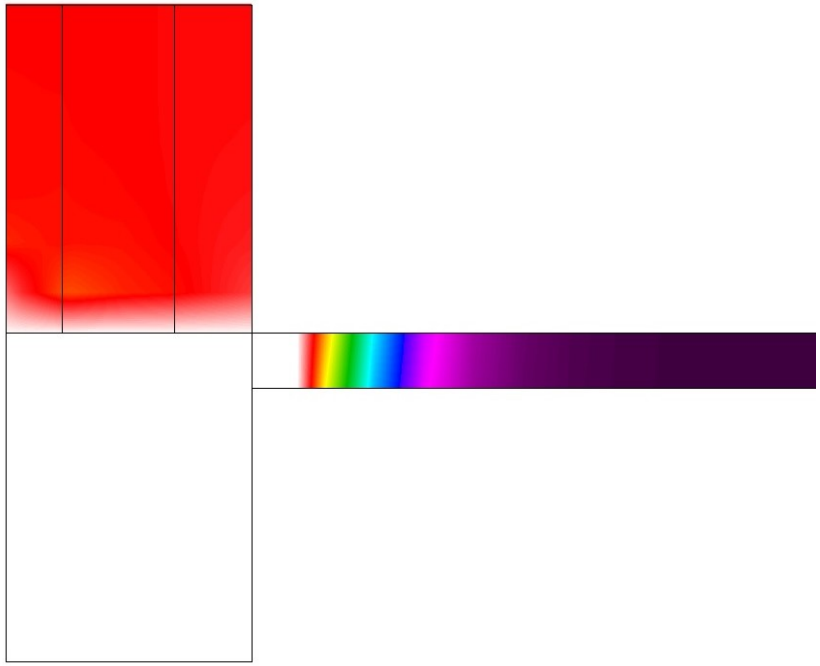
# internal cladding – detail design

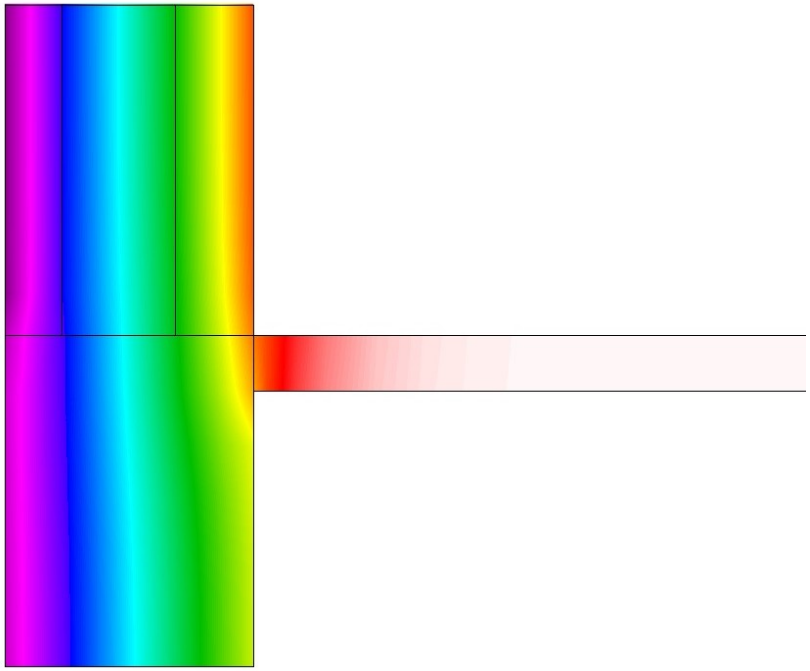
# internal cladding – detail design

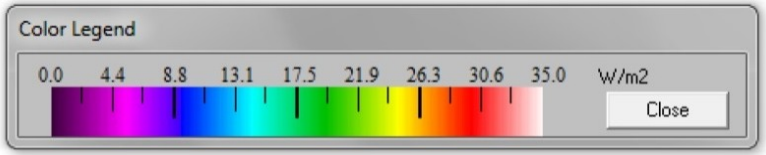


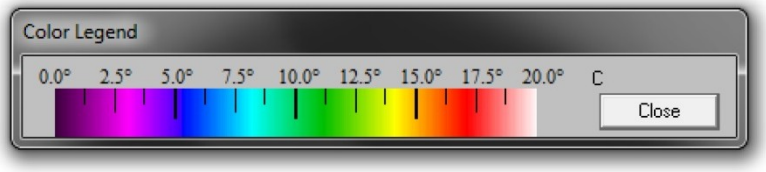
FraserBrownMacKennaArchitects

# envelope – as existing

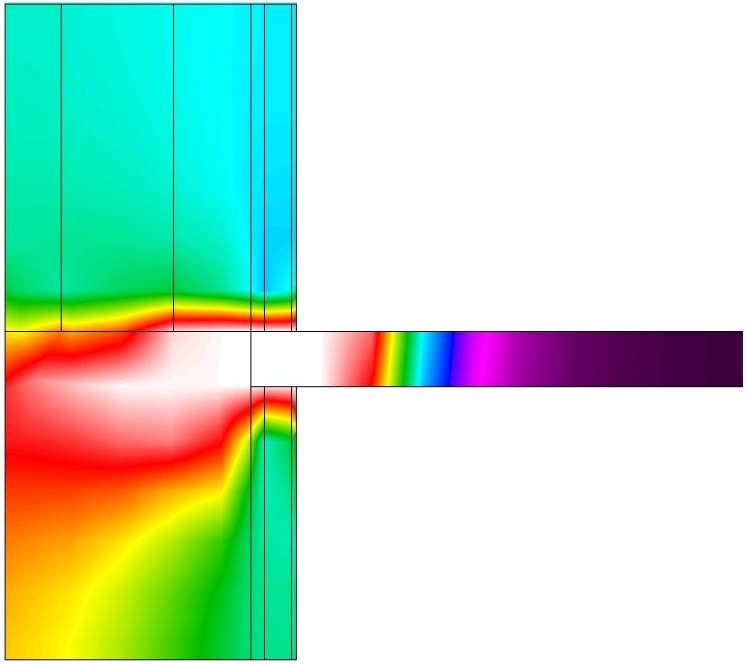


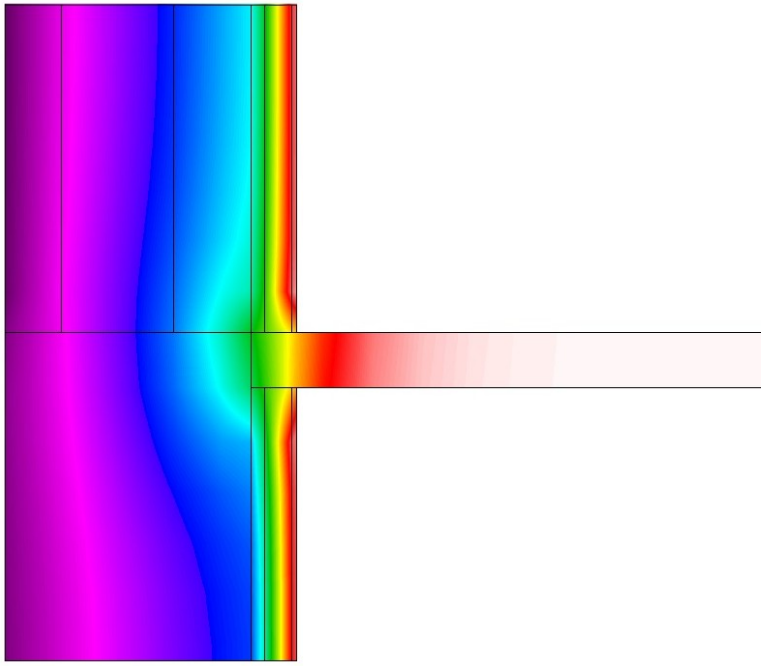


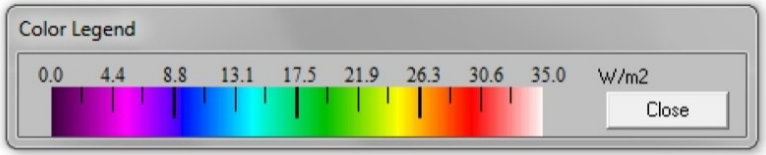


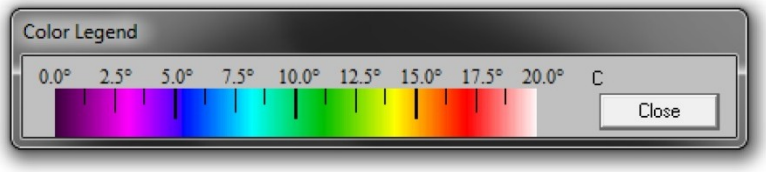



# envelope – walls insulated

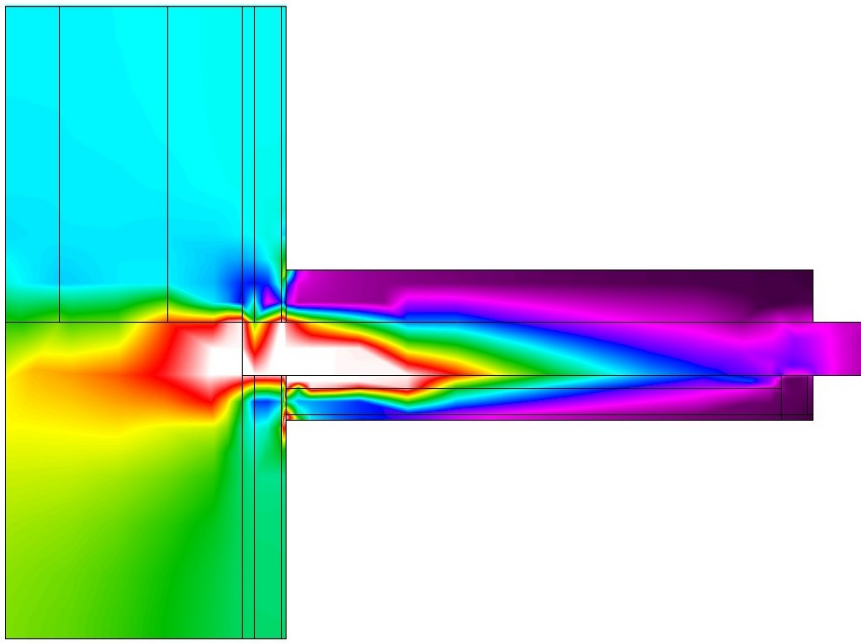


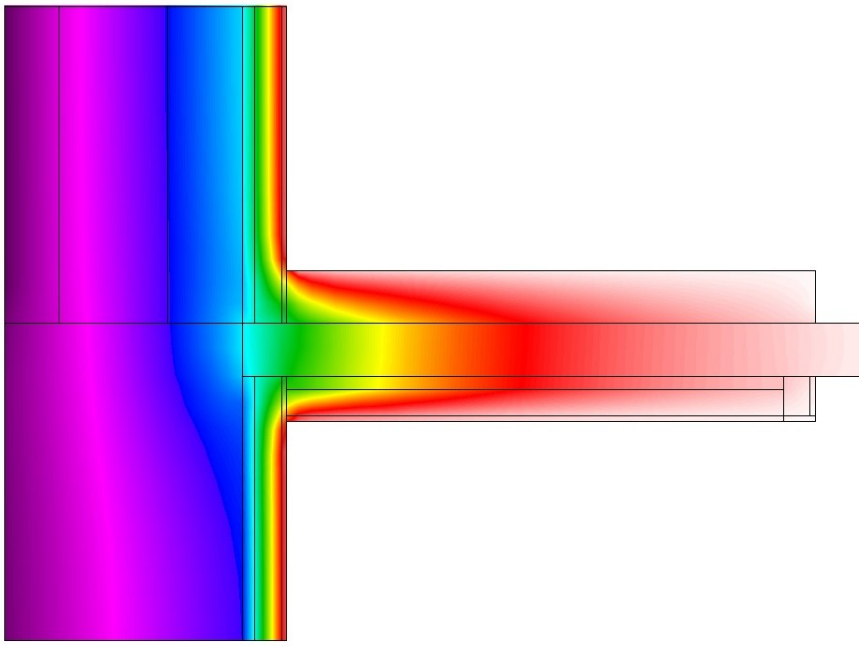


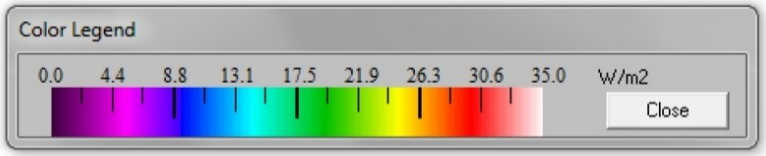


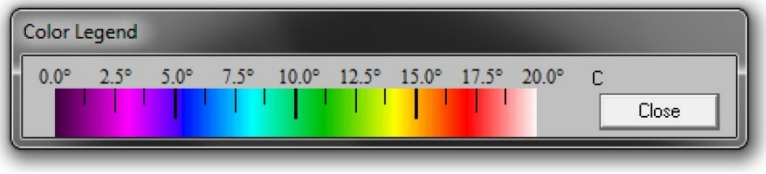



# envelope – walls, floor, soffit  insulated

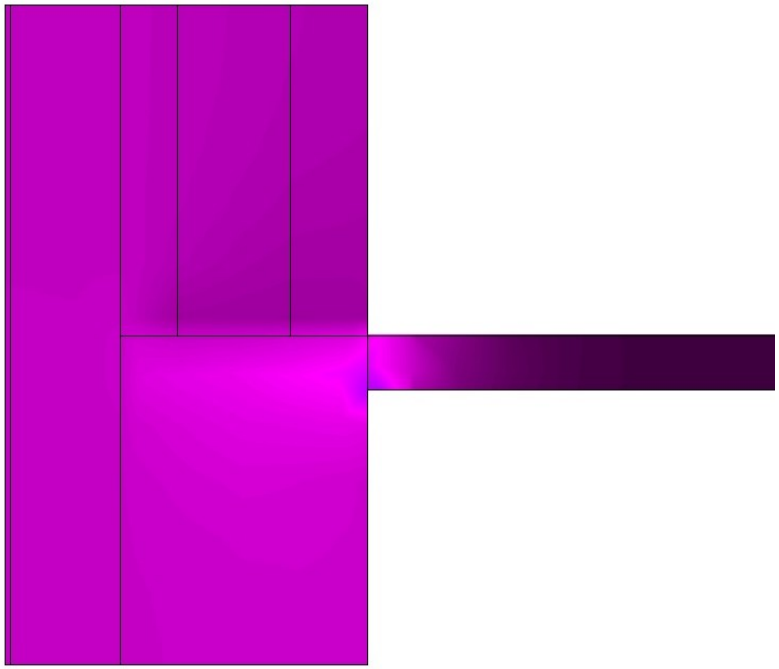


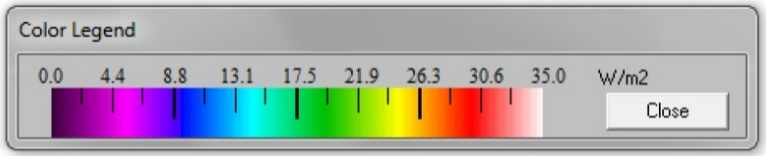


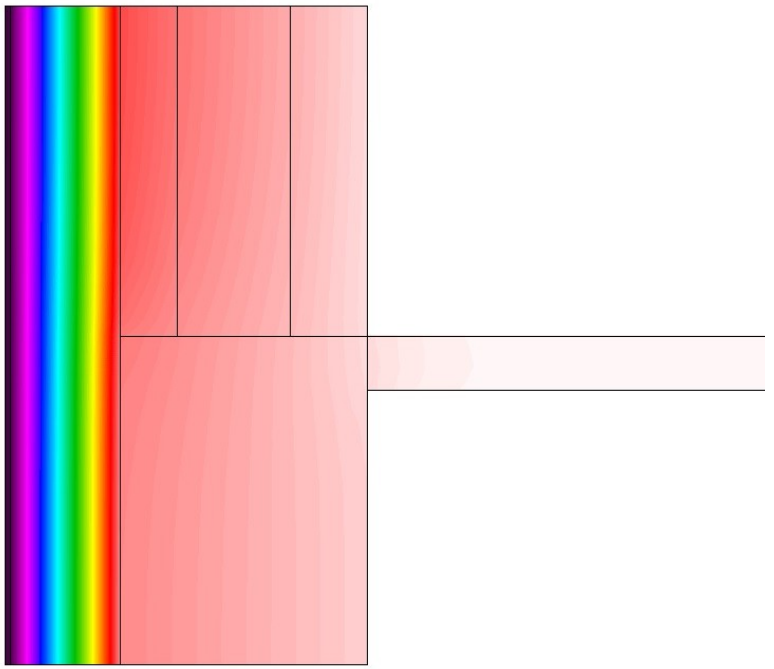


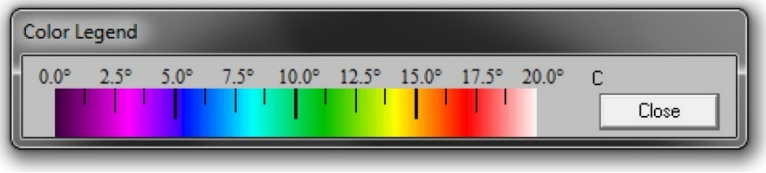



# envelope – walls insulated externally

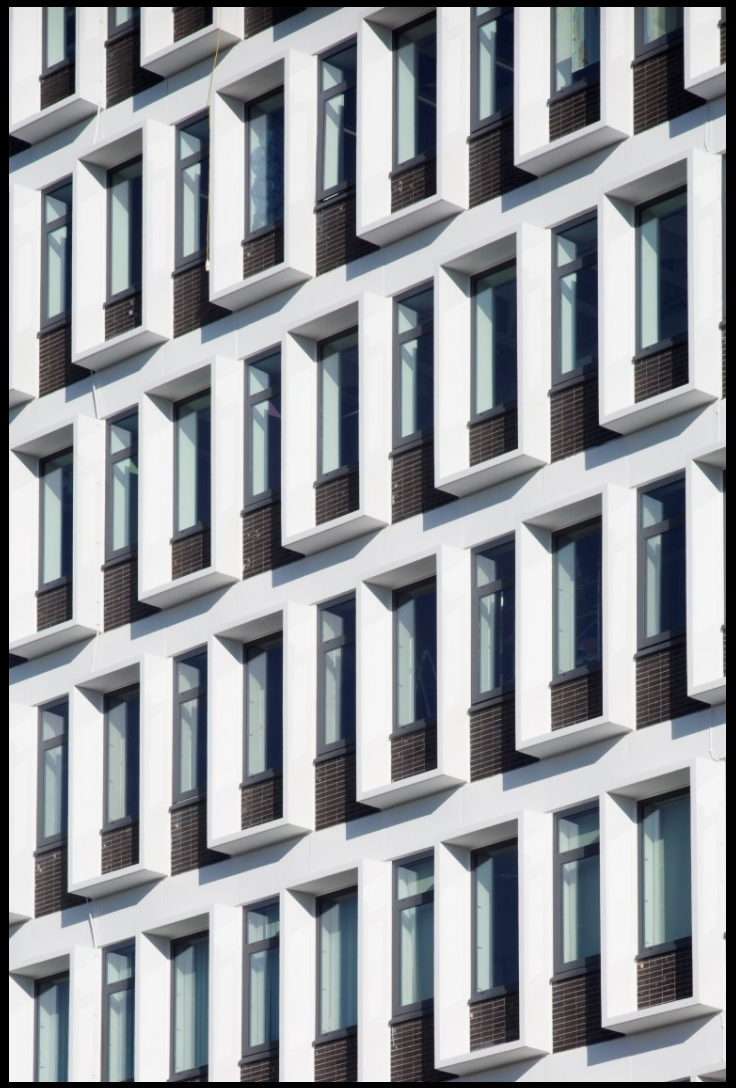






# envelope

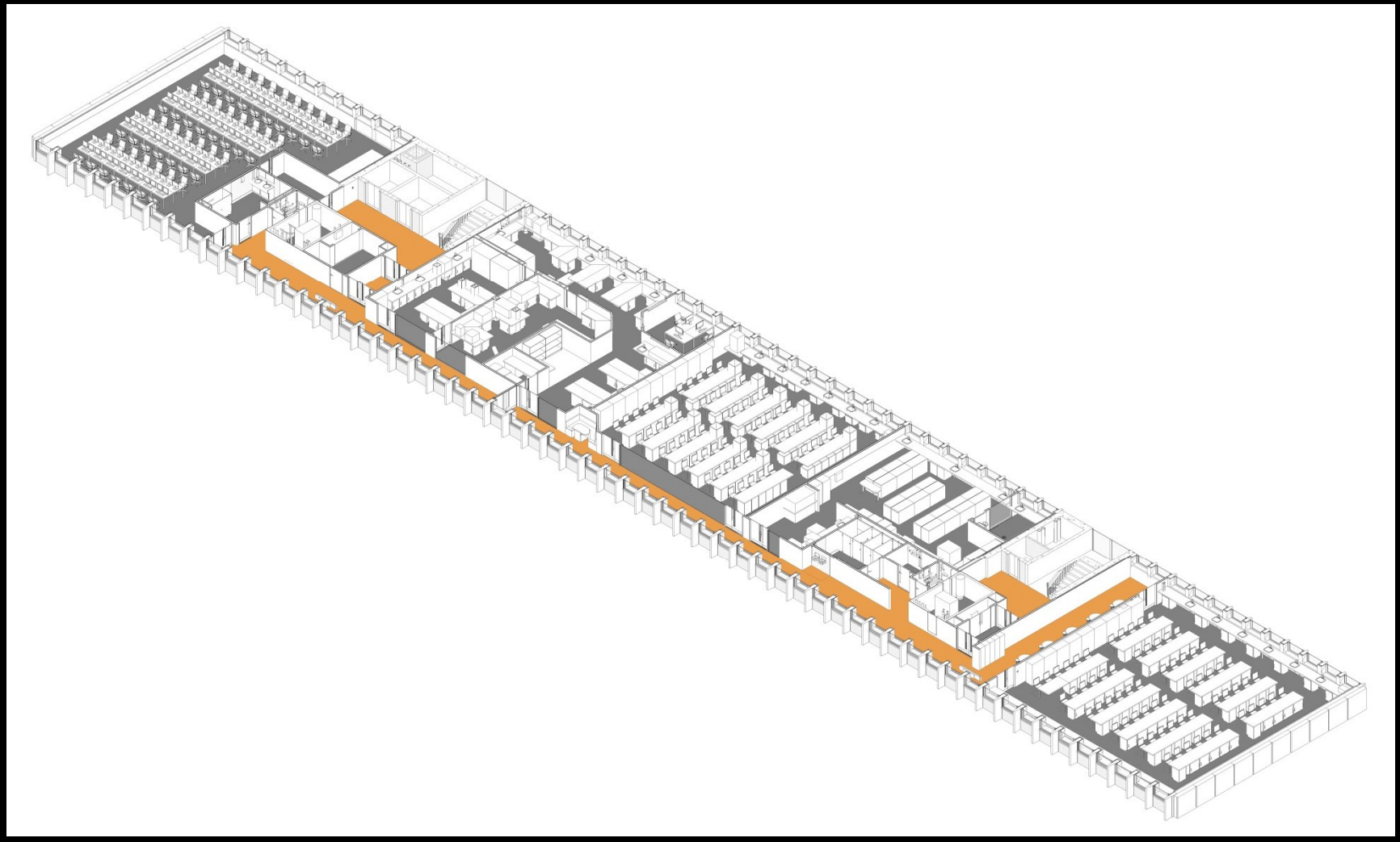


FraserBrownMacKennaArchitects

# envelope

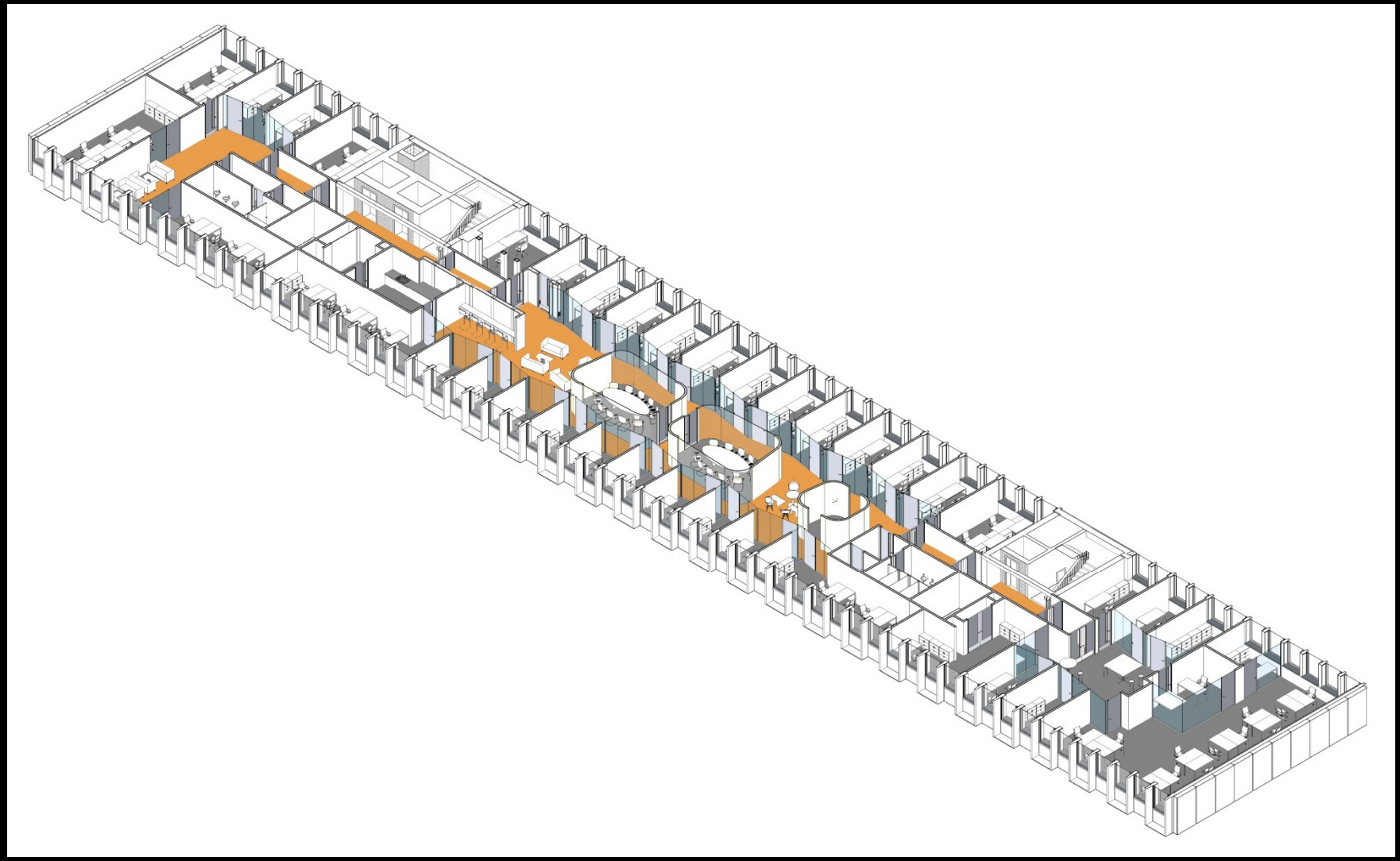
FraserBrownMacKennaArchitects

# space planning – teaching floors



FraserBrownMacKennaArchitects

# space planning – office floors



FraserBrownMacKennaArchitects

## fit-out

- glazed screens – daylight and transparency
- minimal ceilings – accessible thermal mass and services
- minimal floor coverings – reflect daylight and accessible services

# fit-out

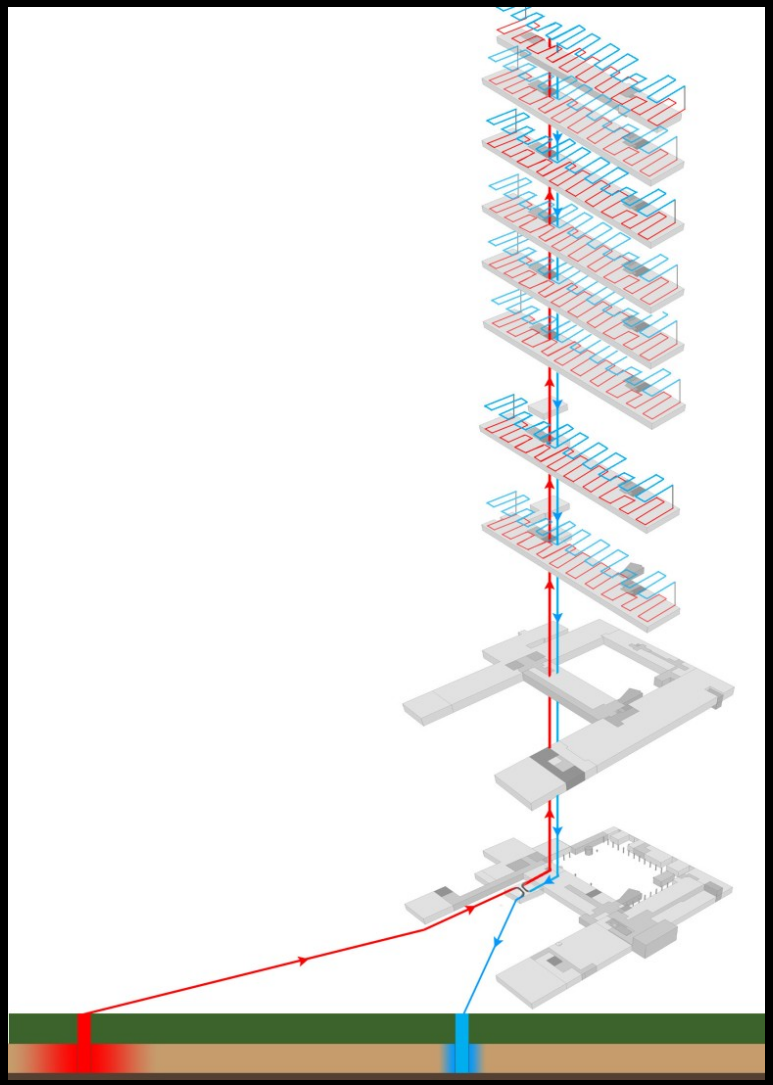
FraserBrownMacKennaArchitects

## services

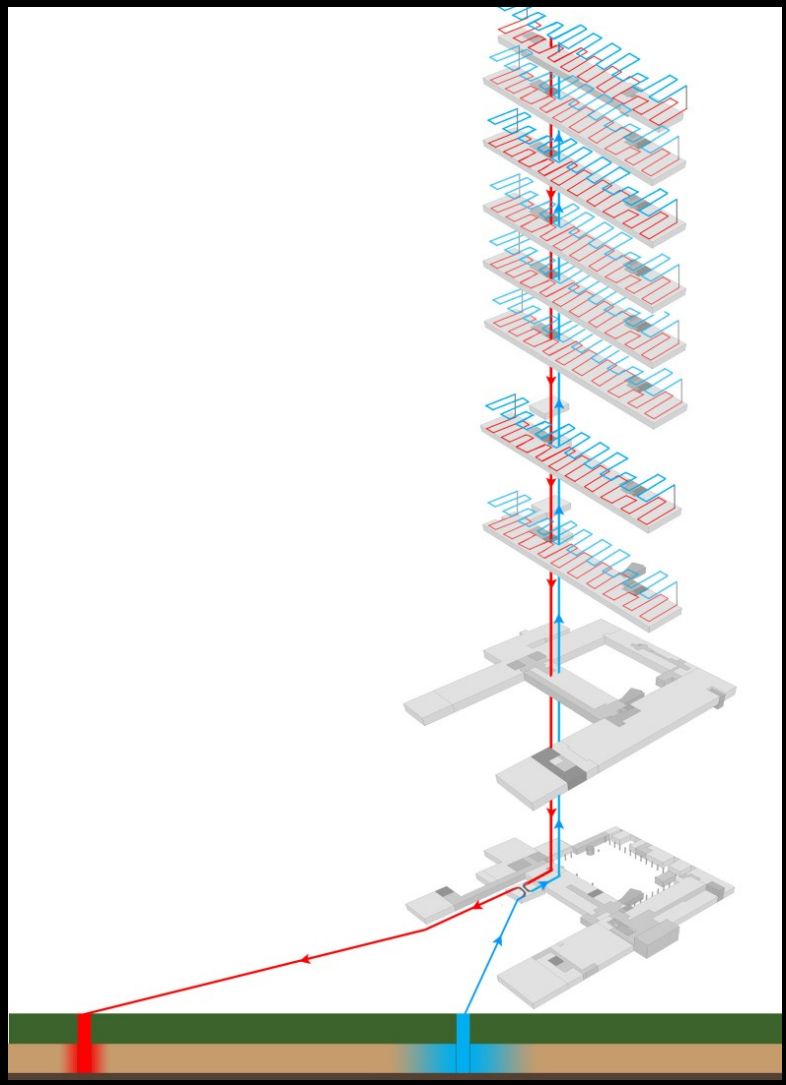
- full replacement of all services while keeping occupied areas operational
- mixed-mode ventilation with heat recovery
- ventilation and heating/cooling on separate systems to avoid over-ventilation
- LED lighting with daylight linking & presence detectors
- low water consumption toilets & urinals
- full BMS control of heating & cooling to optimise useage
- renewable heating & cooling source

# **renewables –** 230m$^2$ PV array (24,500kWh/yr)

# renewables - aquifer thermal energy store



winter



summer

FraserBrownMacKennaArchitects

# renewables - aquifer thermal energy store

# renewables - aquifer thermal energy store

# the transformation

# 8th floor

# 8th floor

FraserBrownMacKennaArchitects

# 8th floor

FraserBrownMacKennaArchitects

# 8th floor

FraserBrownMacKennaArchitects

# 7th floor

# 7th floor


FraserBrownMacKennaArchitects

# 7th floor

# 7th floor

FraserBrownMacKennaArchitects

# 6th floor

# 6th floor

FraserBrownMacKennaArchitects

# 6th floor

FraserBrownMacKennaArchitects

# 6th floor

FraserBrownMacKennaArchitects

# 5th floor

# 5th floor

# 5th floor

FraserBrownMacKennaArchitects

# 4th floor

# 4th floor

FraserBrownMacKennaArchitects

# 4th floor

FraserBrownMacKennaArchitects

# south elevation

# south elevation

FraserBrownMacKennaArchitects

# south elevation

FraserBrownMacKennaArchitects

## summary

- building transformed for students & staff – will become a major asset for the university for years to come
- energy use should reduce by 57%, annual fuel bill predicted to drop from £124k to £42k
- 59% predicted reduction in $CO_2$ emissions (regulated and unregulated)
- building performance monitoring & post-occupation surveys recommended to check benefits are being delivered
- completion of the building works is a starting point not an end point – how well the building performs is up to the users – fine-tuning, tweaking & adapting will be needed

thank you