

balehaus[®]
custom homes

BEAUTIFUL AFFORDABLE SUSTAINABLE

A New Way of Building
Homes for Sustainable
Communities







ModCell Straw Technology
we Build with Carbon



Build with Carbon

global value £2.9 trillion pa
45% of man-made CO₂

biggest business opportunity
since the industrial revolution

60% of materials

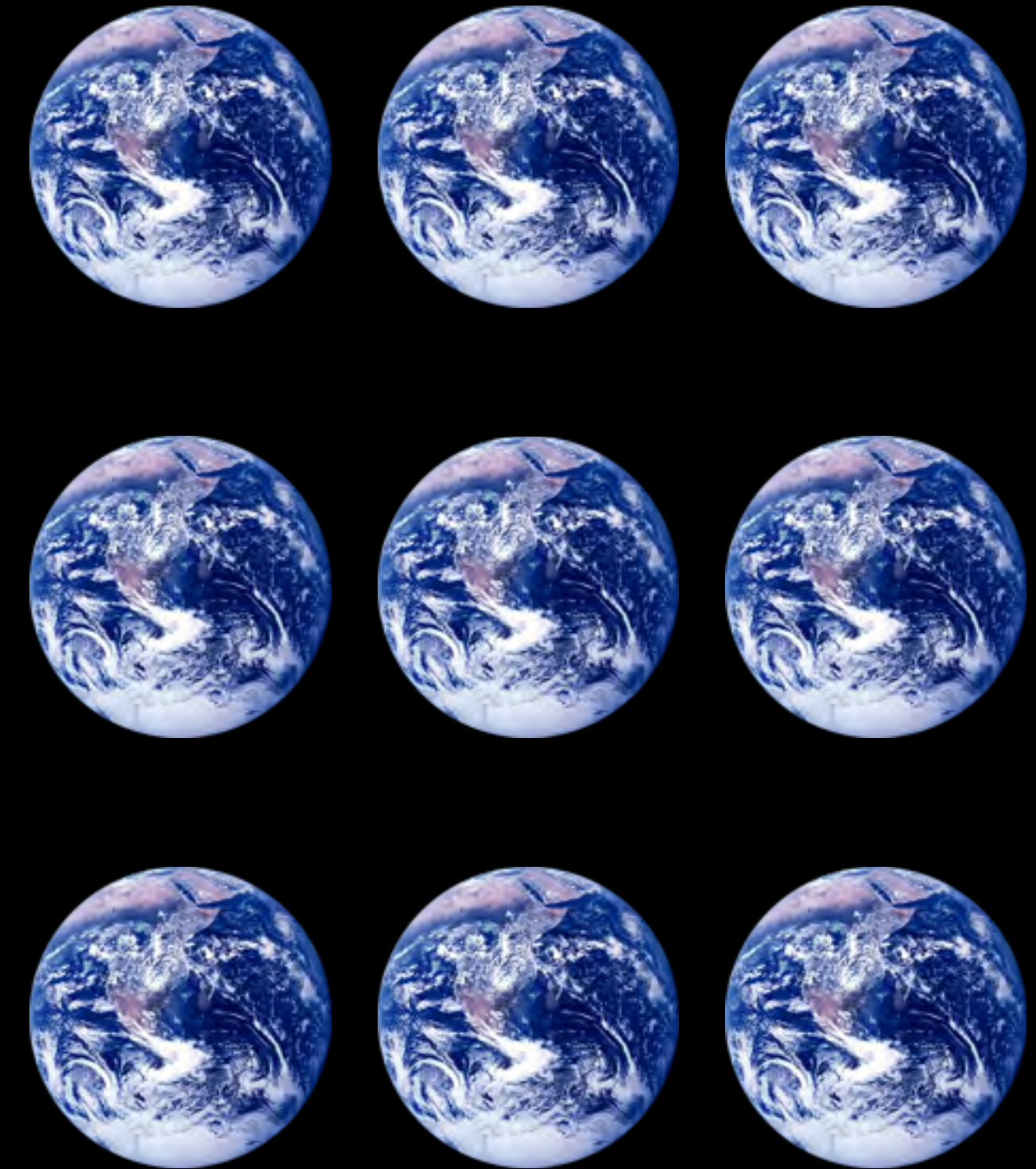
12% of CO2 emissions embodied

20% end up in landfill

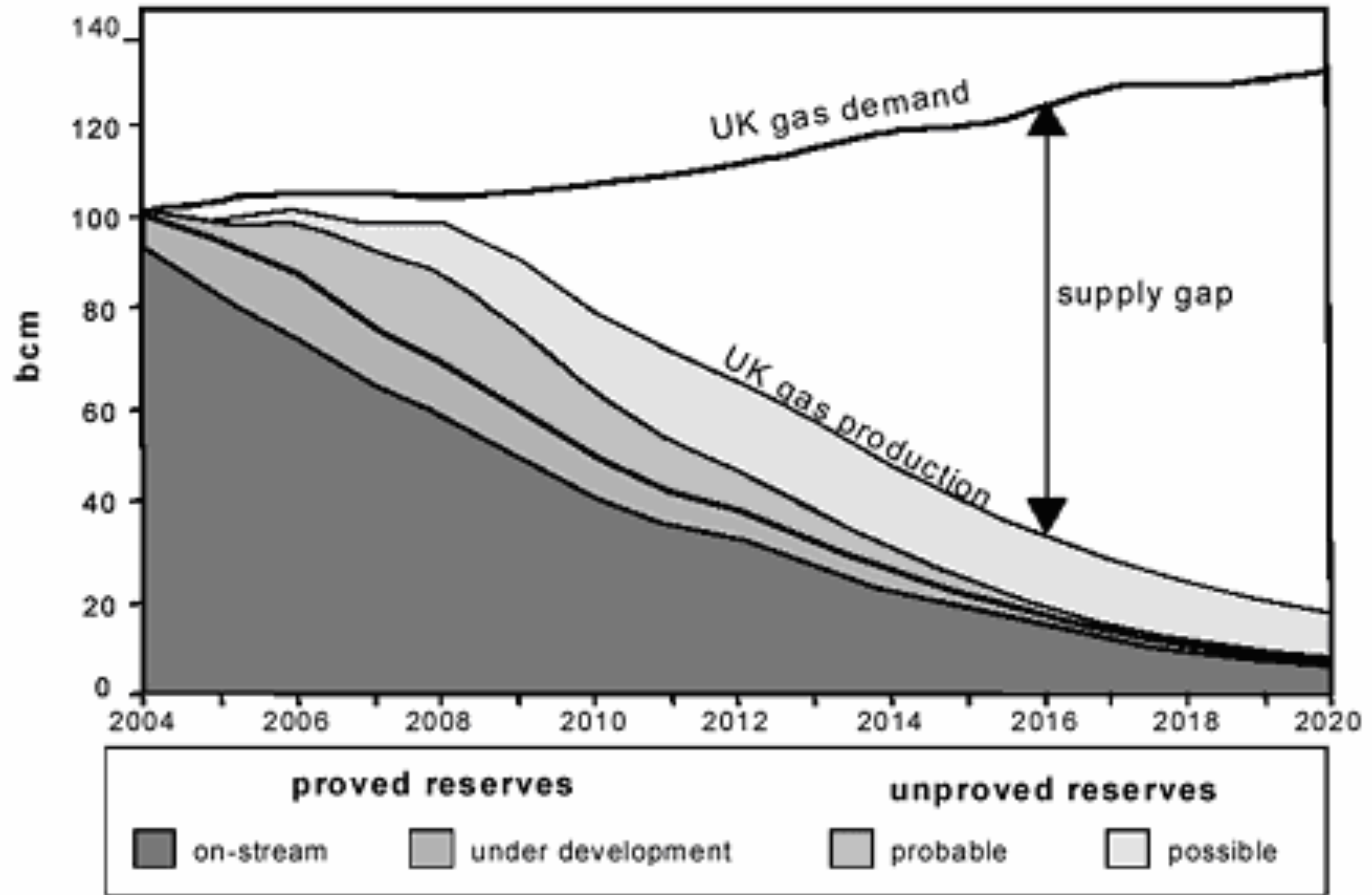
Buildings impact



1.9 hectares per person



america 12 hectares
europe 6 hectares



40% from the
middle east



40%



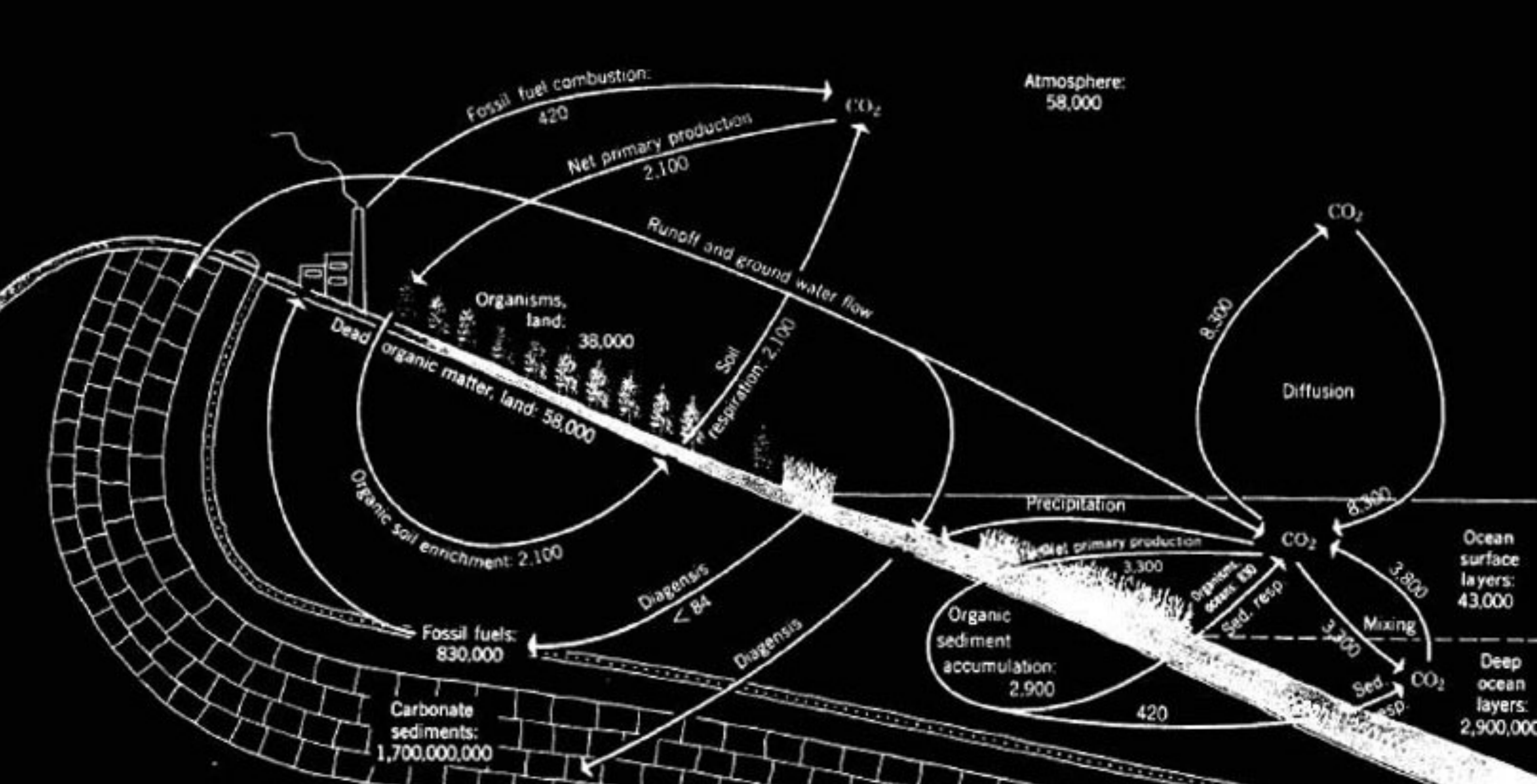
by 2020 the UK will import 80% of its gas needs - from where?

gas supply strategic risk

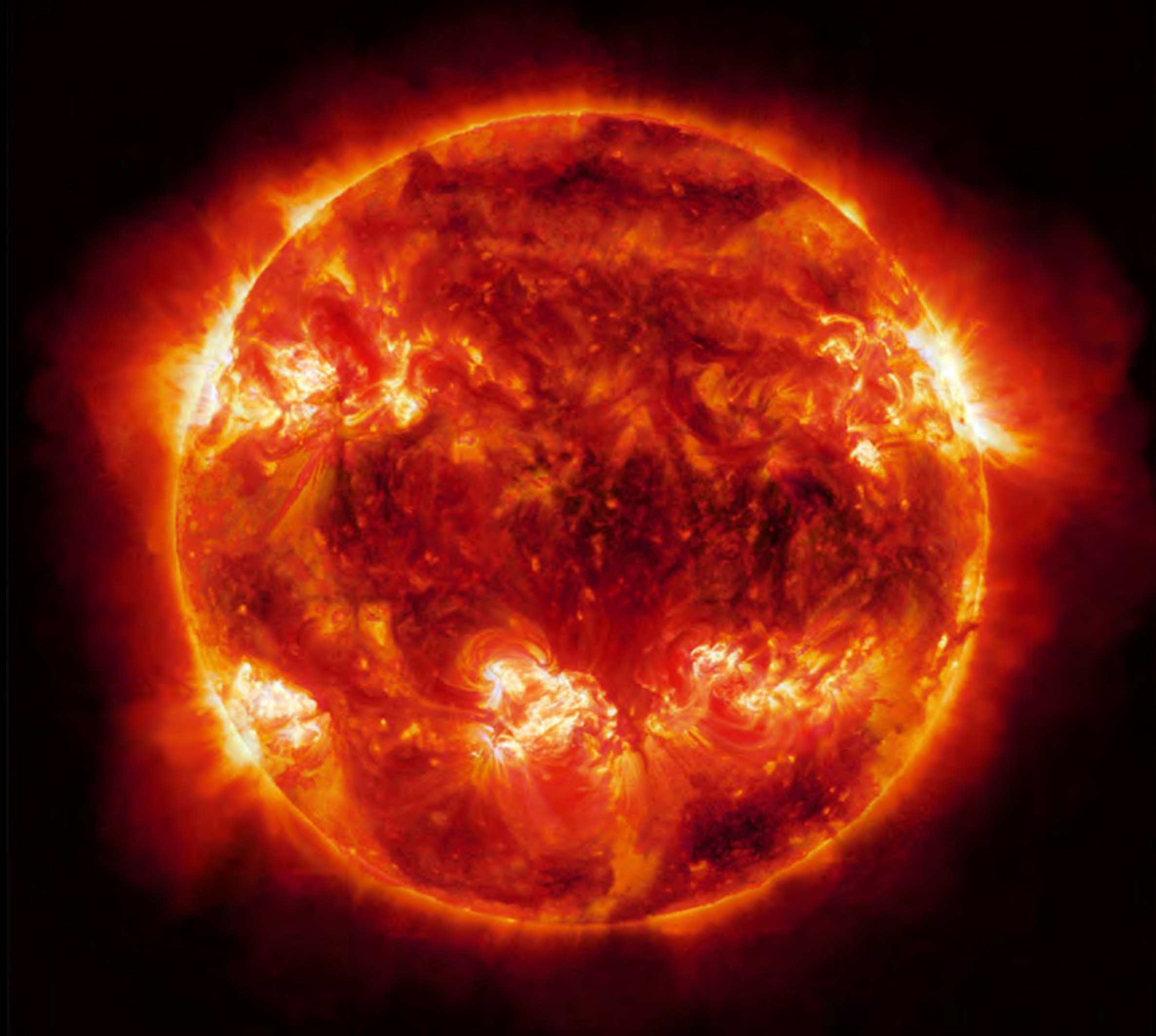


Notification of Insufficient System Margin

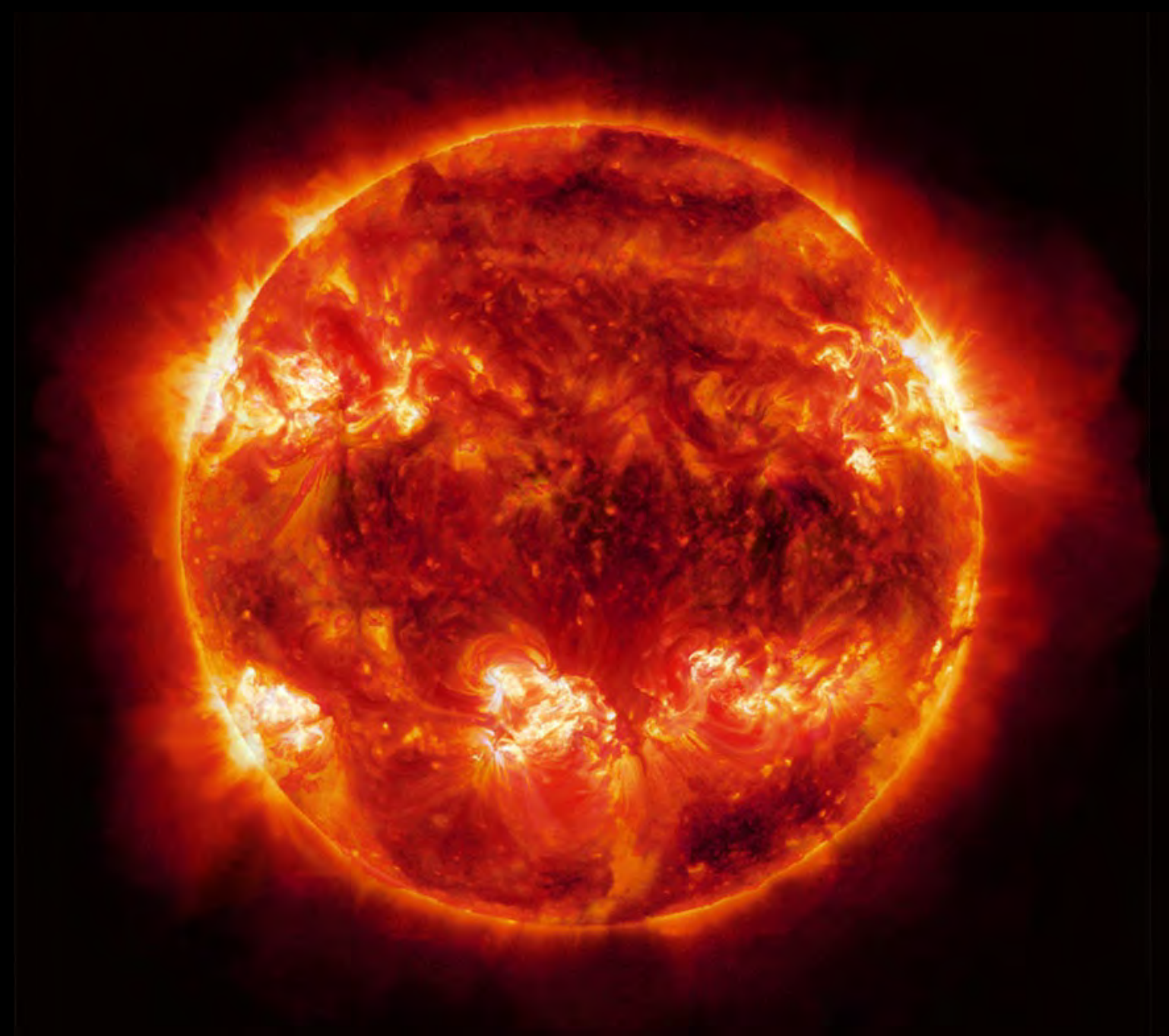
strategic risk



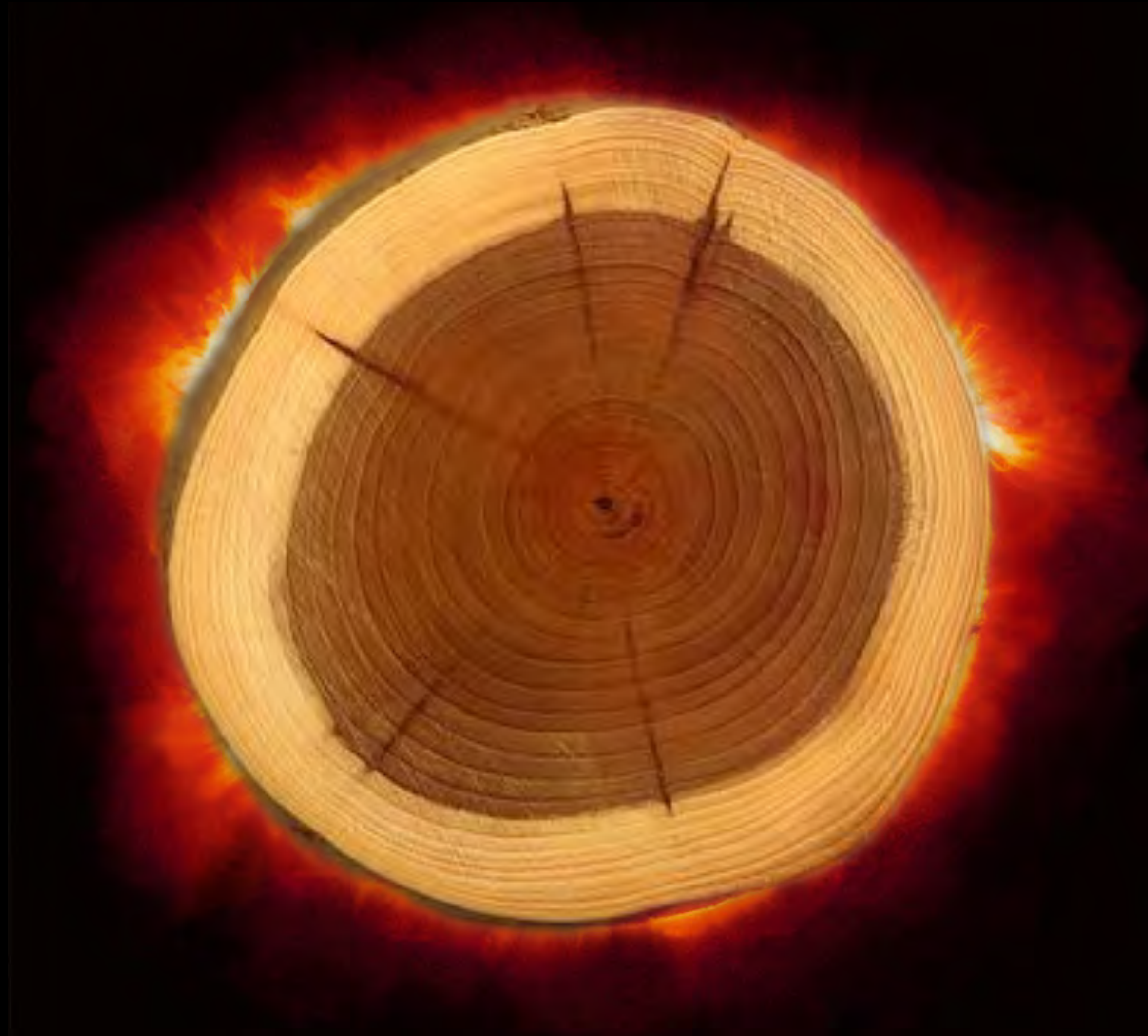
carbon cycle



photosynthesis



photosynthesis - sunlight + water + CO₂ = cellulose



742 kg of CO₂ per m³



straw
211 kg per m³



wood

+



straw

+



lime
(render)



screws and glue







Frome

Flying Factory - built locally







Frome

delivered to site pre-rendered



ECO-innovation



euro-cell

The Eco-Innovation EuroCell project has sought to provide a solution towards decarbonisation through the development of wider sector uptake of straw bale construction using ModCell: an innovative prefabricated low carbon cellulose-based panel building system designed for use in a wide variety of construction sectors, including housing, schools and retail projects.

The EuroCell Project has addressed current EU wide market barriers to the mainstream uptake of ModCell® and BaleHaus® products. Barriers include the lack of product certification, warranty approval, scaling the manufacturing approach and limited market presence.



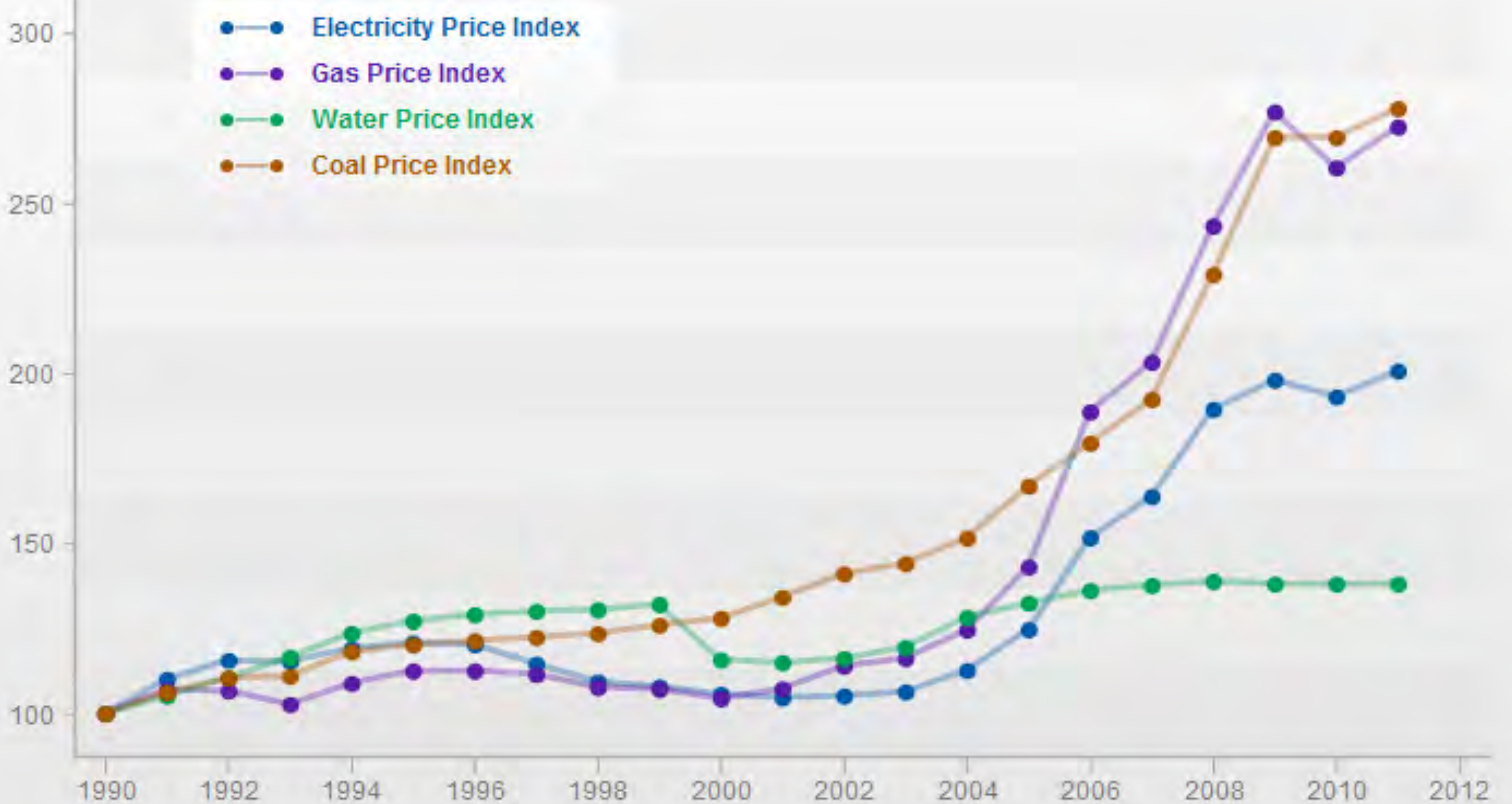
The ECO-SEE project aims to address an emerging health problem associated with modern low carbon buildings. Modern buildings have been developed to be very airtight, improving their energy efficiency and reducing their carbon footprint. However, these sealed environments have created unexpected side effects, with research showing that a build-up of potentially harmful chemicals in the air is potentially causing negative impacts on occupants.

The ECO-SEE project studies the use of innovative eco-building materials that will address poor air quality, while also radically improving the energy efficiency of buildings

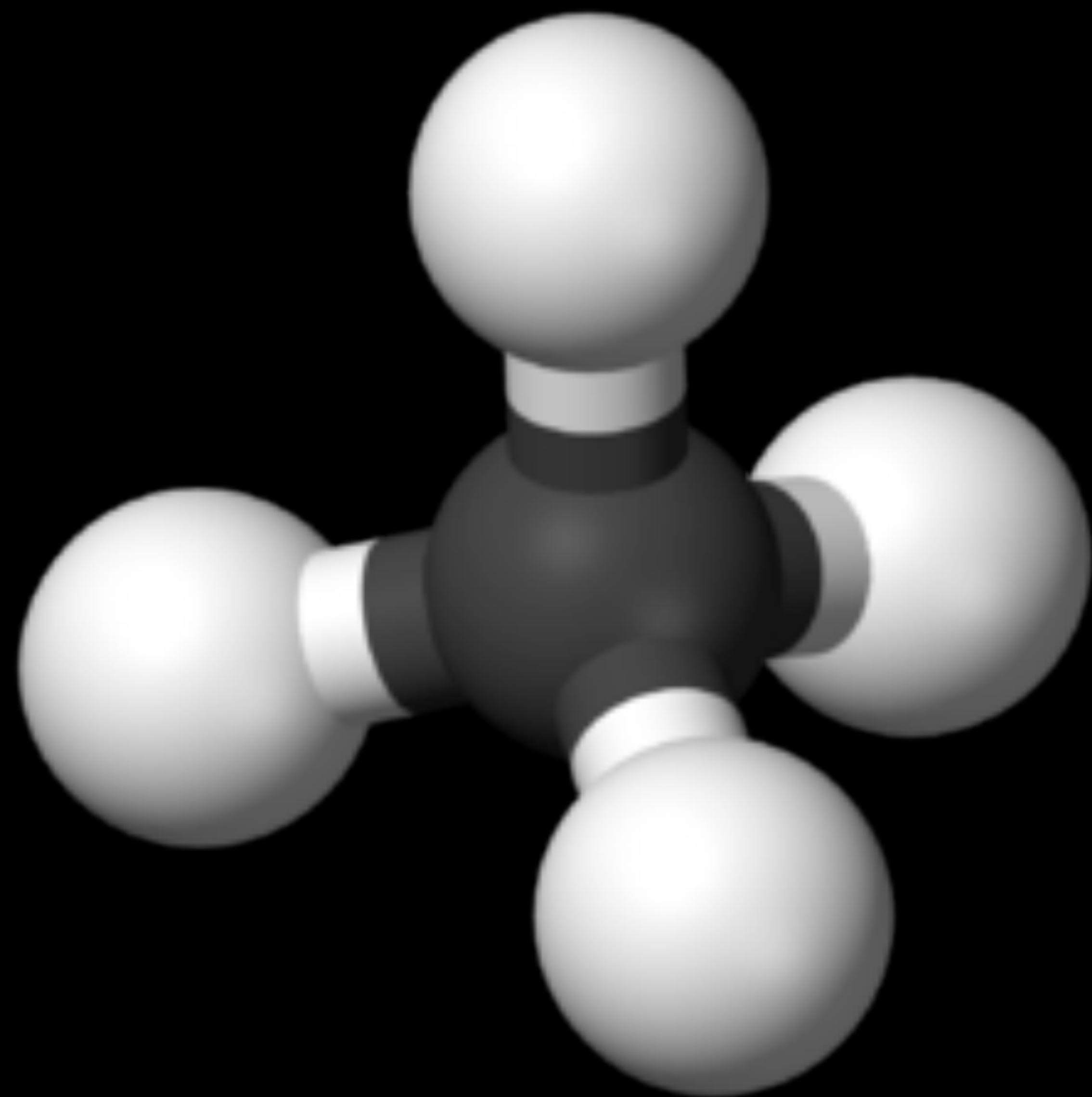


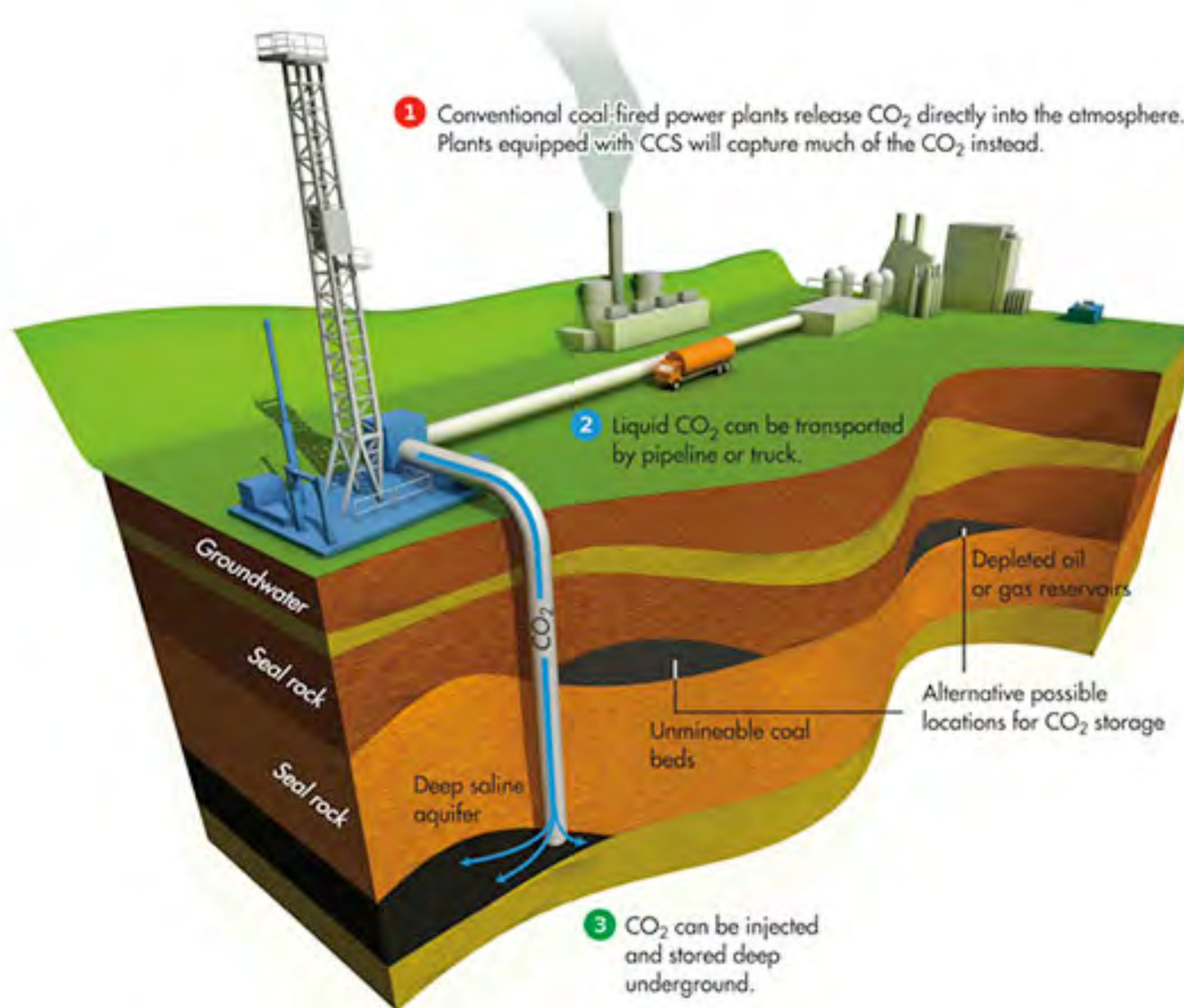
IsoBio, aims to transform mainstream adoption of sustainable materials in building and construction - delivering significant energy efficiency improvements and wider environmental benefits.

The project runs from 2015 for four years, has a budget of €6,3M, and the development is planned in four significant phases. The first two will focus on taking the materials from idea to application, before emphasis switches to a transition from lab to demonstration scale.



inexorable rise of energy and utility costs





Carbon Capture and Storage

The oil and gas industry want us to pay
€96 per tonne





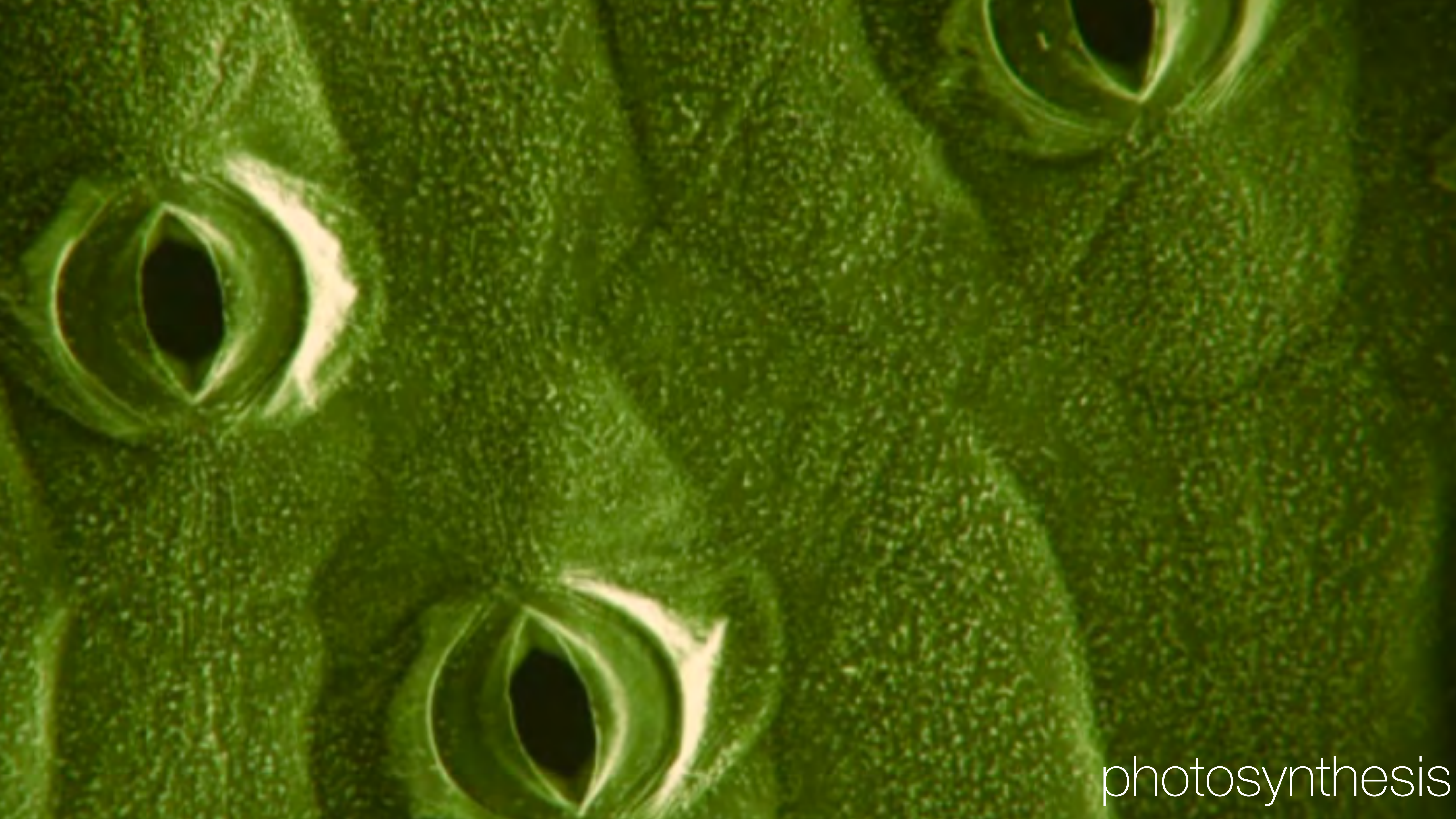
photosynthesis



photosynthesis



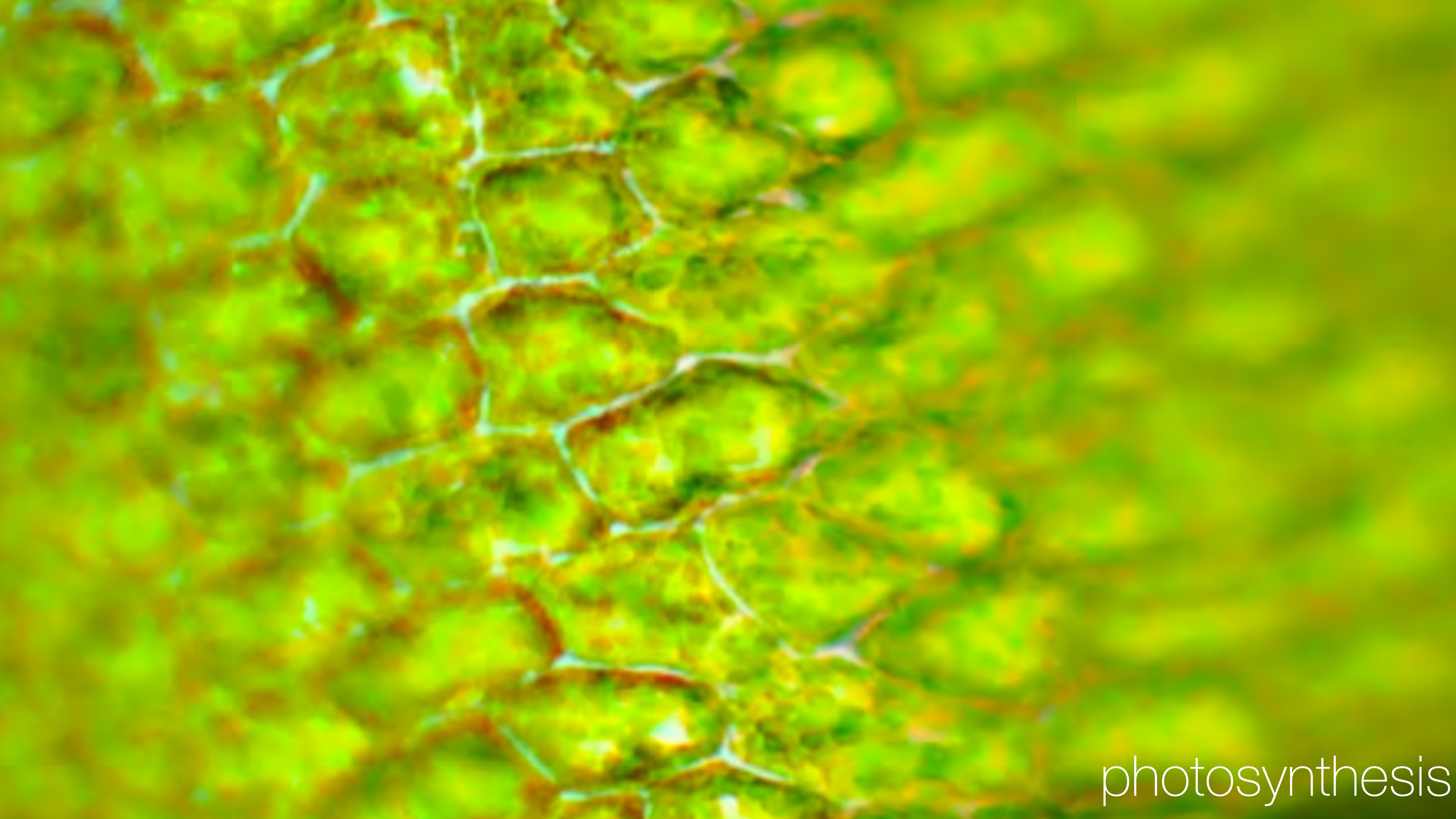
photosynthesis



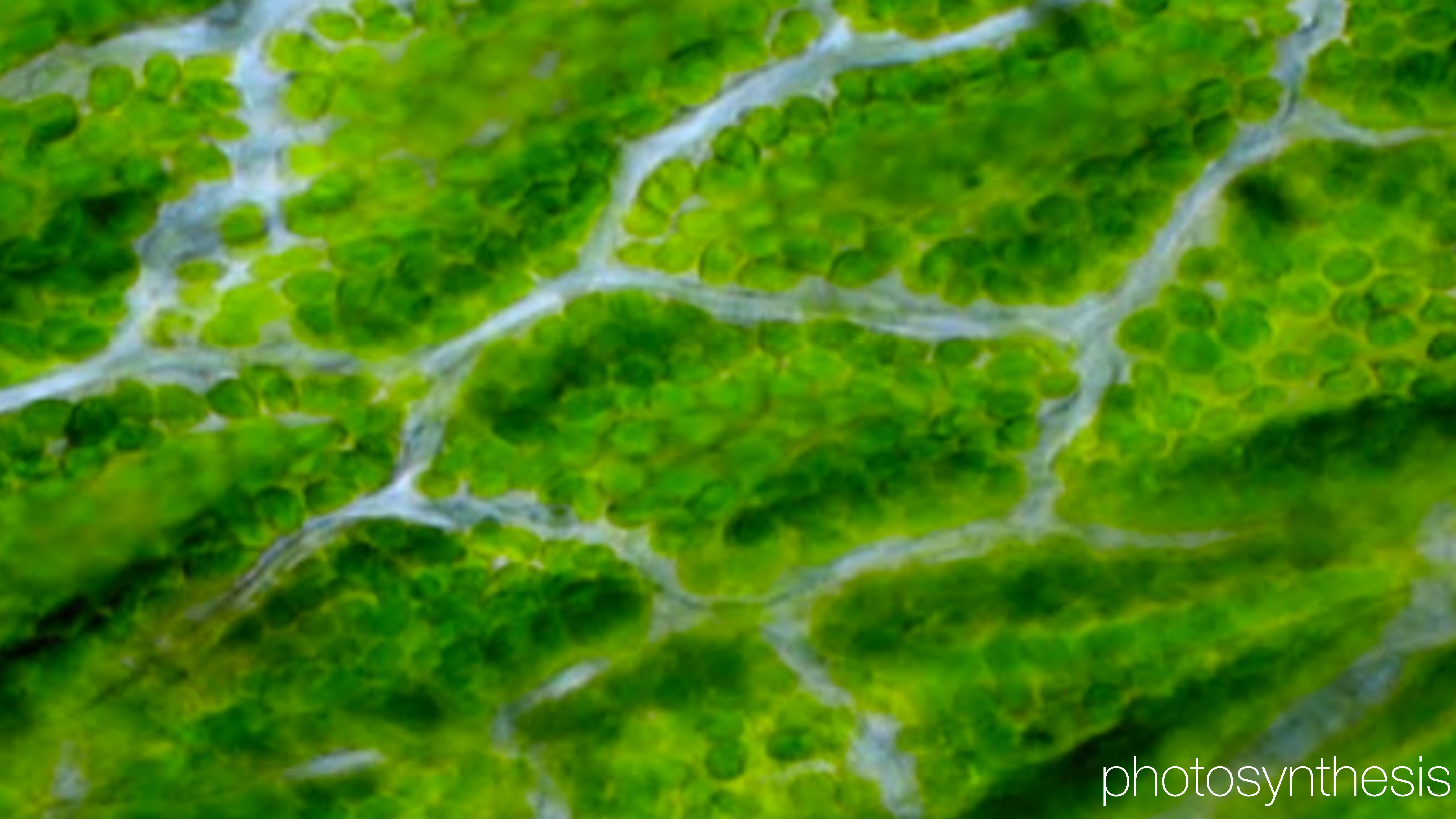
photosynthesis



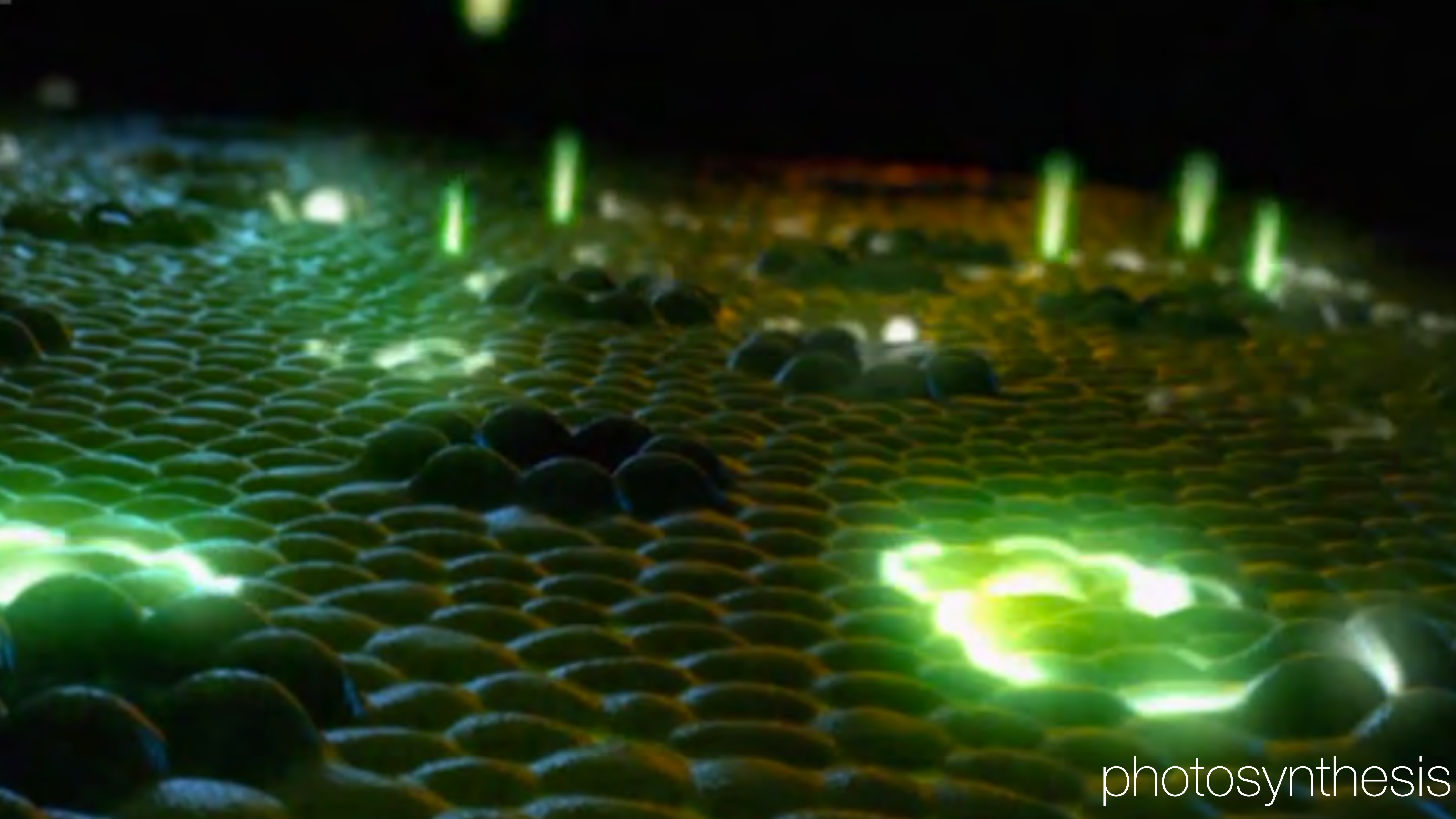
photosynthesis



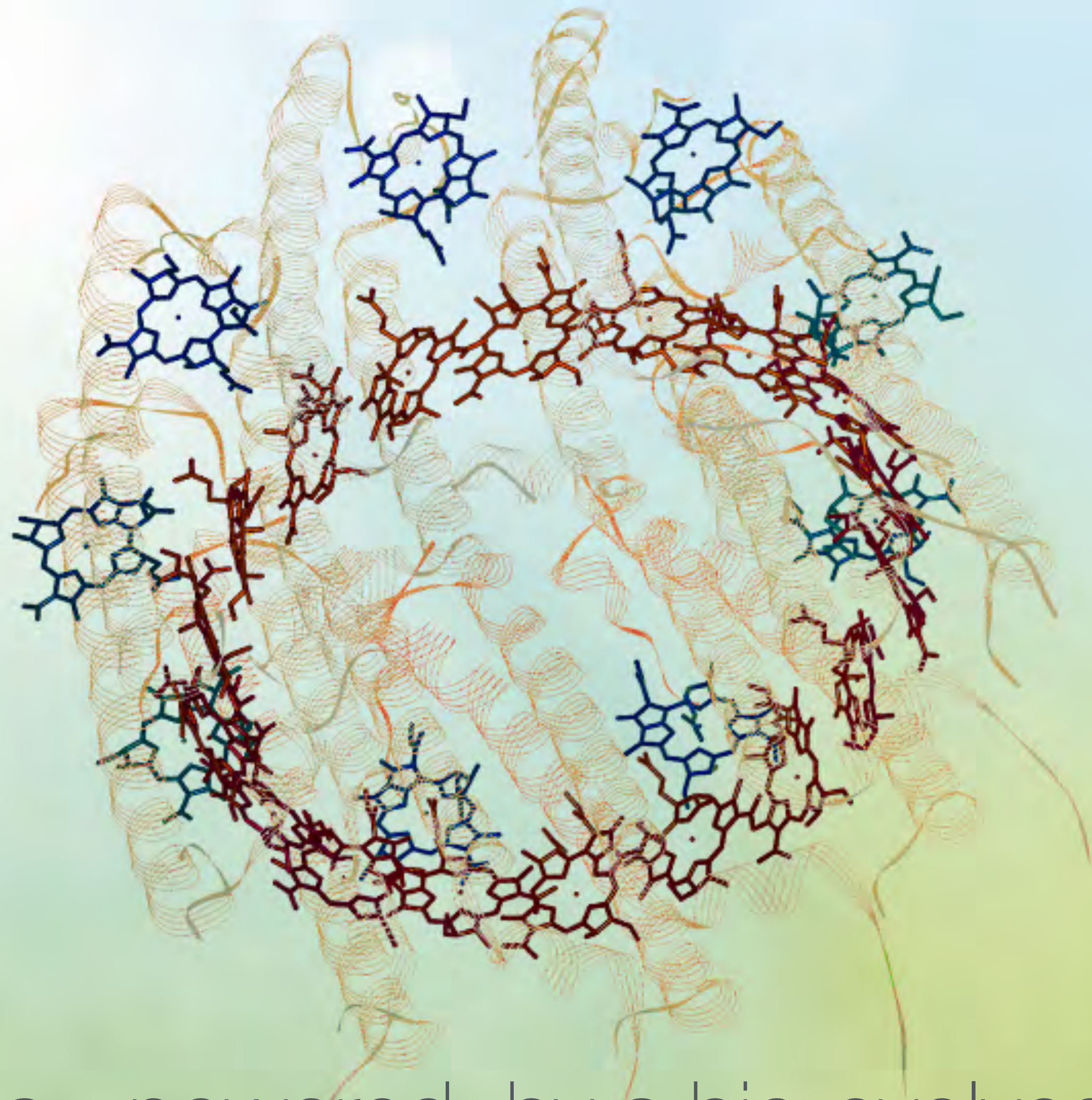
photosynthesis



photosynthesis



photosynthesis



photosynthesis - powered by a bio-evolved quantum machine







Carbon dioxide banked in the timber superstructure:

75 assorted panels: 62,912 kg CO₂

Cross laminated timber (1st floor): 129,784 kg CO₂

CLT Partitions: 48,000 kg CO₂

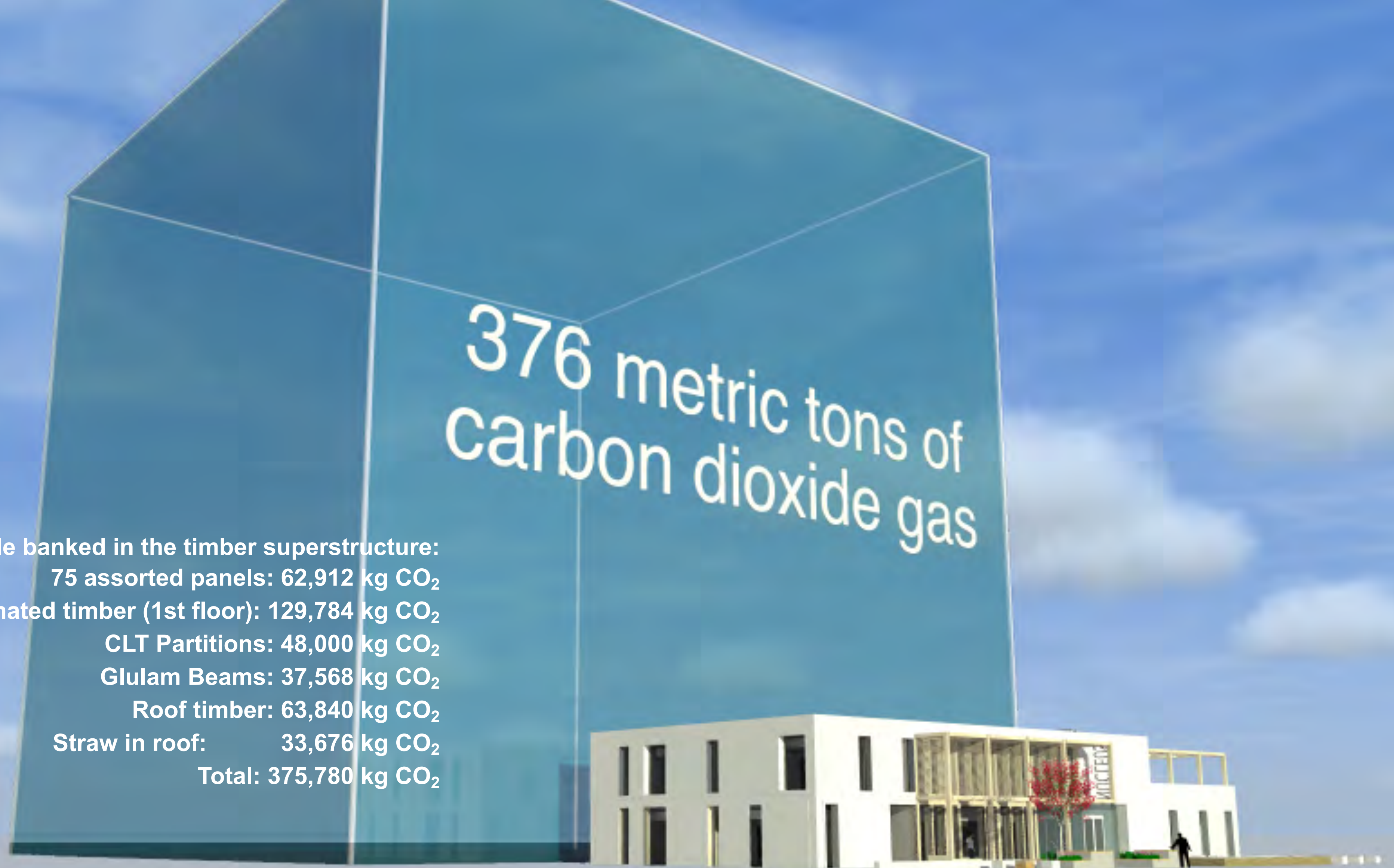
Glulam Beams: 37,568 kg CO₂

Roof timber: 63,840 kg CO₂

Straw in roof: 33,676 kg CO₂

Total: 375,780 kg CO₂

376 metric tons of
carbon dioxide gas









THE ECOS HAVE LANDED

Meet the pioneering eco-warriors living in Bramley, West Leeds.
Their environmentally sustainable co-housing project LILAC (Low Impact Living Affordable Community) is the first of its kind in Britain

• AVELINO MANUEL, 48, BIOMEDICAL SUPPORT WORKER, AND HIS SON SAMUEL, 4

I used to live in Portugal, in a community of farmers who supported one another, collecting grapes together, digging potatoes. My wife and I were happy to find this place. We child-share with the families in the other houses [in the development behind the fence]

• BRENDA GOSLING, 75, VOLUNTEER AND REIKI SPECIALIST
I live here with Clive, 79, who I met through a meeting about LILAC four years ago. We had a lot in common: both widowers, and interested in anything ecological. I love gardening and have an impulsive, adventurous side to me

• RICHARD THOMPSON, 34, IT PROJECT MANAGER, AND HIS DAUGHTER AMBER, 3
The walls of our houses are made of timber, with tightly packed straw bales under layers of rendering. They really hold the heat in. My average monthly gas and electricity bill is £20, compared to my colleague who pays £140!

LAURA SMITH, 54, BIOLOGY TEACHER
I sold my four-bedroom house to move here. We grow vegetables, car-share, order bread and food from other local co-ops. Our carbon footprint is 2-3 tonnes a year, compared to the average household, which is about 10 tonnes

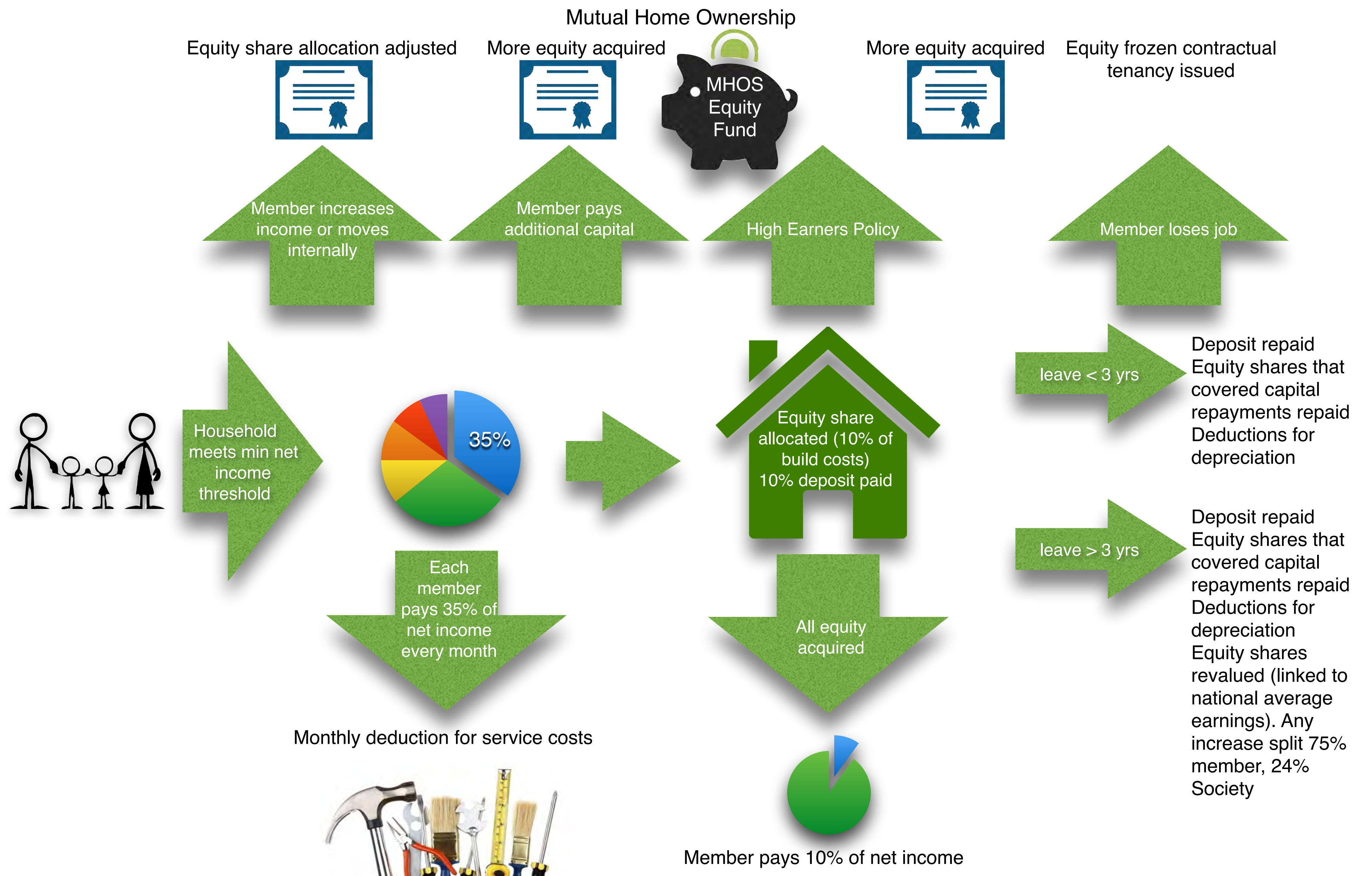
• ROBIN FISHWICK, 53, CHAPLAIN AND SUPPORT WORKER
I feel I'm leaving the right type of legacy for my daughters. Rosa [below] and Grace, I want them to have a sense of how to live well – not just leave them a property they can use

• BETH OXLEY, 30, TRAINEE CPN
It can be intense living here – it's important to get the balance between community and personal time. We hold meetings to discuss issues. Every decision is made by consensus, which isn't always easy

• MIKE HILL, 31, SUPPORT WORKER
People think I live in a place full of naked people running around. I wish that were the case! We pay 35% of our income to live here. I earn £13,500. It's amazing that on my salary I can live in the heart of Leeds in a place like this

Quarterly heating bills
£20 - £50
90% less
than the average for Leeds

INTERVIEWS
BY CLIO WILLIAMS
PHOTOGRAPH
BY MUIR VIDLER



LILAC	Number	m2	Gross Cost per unit	Total	Construction Cost m2	Construction cost per unit	Total Construction costs
1 bedroom apartments	6	48	£83,688	£502,128	£1,047	£50,278	£301,666
2 bedroom apartments	6	71	£123,788	£742,728	£1,047	£74,369	£446,214
3 bedroom houses	6	95	£165,632	£993,792	£1,078	£102,454	£614,725
4 bedroom houses	2	111	£193,528	£387,056	£1,195	£132,618	£265,236
Common House	1	186	£324,291	£324,291	£1,090	£202,734	£202,734
	21	1692					
Total Development Costs				£2,949,995	Total Construction Costs		£1,830,573
Gross Cost/m2				£1,743		m2	£1082
						sq ft	£101
Affordability							
Avg House price Leeds	£ 170,655	Source Land Registry of England & Wales April - June 2013					
Avg House price LILAC	£ 140,476						
% reduction	18% Less						

Super-insulated and Airtight
Heating MVHR and ASHP
all LED lighting all electric design

Rainwater Harvesting

Plasterboard Free - Compressed Straw Board CSB,

2kW PV per home

£1180m2







the one show



HoME Made

Custom Build

target to deliver 3,000 homes per year



what next for bio-based materials and CO₂?

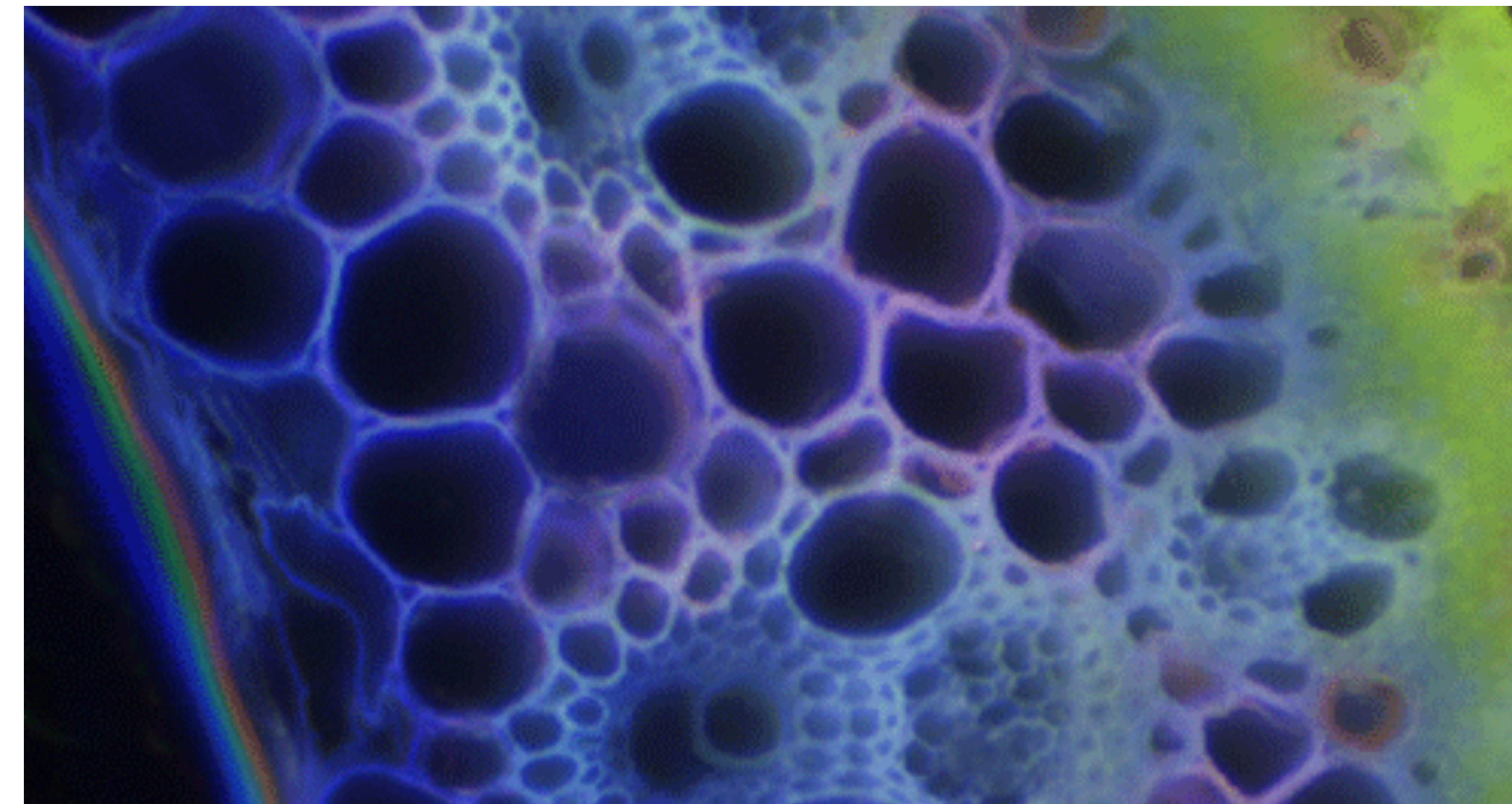
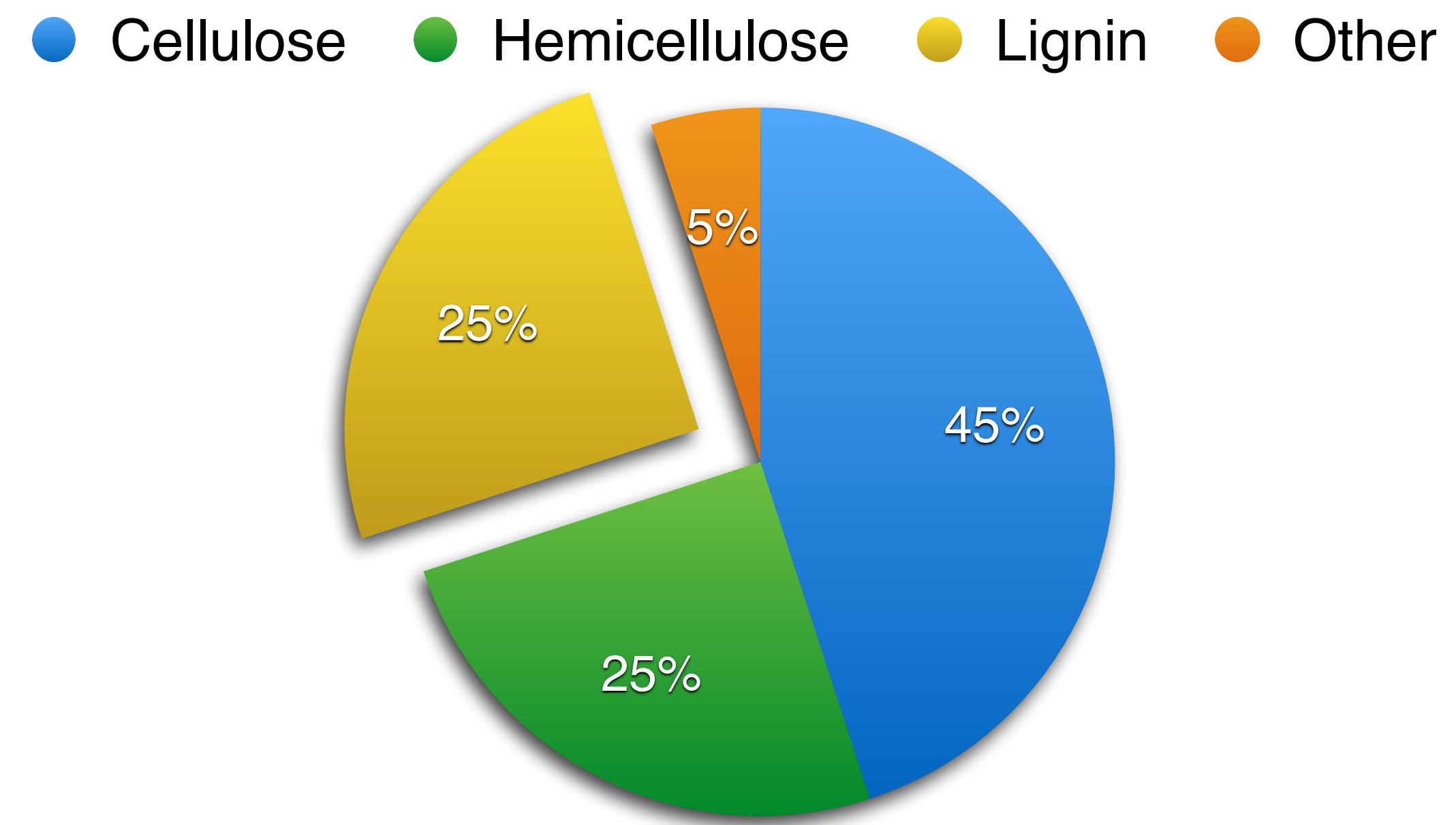


Lignin is a complex polymer of aromatic alcohols known as monolignols.

Lignin is an integral part of the cell walls of plants.

25% of a plant's cell wall is made of lignin

After cellulose, lignin is the second most abundant renewable carbon source.



Metamorphic bio-based materials

Application of heat and pressure to cellulose materials:

Heat causes naturally present moisture to be turned to steam

Steam liquifies lignin in cell walls

Lignin is a long chain molecule

Long chain molecules act as bonding agents

Pressure forces materials together into a self bonded whole

Straw can become load-bearing board materials

Carbon-banking, bio-based material systems

Photosynthesis powers the conversion of CO₂ into mass

Low embodied energy material processing

Self bonding materials use activated lignin

High performance applications in design and construction

Replaces CO₂ intense materials

Delivering sustainable and low carbon outcomes

LigniCell - Compressed Straw Board (CSB):

replaces the need for plasterboard.

reduces the need for stud work.

is load-bearing

has exceptional acoustic performance.

is fast to install.

no special fixings required.

reduces waste and cost.

Manufacturing

A Stramit Machine is up to 90 metres long and 7 meters high. Smaller format machines are also available.

A typical covered area of 3,000m² is recommended for a full set-up. A straw storage facility is also required.

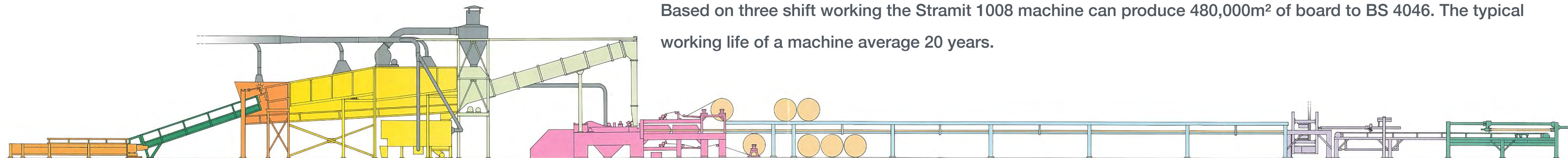
A Stramit Machine running three shifts consumes:

10,000 tonnes of Straw

390 tons of paper

135 tons of glue

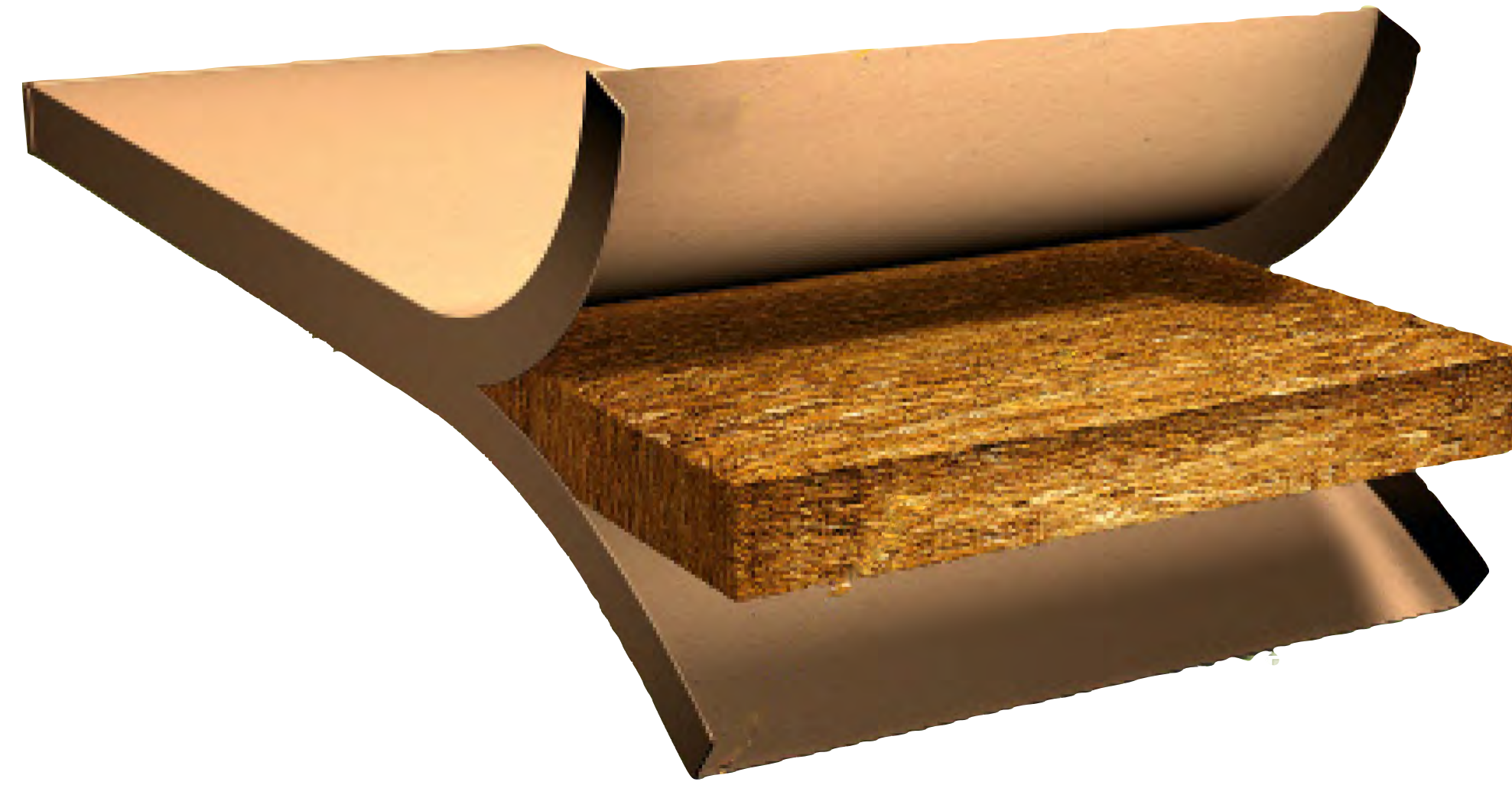
Power - 150 KVA generator



Based on three shift working the Stramit 1008 machine can produce 480,000m² of board to BS 4046. The typical working life of a machine average 20 years.



LigniCell - Compressed Straw Board (CSB):



40 thick

up to 3.2m long

800 wide

60 thick

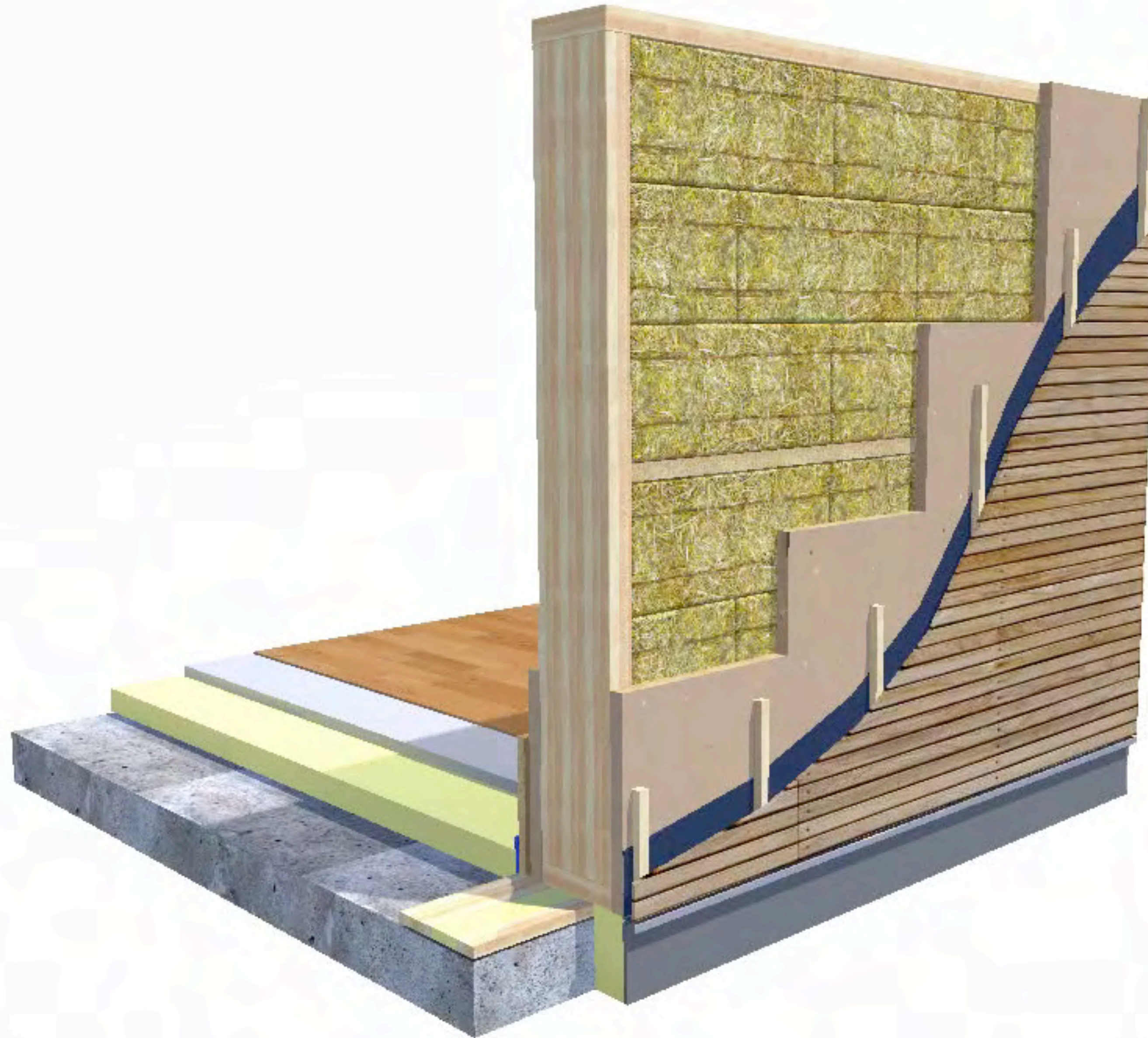
up to 3.2m long

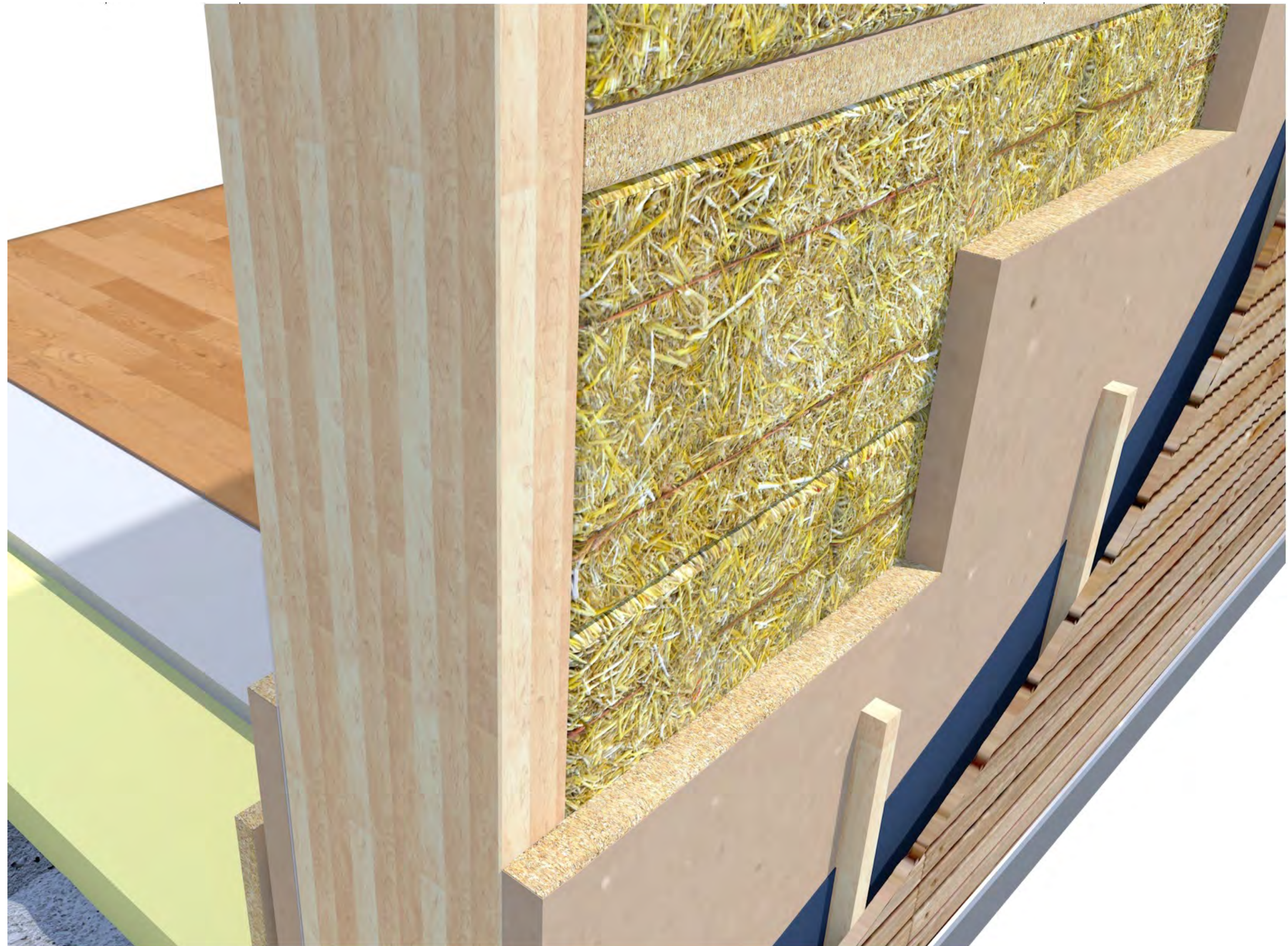
800 & 1200 wide











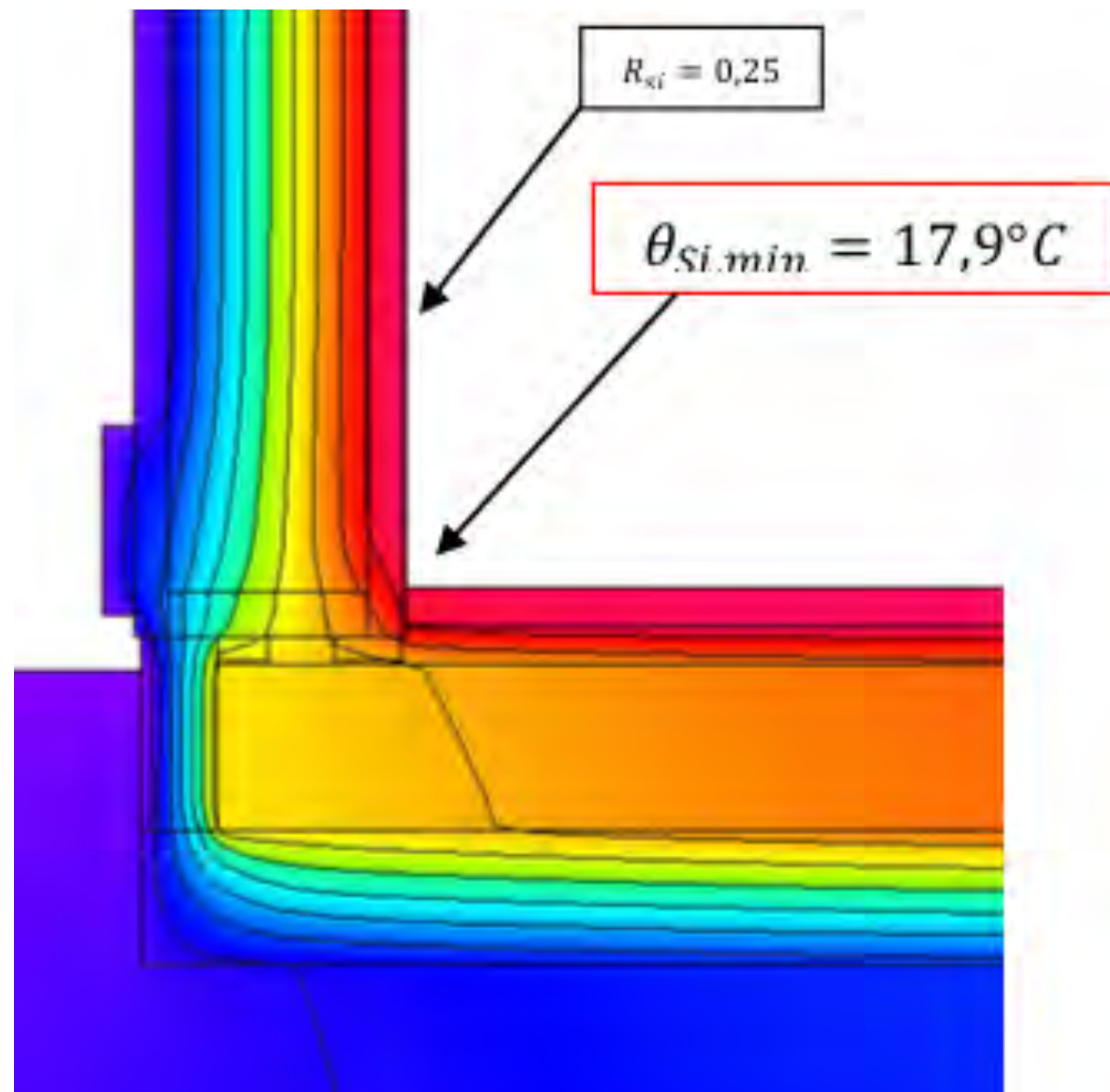
Timber Frame Elements



Q-Mark Certificate Number QTF-006

Issue Date - 06 10 2014

Expiry Date - 05 10 2017



Heat transfer coefficient of building envelope:

$$f * U_{opaque} \leq 0.15 \text{ W}/(\text{m}^2\text{K})$$

with f: temperature reduction factor



Thermal bridge free design:

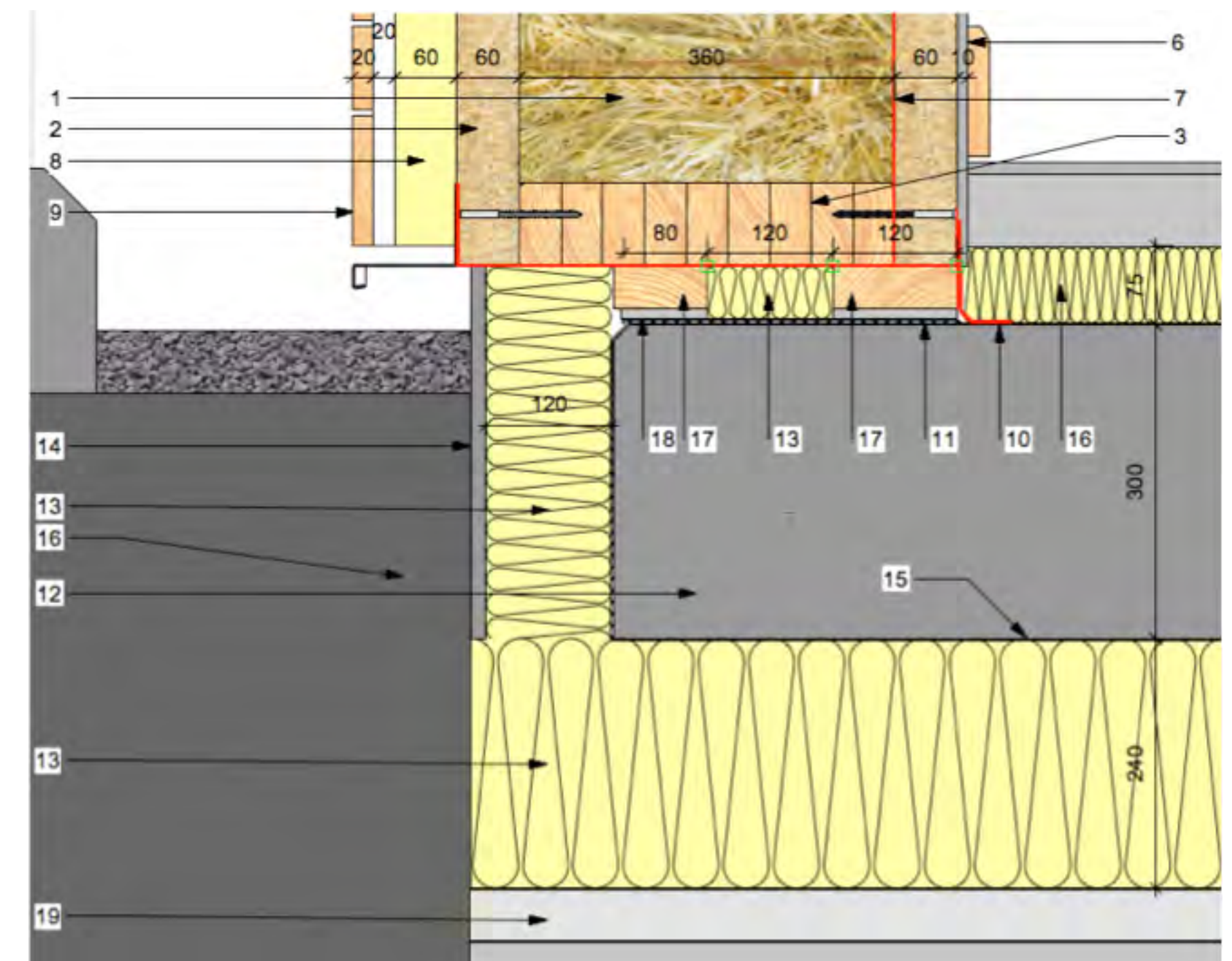
$$\Psi_e \leq 0.01 \text{ W}/(\text{mK}) \text{ for key connection details}$$

with Ψ_e : linear heat transfer coefficient

$$U_{w, \text{standard window, installed}} \leq 0.85 \text{ W}/(\text{m}^2\text{K})$$

with standard window: width 1.23 m; height 1.48 m

Interior surface temperatures minimum 17°C
at $\vartheta_{ext} = -10^{\circ}\text{C}$ und $\vartheta_{int} = 20^{\circ}\text{C}$





 **STRAMIT**
INTERNATIONAL

Original Strawboard Technology since 1945



Stramit Machine Technology - Celebrating 70 years of continuous innovation

NATURALLY HIGH
PERFORMANCE
INSULATION

isobio





UK has failed to meet housing demand for over a decade.

In 2013 we built 130,000 homes, less than half the demand.

A market failure that has its roots in the 2007 financial crisis.

House prices have risen to the point where access to home ownership is out of the reach of the young and those on low wages. Generation Rent.

Pensions are not performing the way they should.

The UK has relied on a property owning population able to release equity in retirement to close the pension performance gap.

A double whammy of a non-property owning population with poorly performing pensions.

An ageing population without the equity or pensions face the likelihood of living in poverty.

Government has to rethink how housing will be delivered at scale.

Of the 130,000 houses built in 2013, over 15,000 of them were built by self-builders.

Three times more than the largest house builder.

How do you scale self-building?

Self-build requires individuals to build one house at a time, taking longer than they ever imagined & costing more than they hoped! It's hard work.

The government's approach to resolving this is to develop a what is called Custom Build.

Custom Build is a significant and emerging agenda for the UK.

The Community Right to Build was embodied in the Localism Act.

Self-build and Custom Housebuilding Bill 2014-15 was laid before Parliament as a Private Members' Bill. It's in the house of Lords and will emerge in March

Every local authority is obliged to identify land for Custom Build.

Government hopes to scale the Self Build market from 15,000 thousand home in 2103 to 100,000 by 2020 using Custom Build.

The largest change in housing provision in the last 60 years.

Scale Prefabrication from 5,000 today 50,000 by 2020

Affordable Housing Programme £150m. From September the HCA call for bids encouraging use of MMC Custom Build Fund - <https://www.gov.uk/government/publications/custom-build-serviced-plots-loan-fund>. **We have already secured £2.7m of this funding for a 68 home development in Frome.**

Right to Build £400m for London, £200m rest of UK for 10 zones DCLG invitations to Vanguard Local Authorities for Custom Builder Housing Zones and Brownfield development <https://www.gov.uk/government/news/government-initiatives-to-help-build-more-new-homes-on-brownfield-land>

Local Growth Fund - £300m Housing Revenue Account Borrowing Programme for 10,000 new affordable homes over 2015 to 2016 and 2016 to 2017.

Local Growth Deals - Provides funds to local enterprise partnerships or LEPs <https://www.gov.uk/government/collections/local-growth-deals>.

RGF Round 6 £200m - Regional Growth Fund is now open <https://www.gov.uk/understanding-the-regional-growth-fund#rgf-round-6>

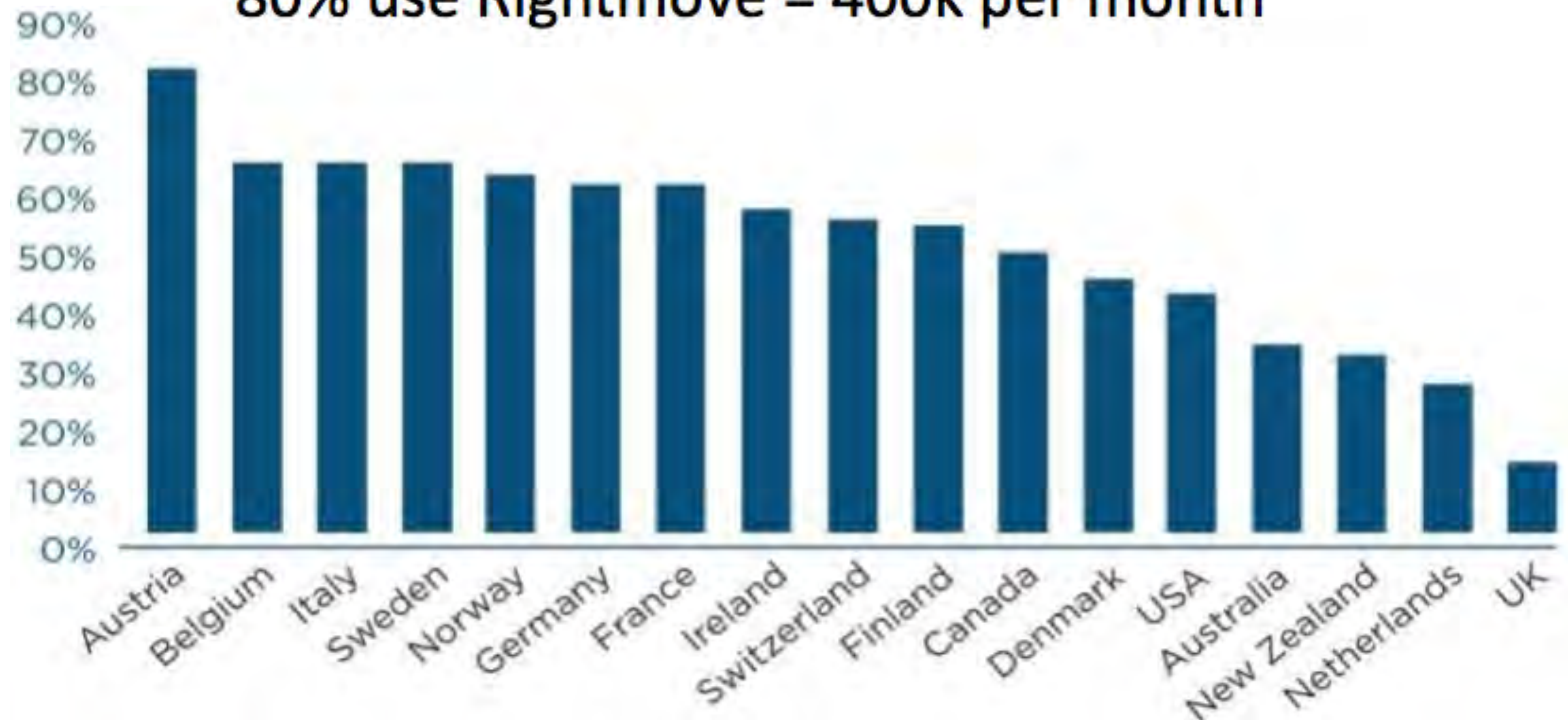
67% would not buy from a volume housebuilder

53% want to Custom Build at some stage

30% want to Custom Build in next 5 years

12% want to NOW = 6 million people

80% use Rightmove = 400k per month



100,000 new homes

That's a new £20bn housing market

it doesn't exist today

it will by 2020

HoME Made

Custom Build

target to deliver 3,000 homes per year

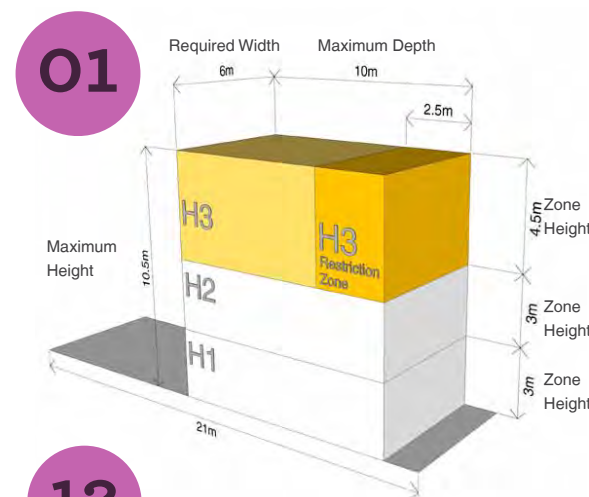




Detail planning secured 30 January 2015
Flying Factory in Devon
Passed Judicial review 22 March

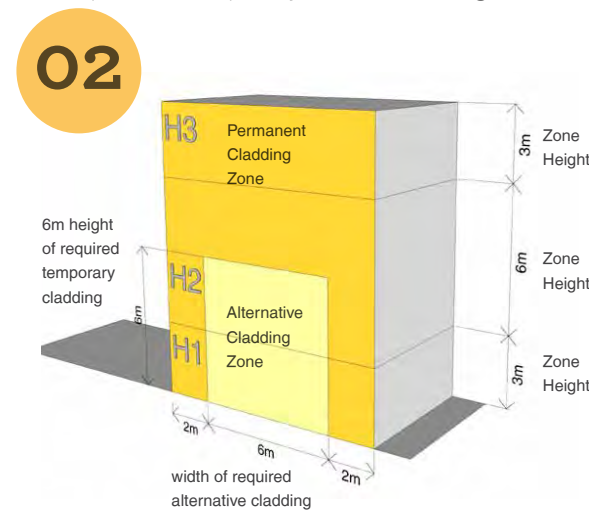
01 PLOT PARAMETERS

BCH shown in red



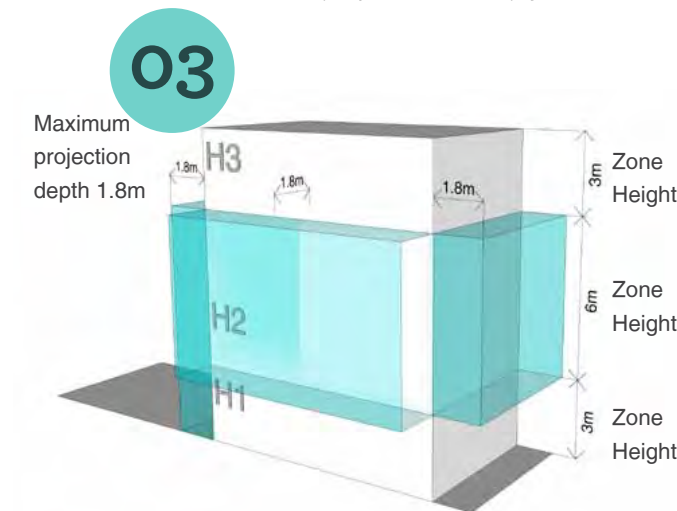
02 ADJOINING PROPERTIES

BCH provide temporary timber cladding



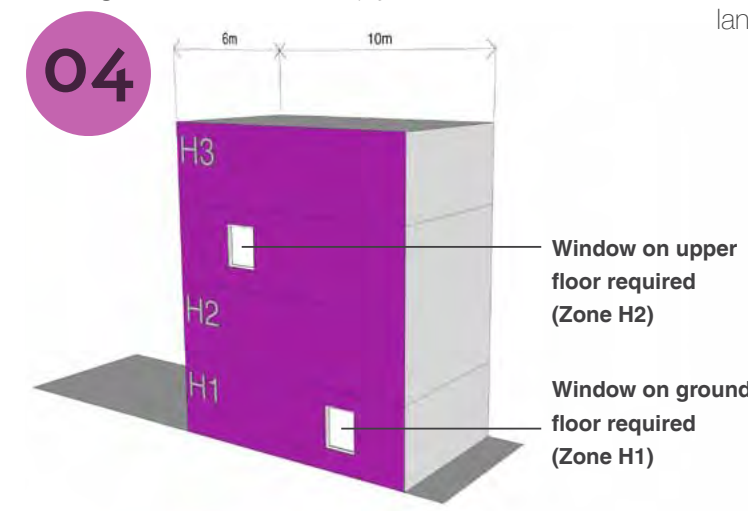
03 PROJECTIONS & RECESSES

BCH us limited recesses projections comply



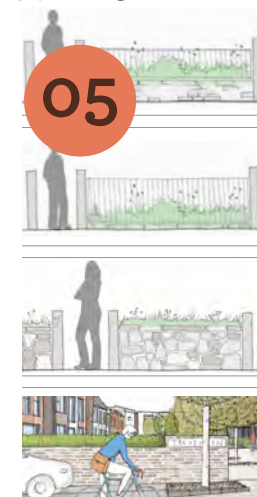
04 CORNER LOCATIONS

BCH gables & corners comply



05 BOUNDARIES

BCH boundary treatments comply planting & hard landscaping



12

12 OTHER ITEMS

BCH Enclosed bin & Bike stores at rear

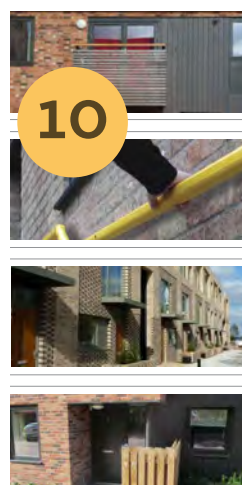
11 EXTERNAL COLOUR PALETTE

BCH uses a range of natural materials aluminium is mill finished



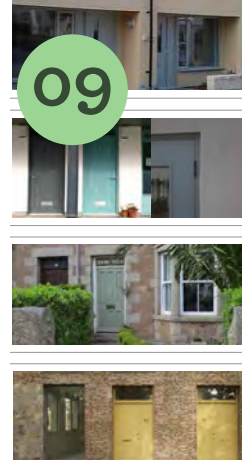
10 EXTERNAL BUILDING DETAIL

BCH Entrance canopies articulate facade



09 WINDOWS & DOORS

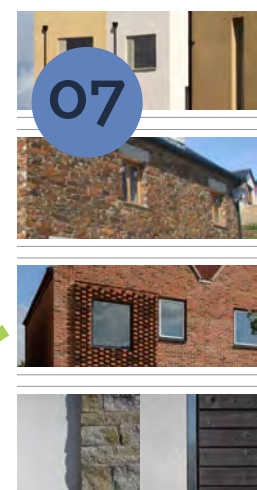
BCH Timber



06

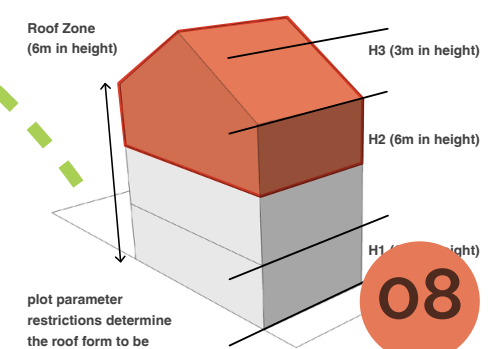
06 PARKING

Dealt with by master plan



07 EXTERNAL MATERIALS

BCH uses render, horizontal & vertical timber, shingles & slate tile hanging



08 ROOF MATERIALS

BCH uses slate, clay or cement fibre tiles

Design Code Compliance





BaleHaus Premier option

£132,850*

3 Bedroom

2 Storey 88m2

Foundations and oversite (Auger piles and reinforced concrete ground beams) PC sum	£15,000
Crane mobilisation (for one installation)	£2,000
Soft landscaping	£3,000
ModCell panel system (walls, roof, internal walls and floors)	£23,300
Roof covering	£5,250
Timber cladding (Jointed treated softwood)	£2,900
Windows, doors	£6,500
Kitchens and bathrooms (supply only)	£6,500
M&E	£10,400
Internal fit out	£17,100
Scaffolding	£2,500
Prelims	£11,500
Overheads	£14,900
Profit margins	£12,000
Total Cost per unit	£132,850

*Excluding: Plot, Customisation fee, Marketing & Plot Shop & CoW, Temporary side elevation weatherproofing (if applicable) and any applicable taxes. Traditional foundations (includes party wall compliant solution) E&OE
Prices based on a minimum of 10 units.

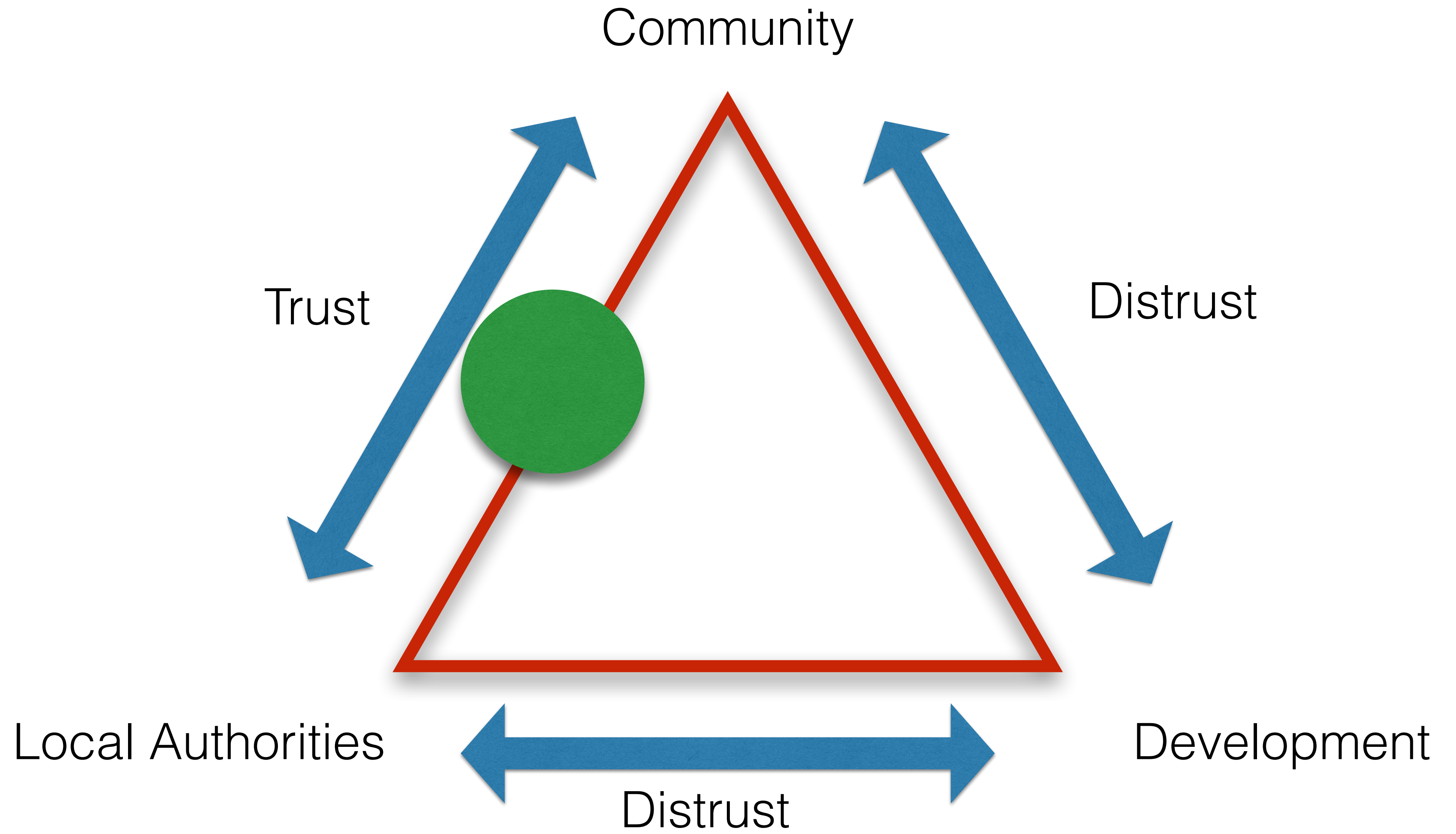


BaleHaus Premier ‘Plus’ option £199,202*

3 Bedroom

3 Storey 132m2

Foundations and oversite (Auger piles and reinforced concrete ground beams) PC sum	£16,400
Crane mobilisation (for one installation)	£2,000
Soft landscaping	£3,000
Rainwater harvesting (kit only)	£2,630
ModCell panel system (walls, roof, internal walls and floors)	£39,860
Roof covering	£5,250
Timber cladding (Jointed treated softwood)	£4,700
Windows, doors	£9,000
Kitchens and bathrooms (supply only)	£9,000
M&E	£17,500
Internal fit out	£29,775
Solar PV	£5,320
MVHR	£3,775
Scaffolding	£3,000
Prelims	£12,841
Overheads	£16,241
Profit margins	£18,910
Total build cost per unit	£199,202

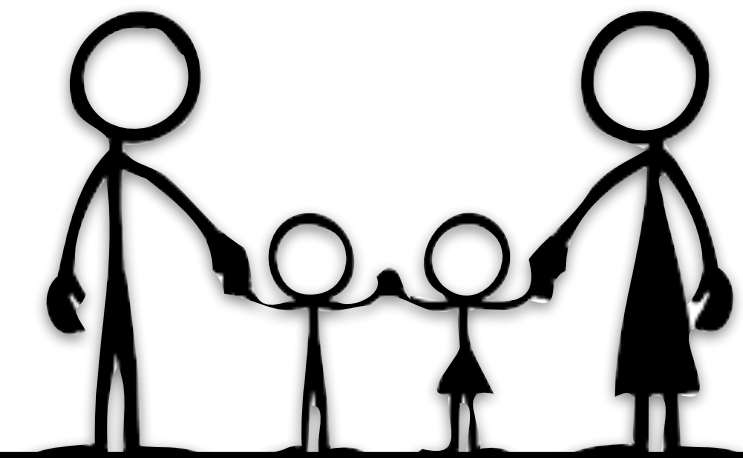


Hardware



**OS
missing
or
confused
or
not defined**

Software



Working with Paul Chatterton

founder of LILAC

we will create the 'red book'

A Toolkit for Community Led Development







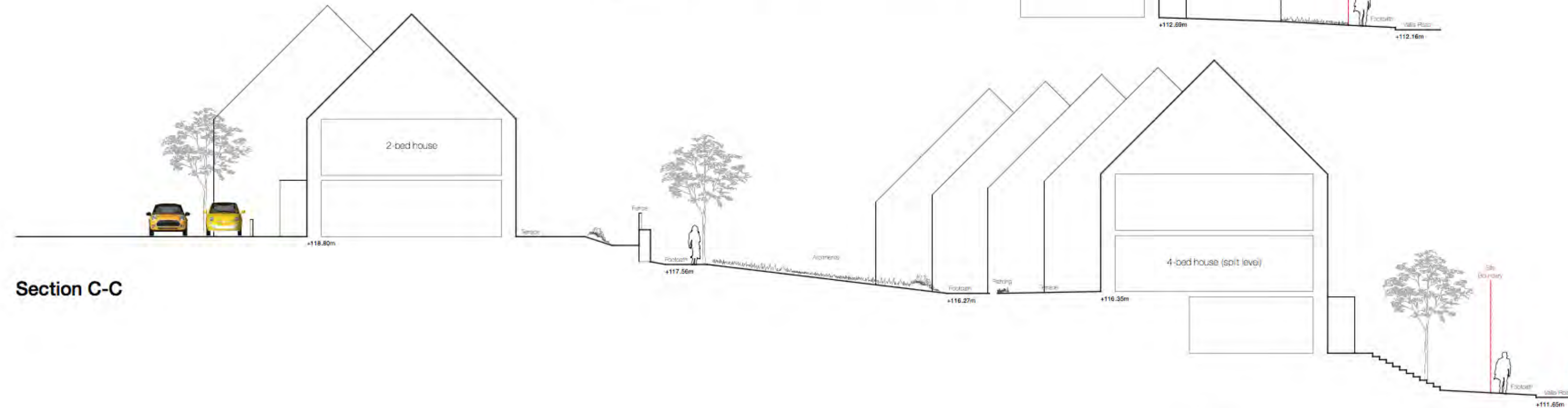
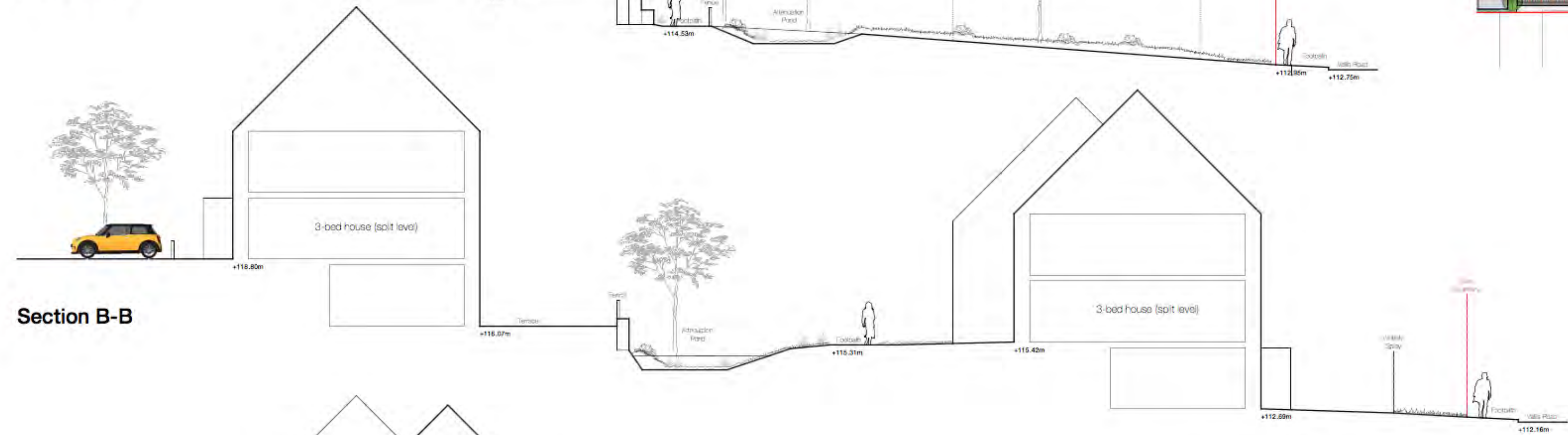
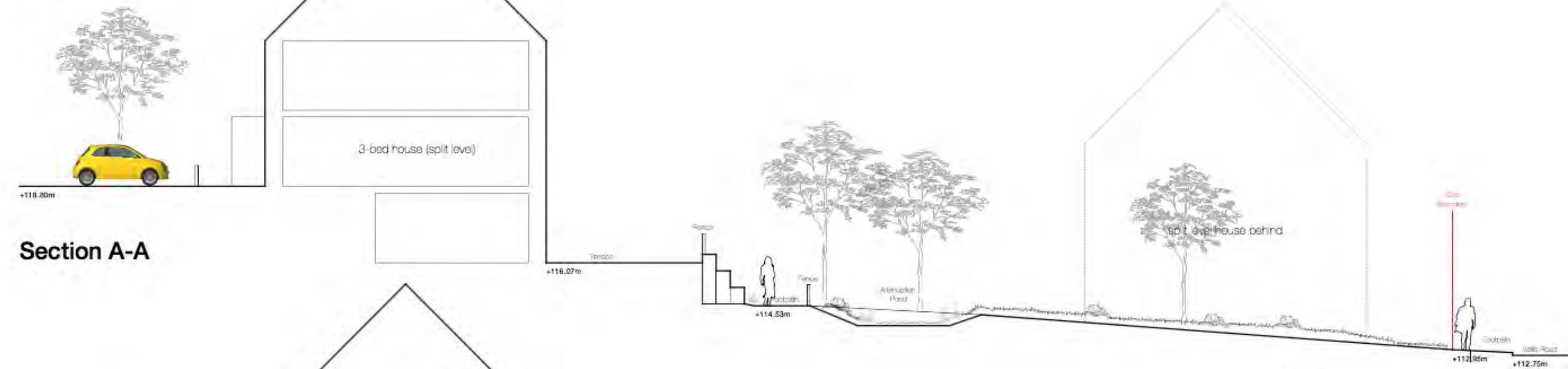


DETAILED PLAN
Co-housing Area



SITE SECTIONS

 Eastern Area



Vallis Road

 Frome

SITE SECTIONS

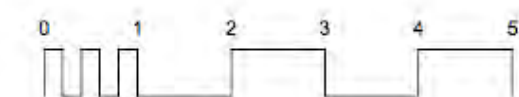
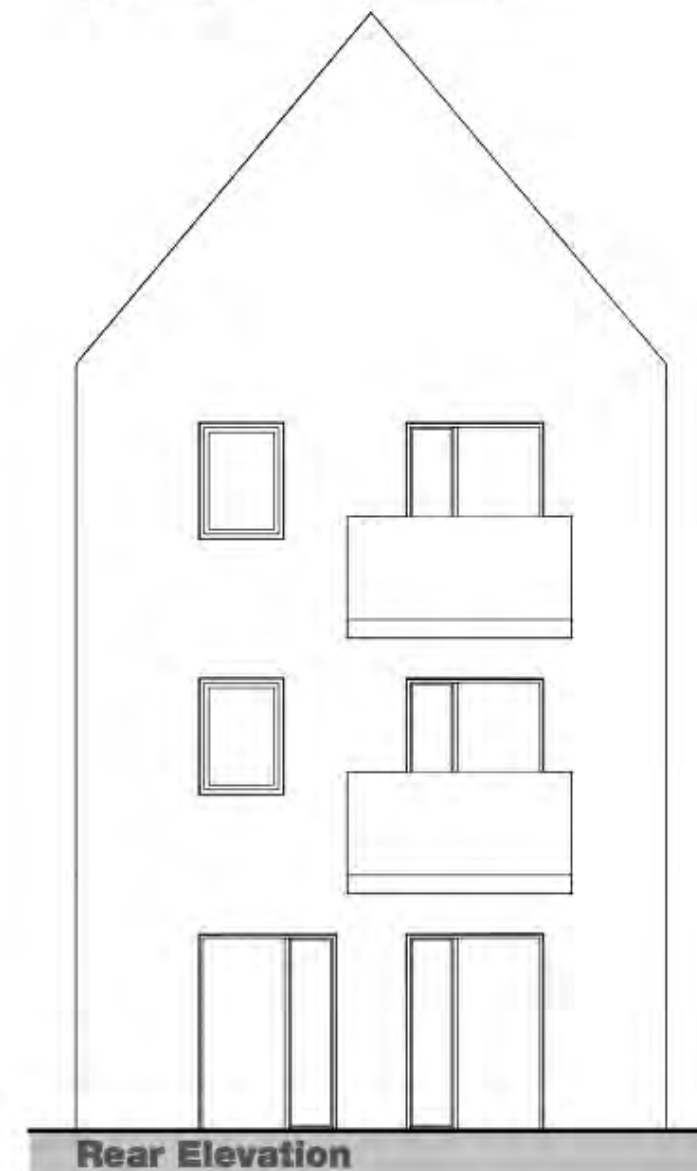
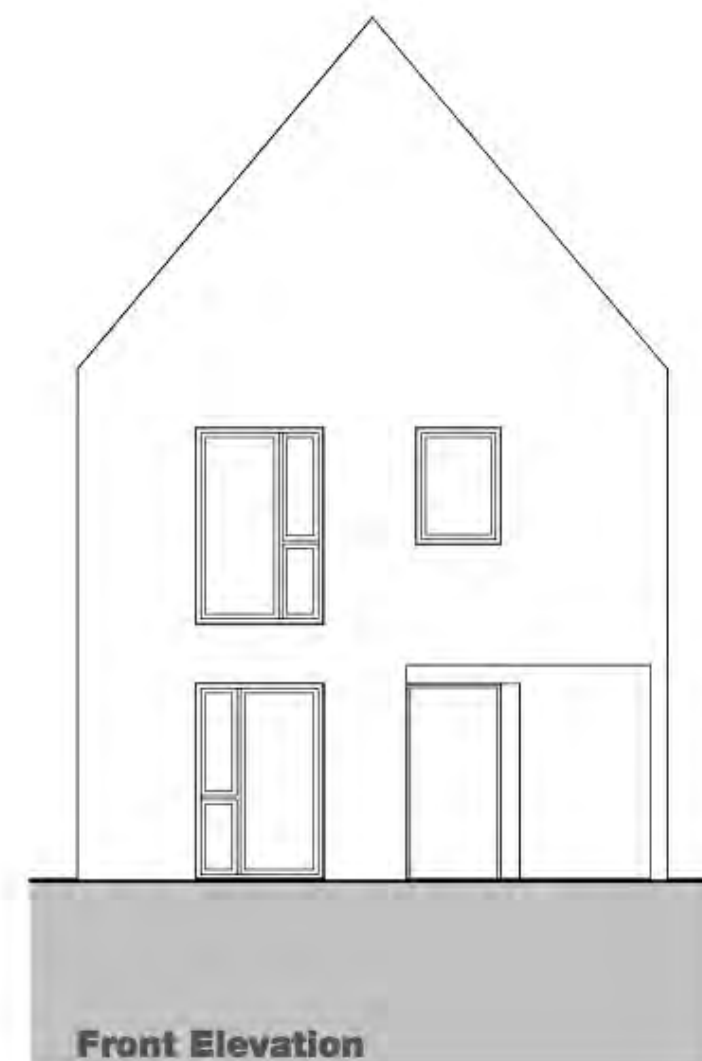
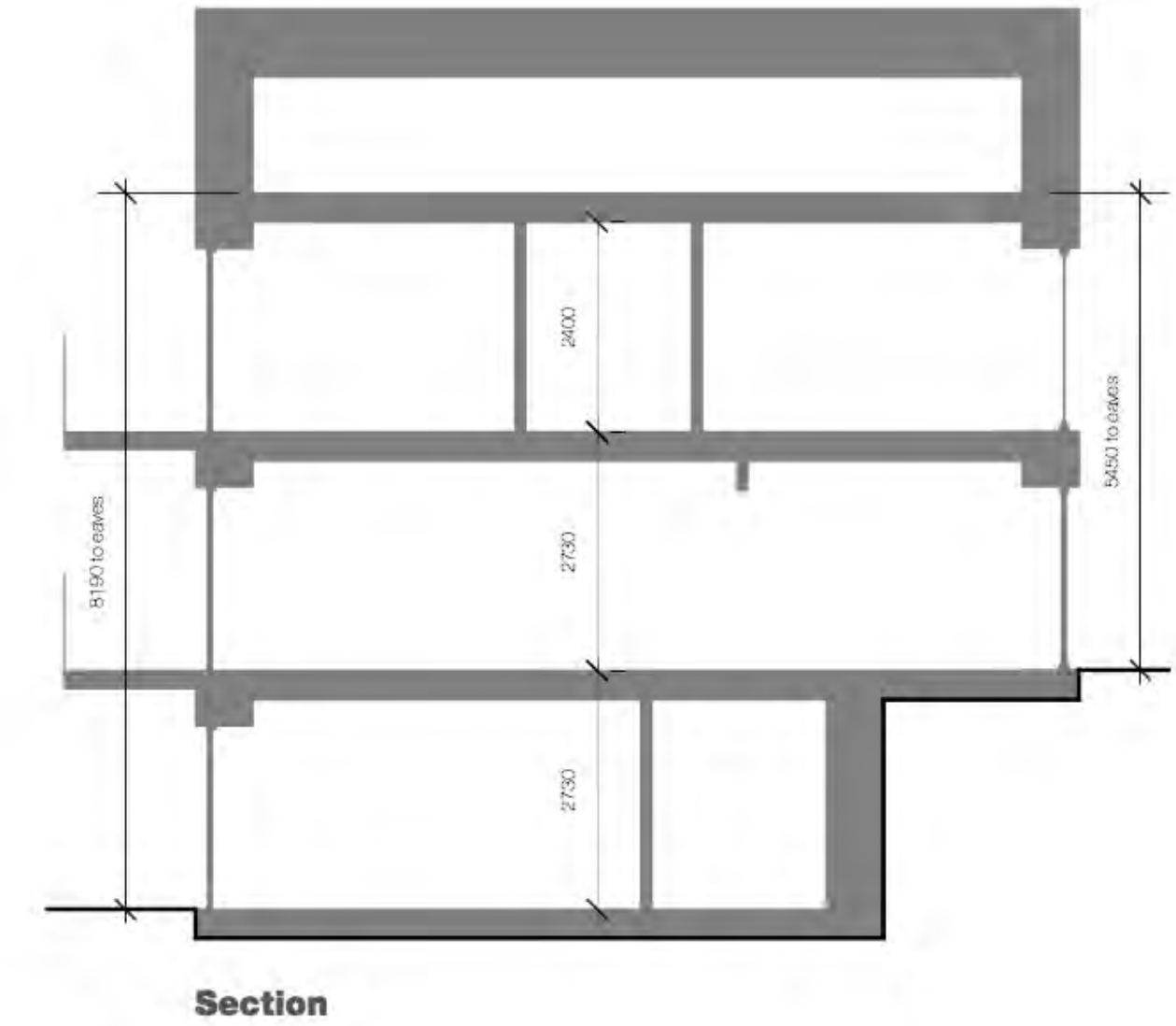
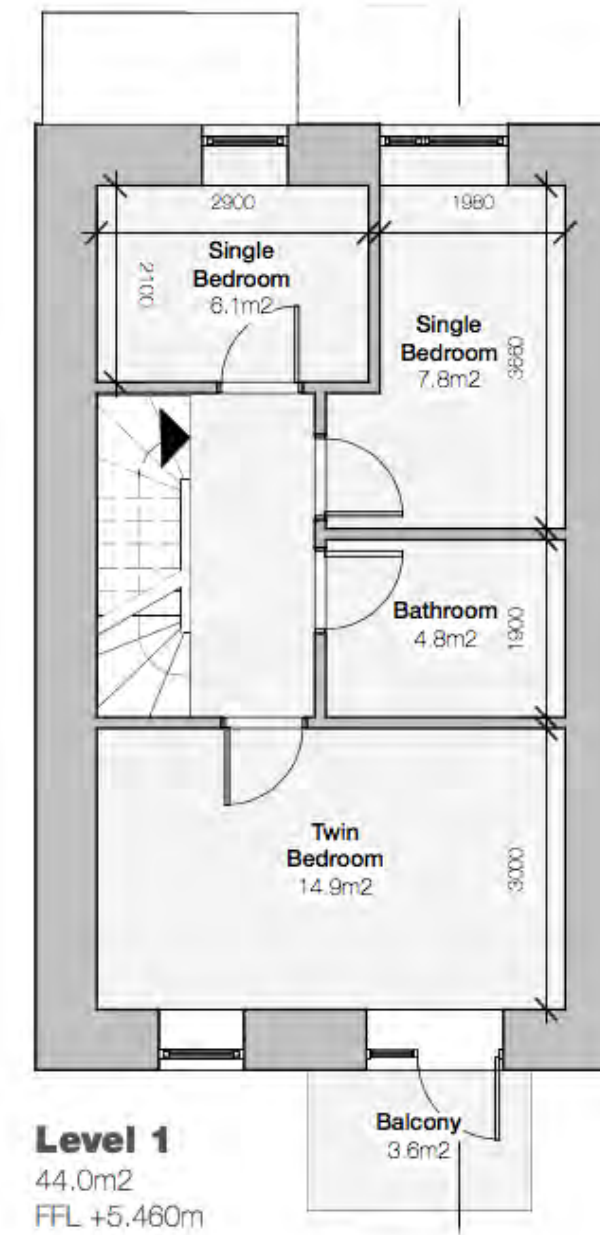
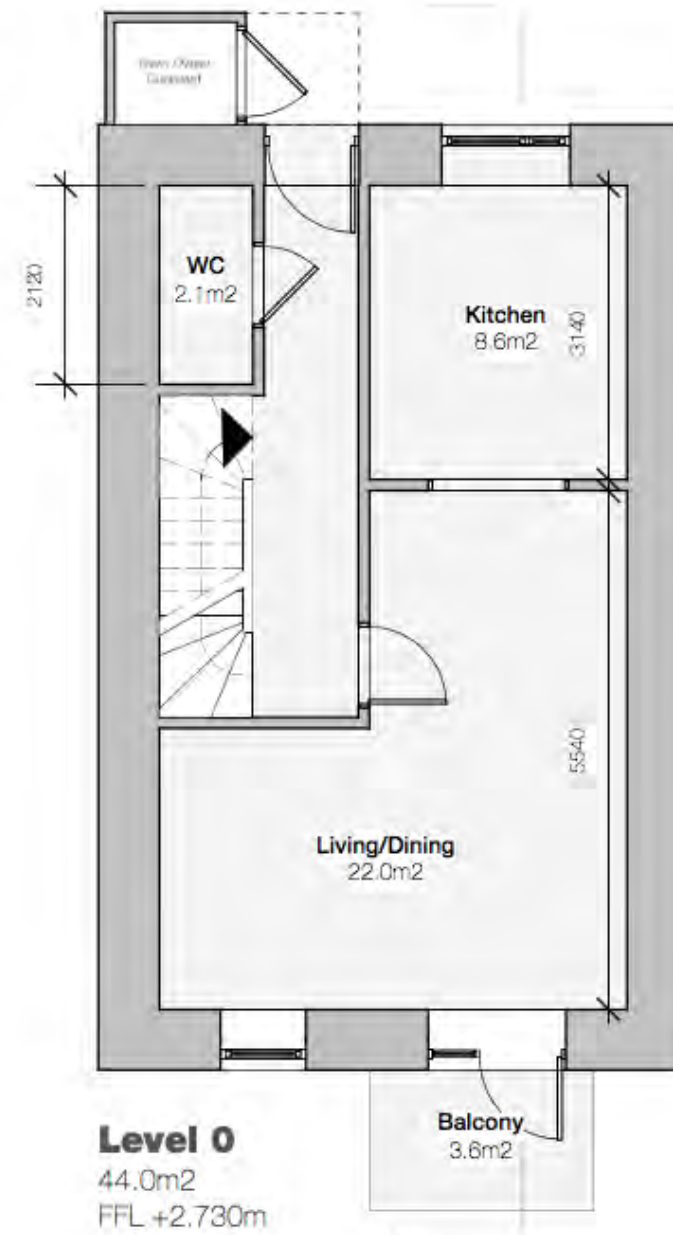
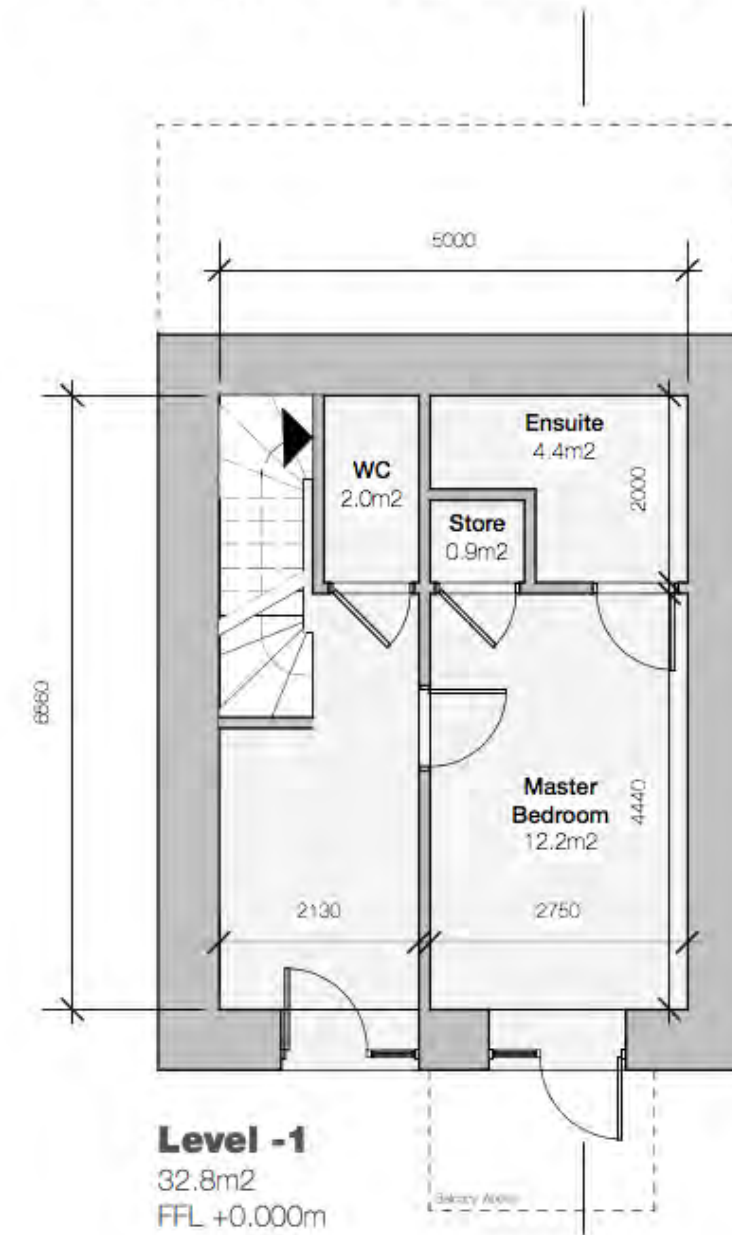
 Eastern Area

 Connolly and Callaghan

Check all dimensions on site, if in doubt ask.

Date	25/11/2015	Drawn	JE	Checked		Drawing No	6285 03 0201	Amendment	
Date		Amended		Checked		Status + Work Stage	Preliminary		
Scale	1:500 @ A3	Scale	A3	Scale @ A3		Developed Design			
					<small> email@white-design.co.uk or www.white-design.com the proving house 101 sevier street Bristol BS2 9UB Copyright © 2015 White Design Associates. All rights reserved. </small>				

PLAN / SECTION / ELEVATION
House Type J - 4 Bedroom / 6 Person - 120.8m²



Revision Notes

Rev.	Date	Notes	Revised by	Checked by
A	28/10/2015	Layout revised; balconies added; area increased.	JE	

Preliminary

Vallis Road
Frome

PLAN / SECTION / ELEVATION
House Type J

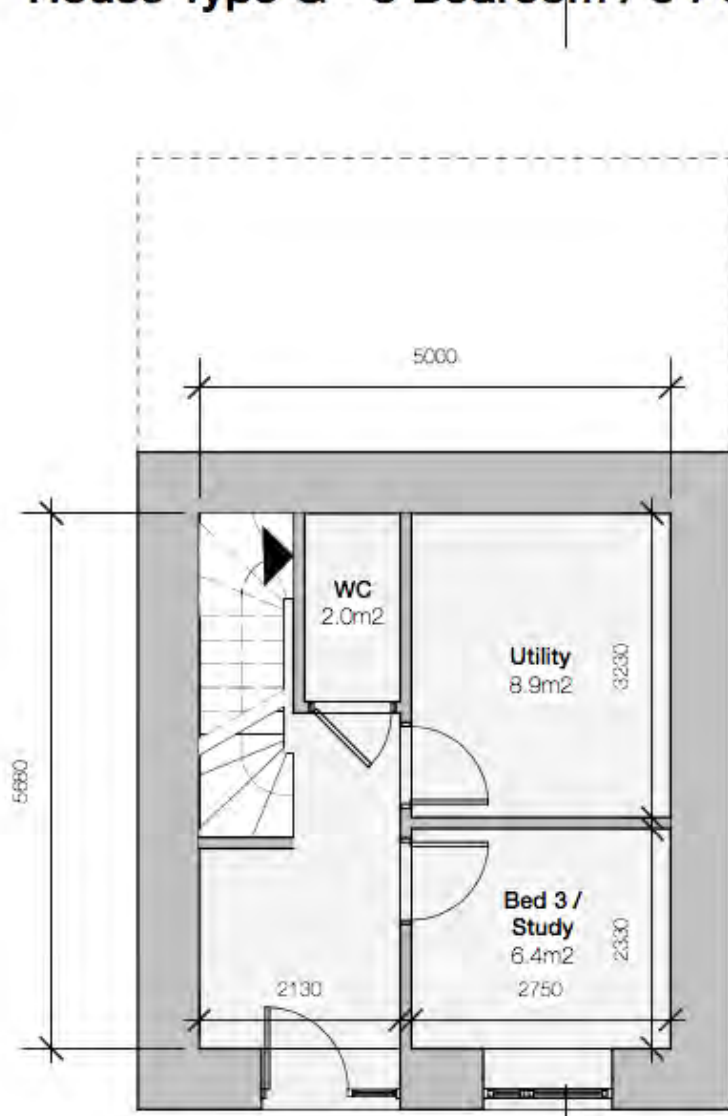
Connolly and Callaghan

Check all dimensions on site. If in doubt ask.

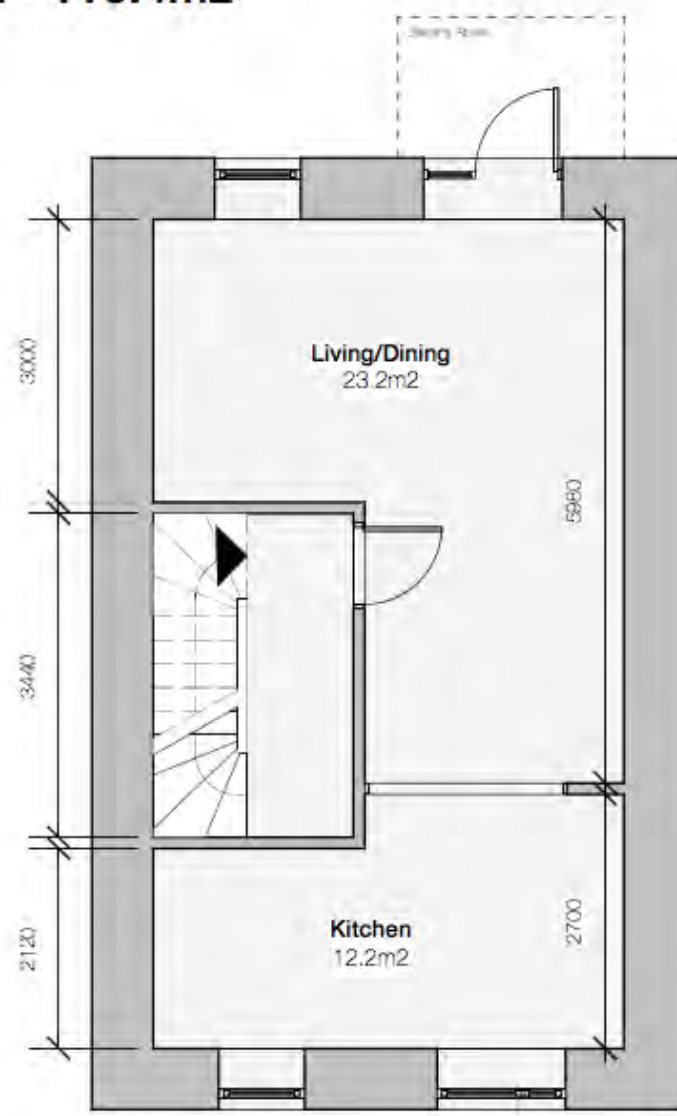
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2/7/2015	NB	JE	6285 2 0119	A
Date	Amended	Checked	Status + Work Stage	
28/10/2015	JE		Preliminary	
Scale	1:100 @ A3	Scale @ A3	Concept Design	

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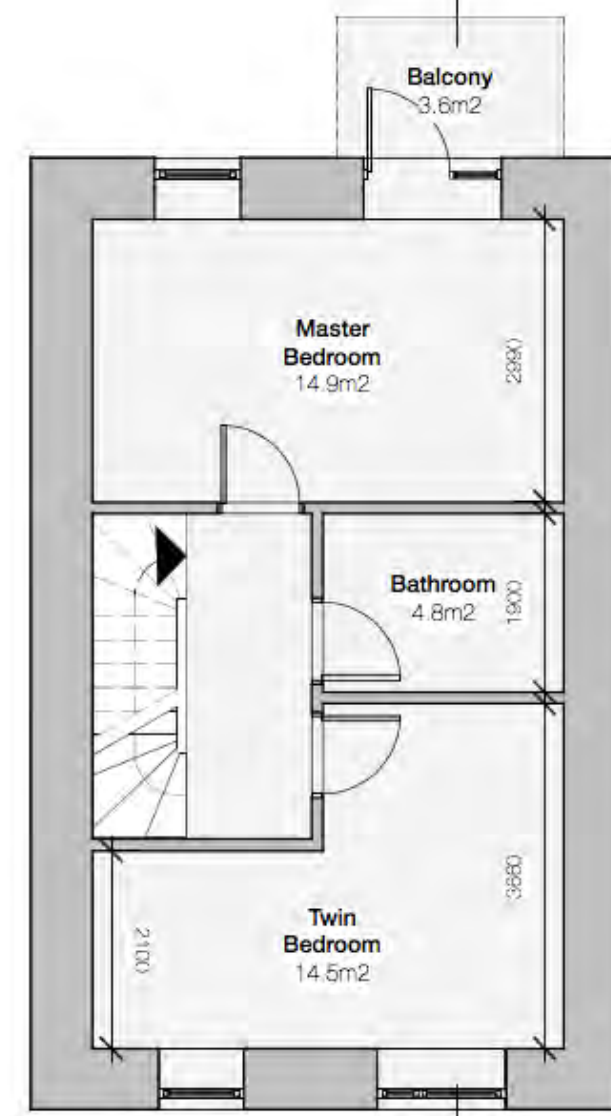
PLAN / SECTION / ELEVATION
House Type G - 3 Bedroom / 5 Person - 116.4m²



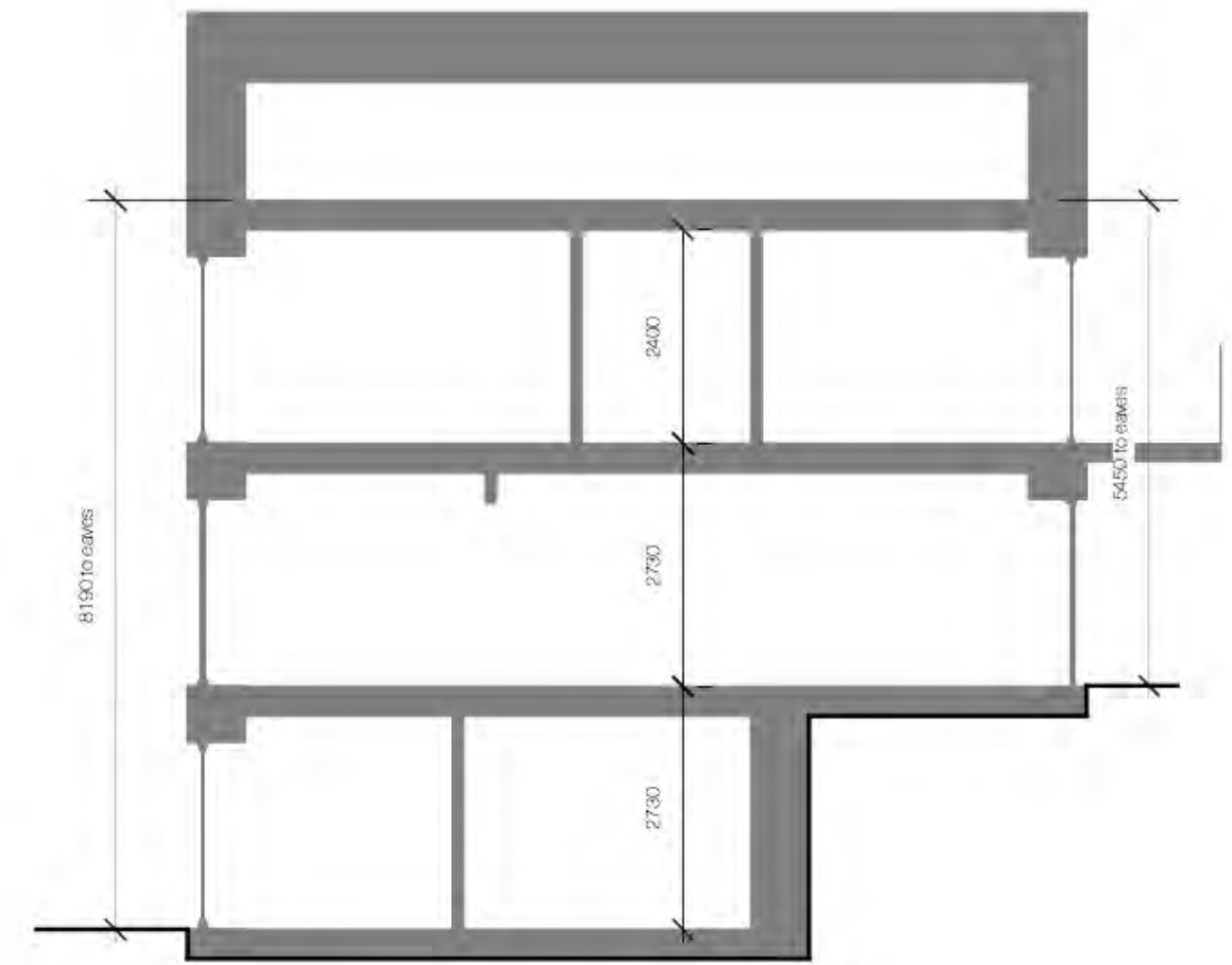
Level -1
28.4m²
FFL +0.000m



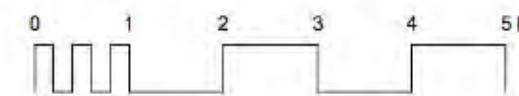
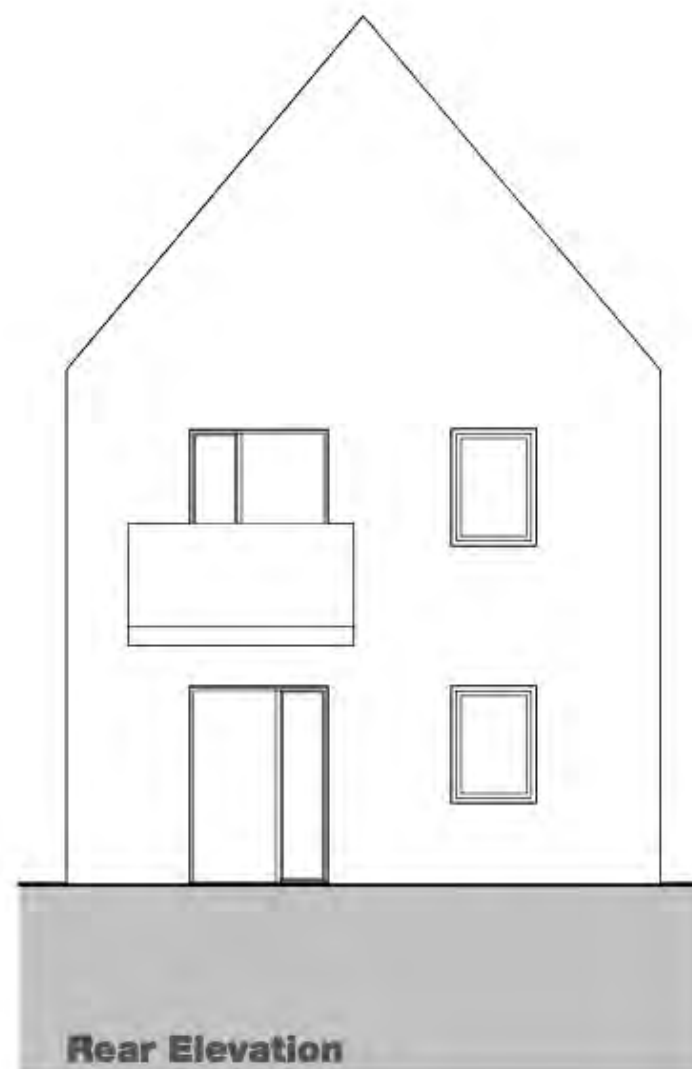
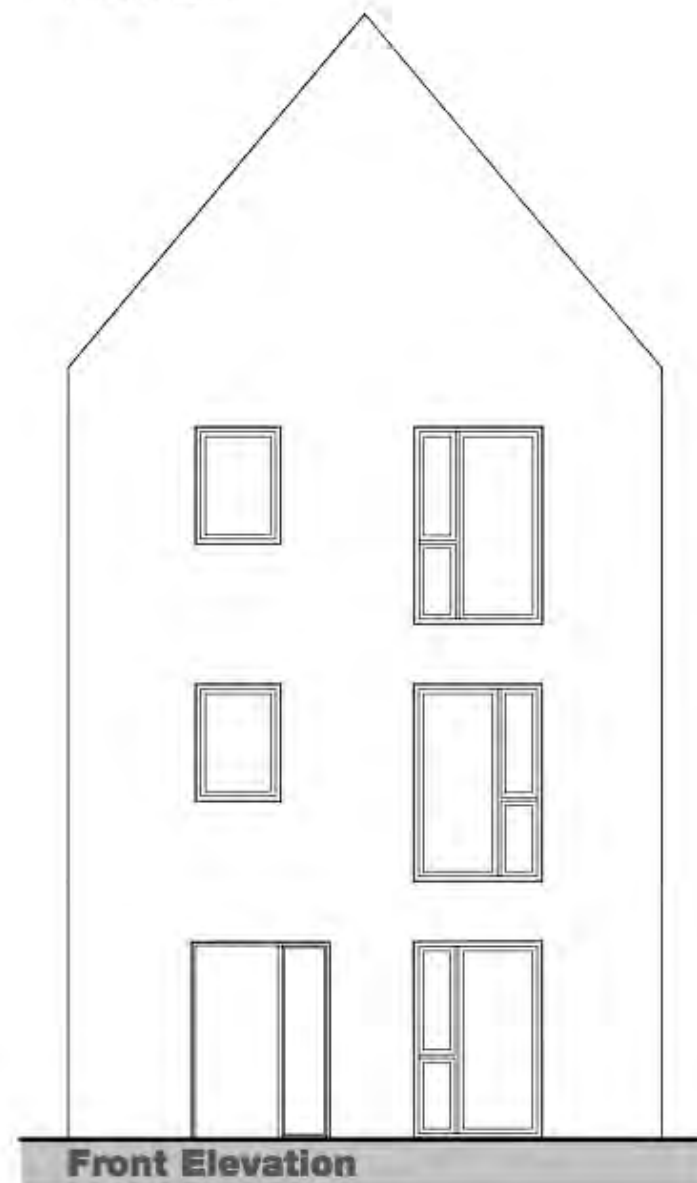
Level 0
44.0m²
FFL +2.730m



Level 1
44.0m²
FFL +5.460m



Section



Vallis Road
Frome

PLAN / SECTION / ELEVATION
House Type G

Connolly and Callaghan

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Date: 28/10/2015 Drawn: JE Checked: Status: Work Stage

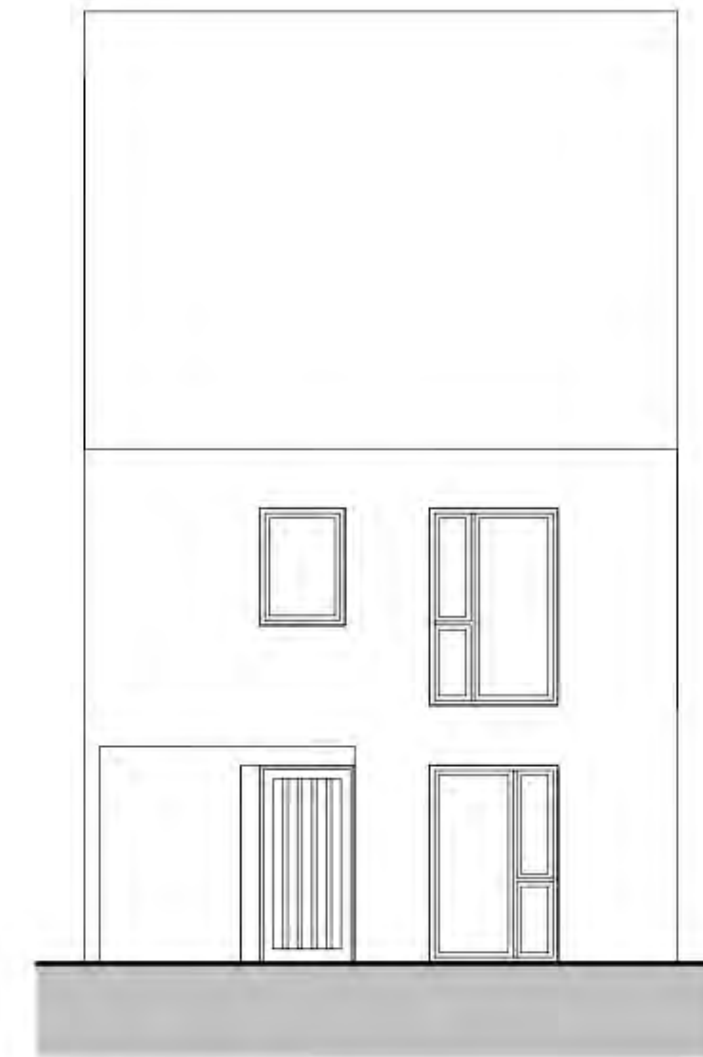
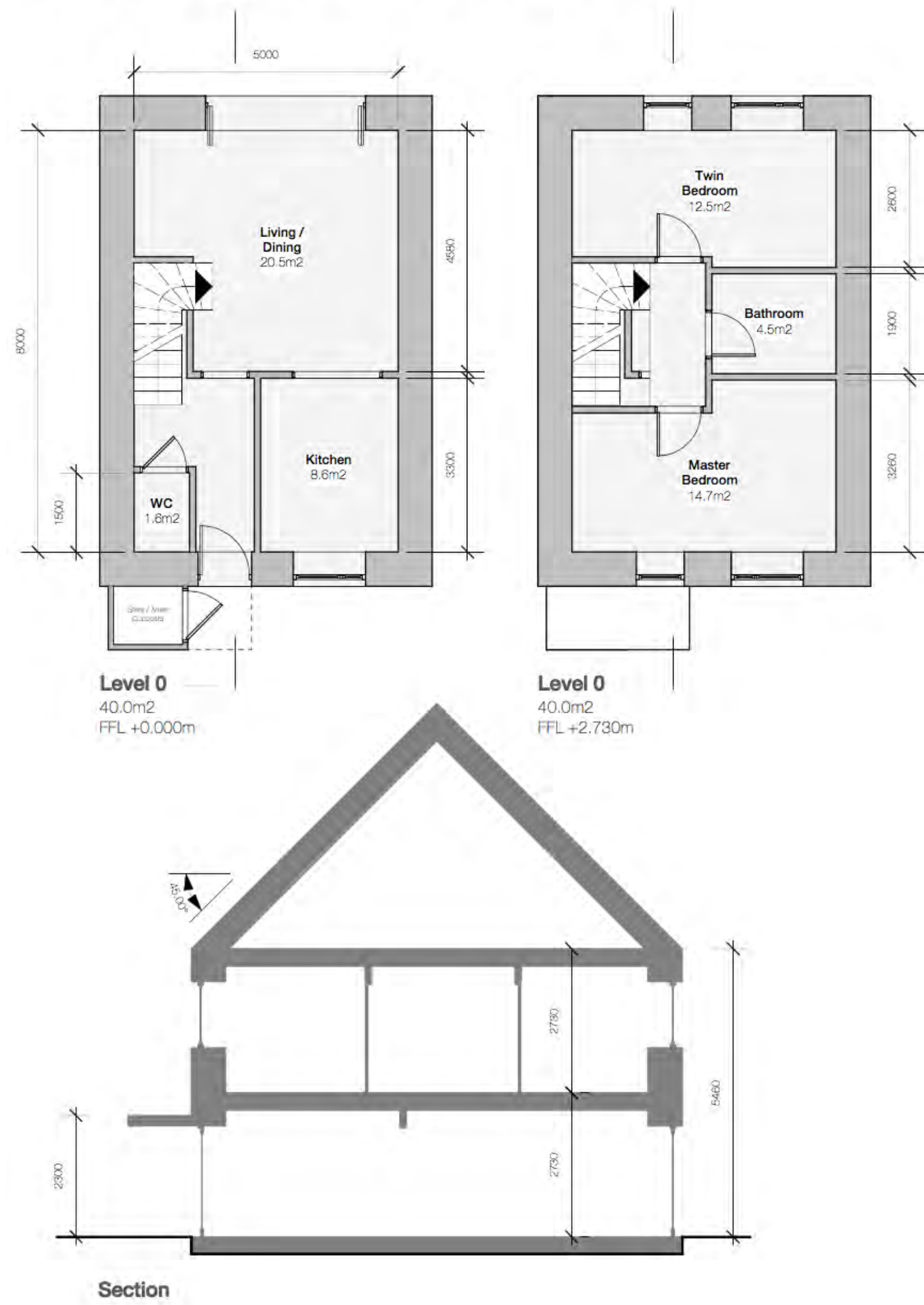
Date: Approved: Checked: Drawing No: 6285 2 0116

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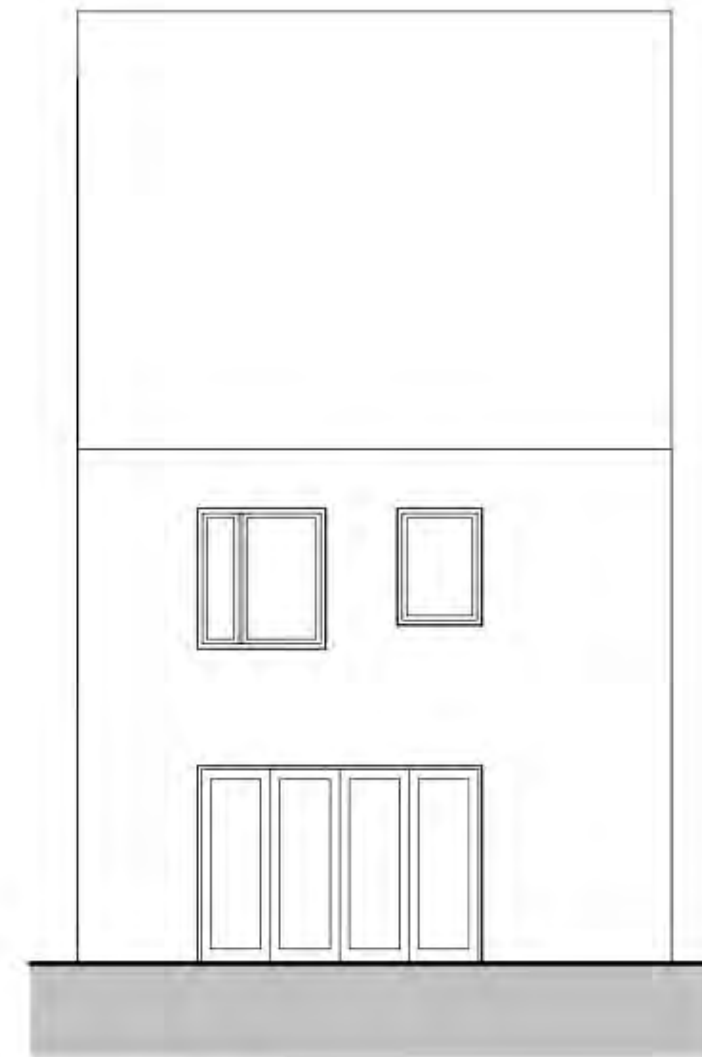
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PLAN / SECTION / ELEVATION

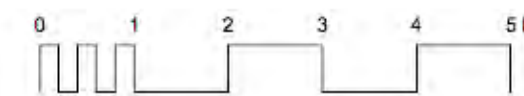
House Type D - 2 Bedroom / 4 Person - 80m2



Front Elevation



Rear Elevation



Vallis Road
Frome

PLAN / SECTION / ELEVATION
House Type D

Connolly and Callaghan

Check all dimensions on site. If in doubt ask.

Date:	Drawn:	Checked:
2/7/2015	NB	JE
Date:	Amended:	Checked:
Scale:	Site:	Status @ A3:
1:100 @ A3	A3	

Drawing No.
6285 2 0113

Status + Work Stage
**Preliminary
Concept Design**

Amendment

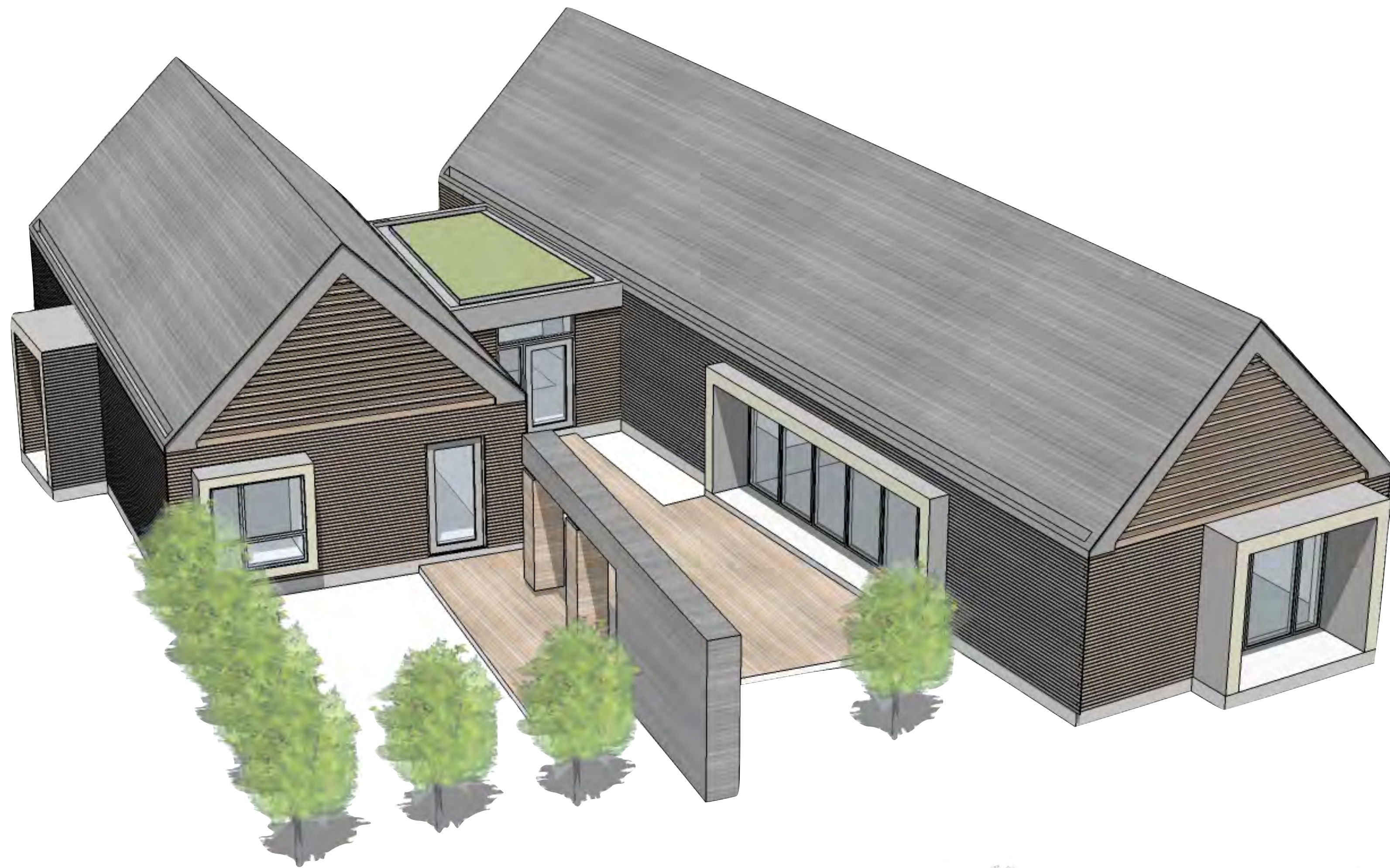
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mellowwhite-design.co.uk
www.mellowwhite-design.co.uk
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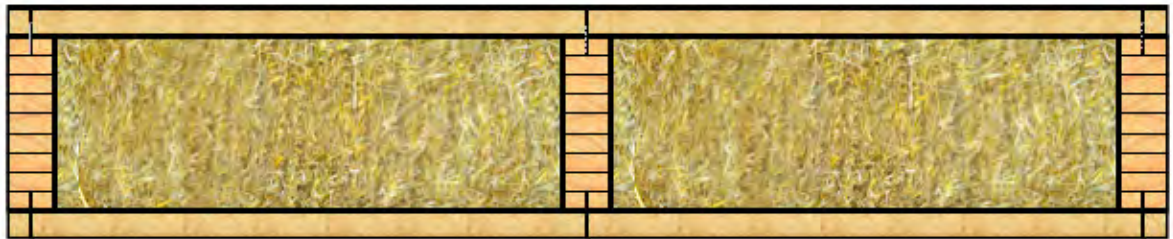
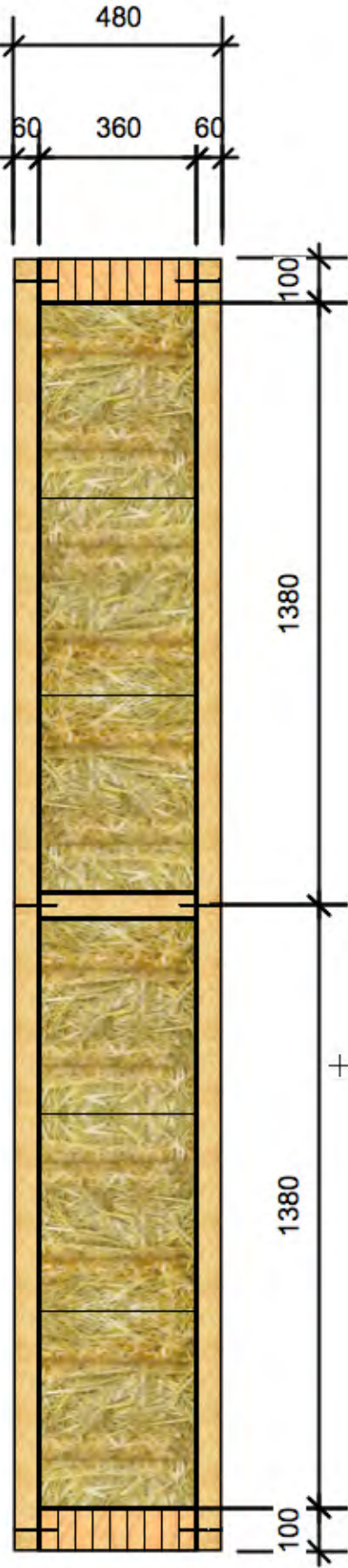
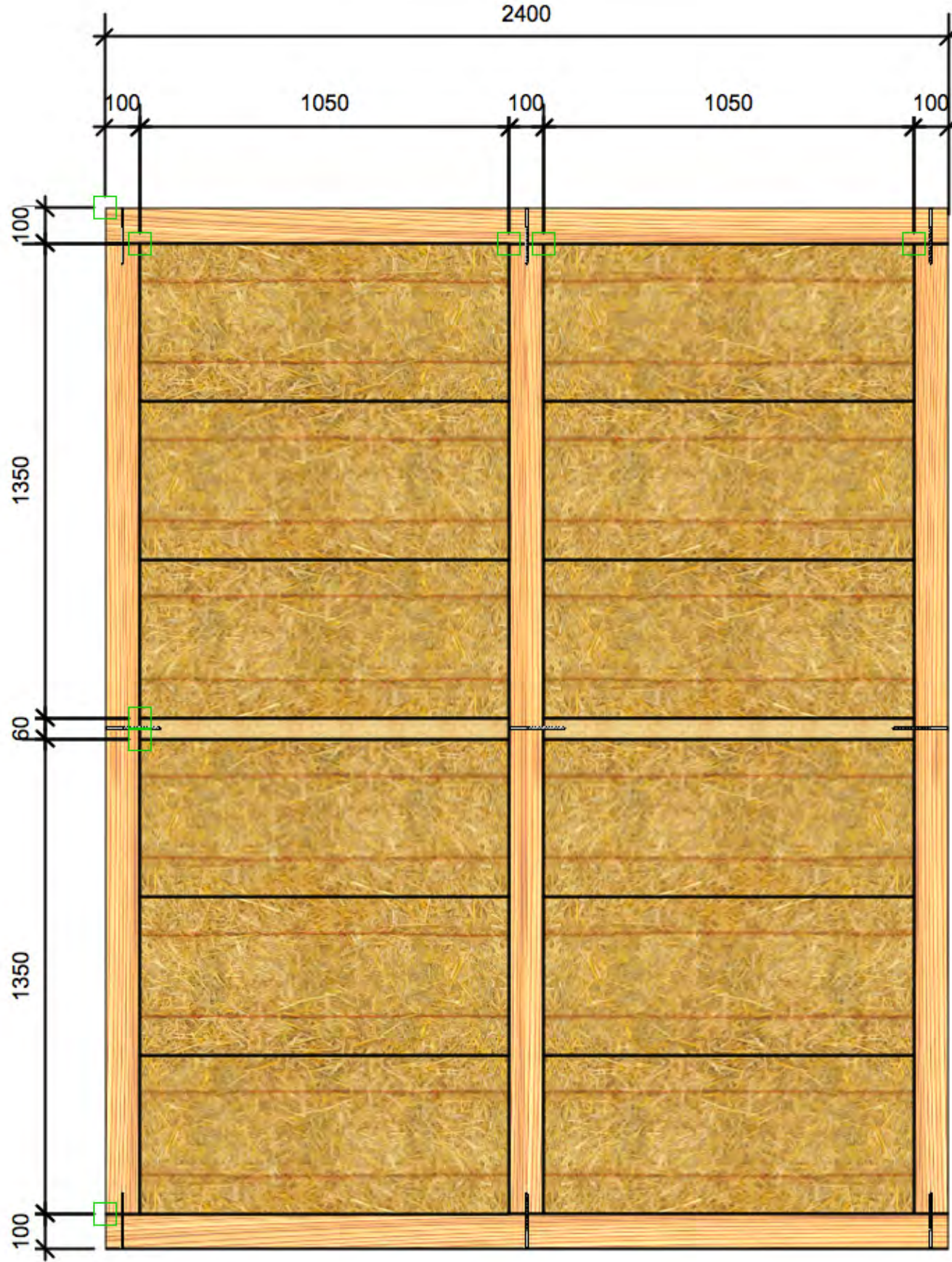




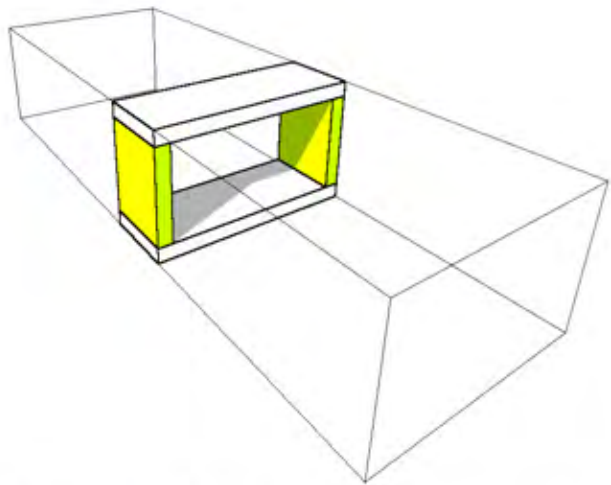








Up-rights shown as 100 mm, these may be reduced to 80 or 60 mm. Structural engineer to comment.



Tunnel form construction
1.2, 2.4 m, 3.2m or 3.6 floor, wall and roof cassettes

Information

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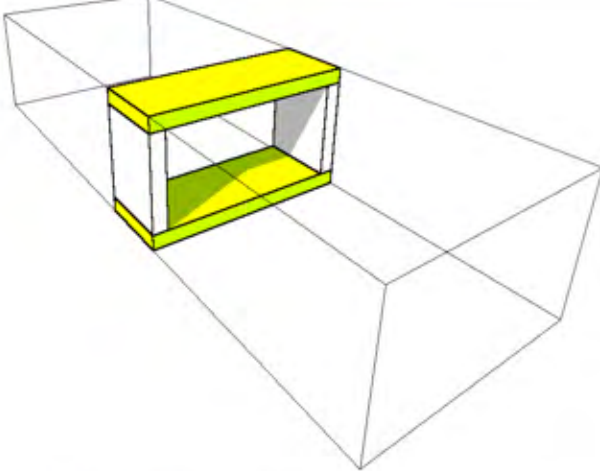
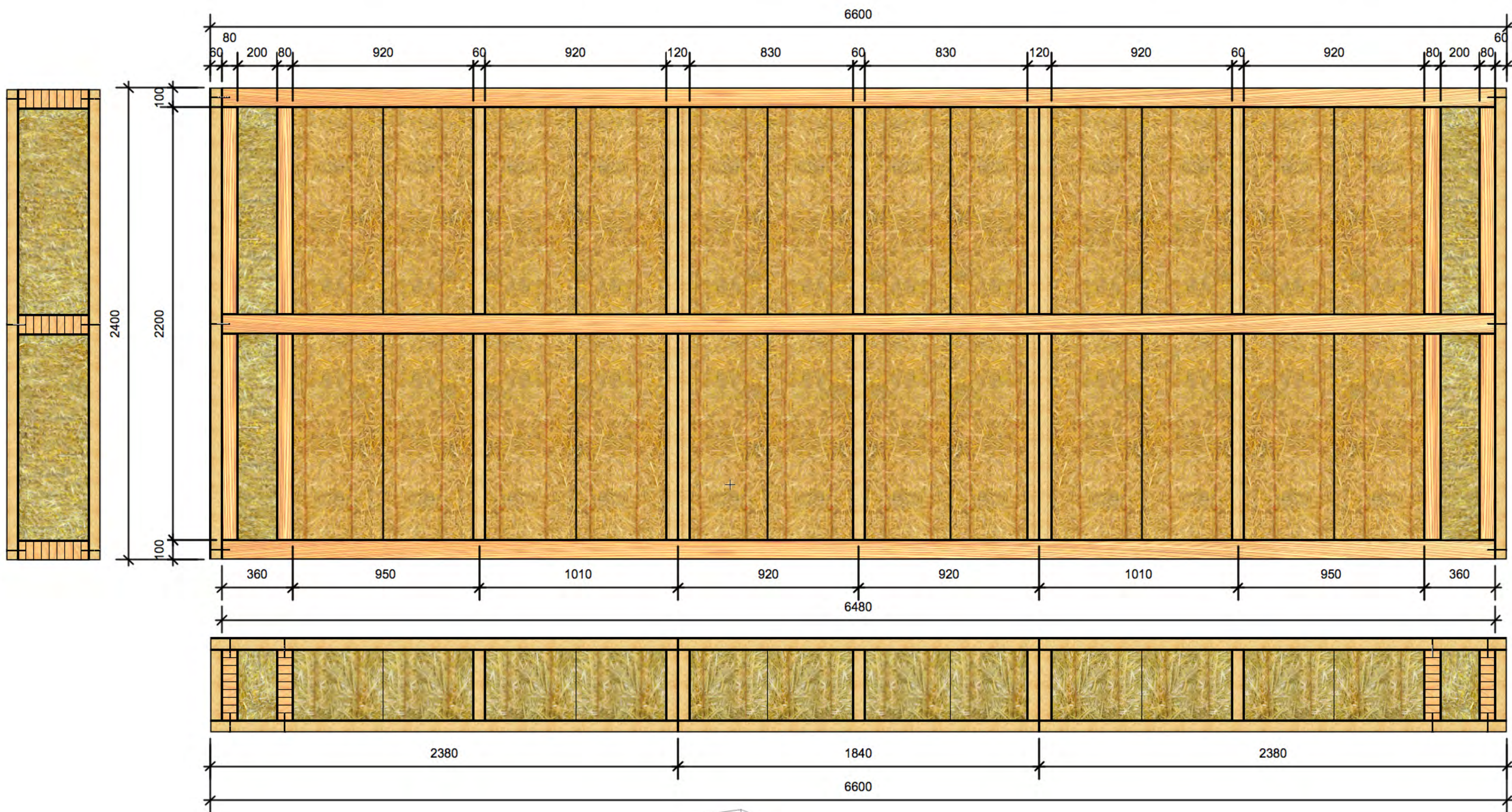
ModCell TAM
Wall Cassette

Plan and Sections 1.2 m Wall Module

Date	7/9/2015	Drawn	CW	Checked	CW	Drawing No	000 5 4.121	Amendment	
Date		Amended		Checked		Status + Work Stage	Information		
Scale	1:20 @ A3	Size	A3	Scale @ A3	1:20 @ A3	Concept Design			

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Tunnel form construction
1.2, 2.4 m, 3.2m or 3.6 floor, wall and roof cassettes

Information

ModCell TAM
Floor and Roof Cassette

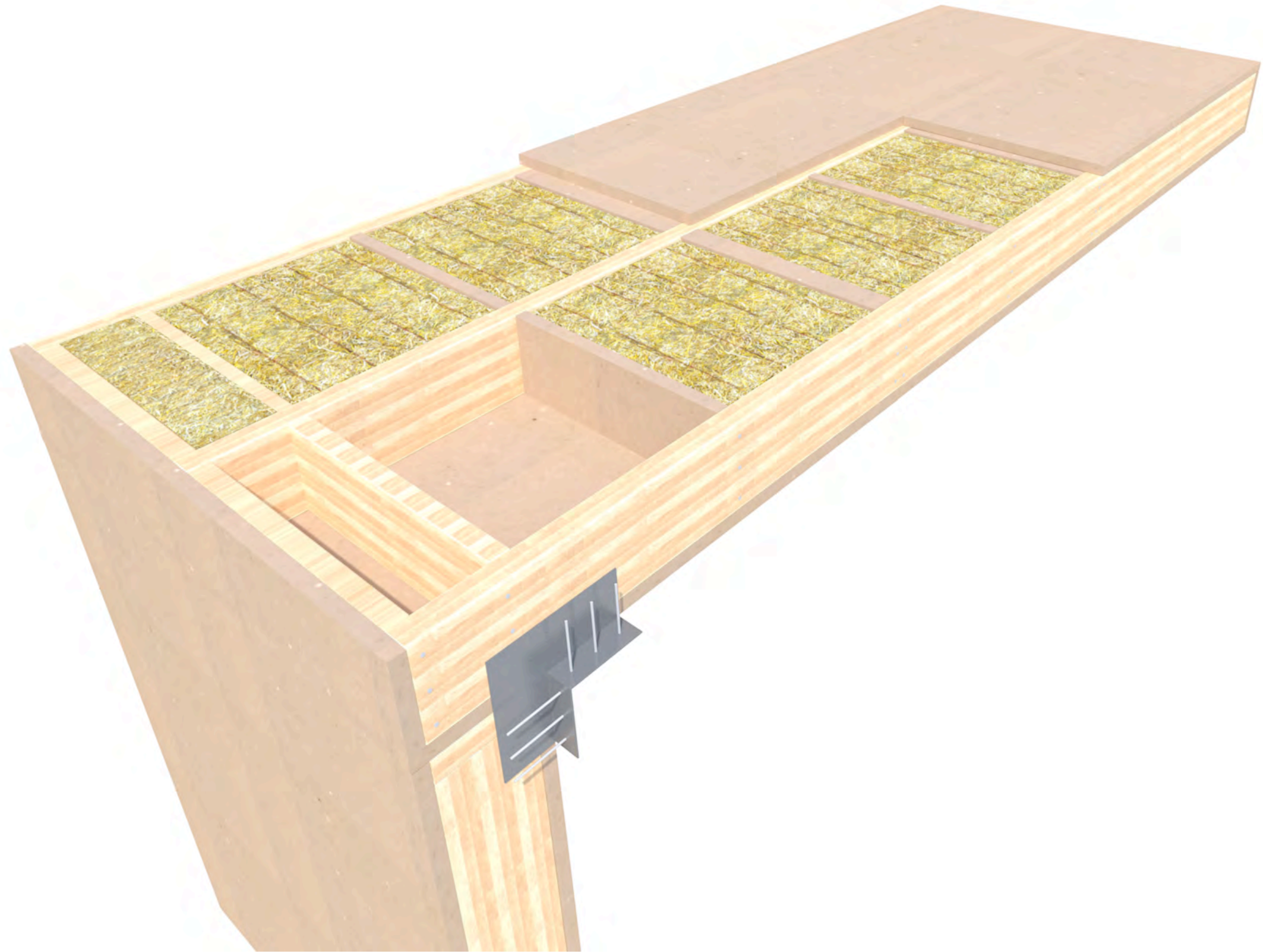
Plan and Sections 2.4 m Module

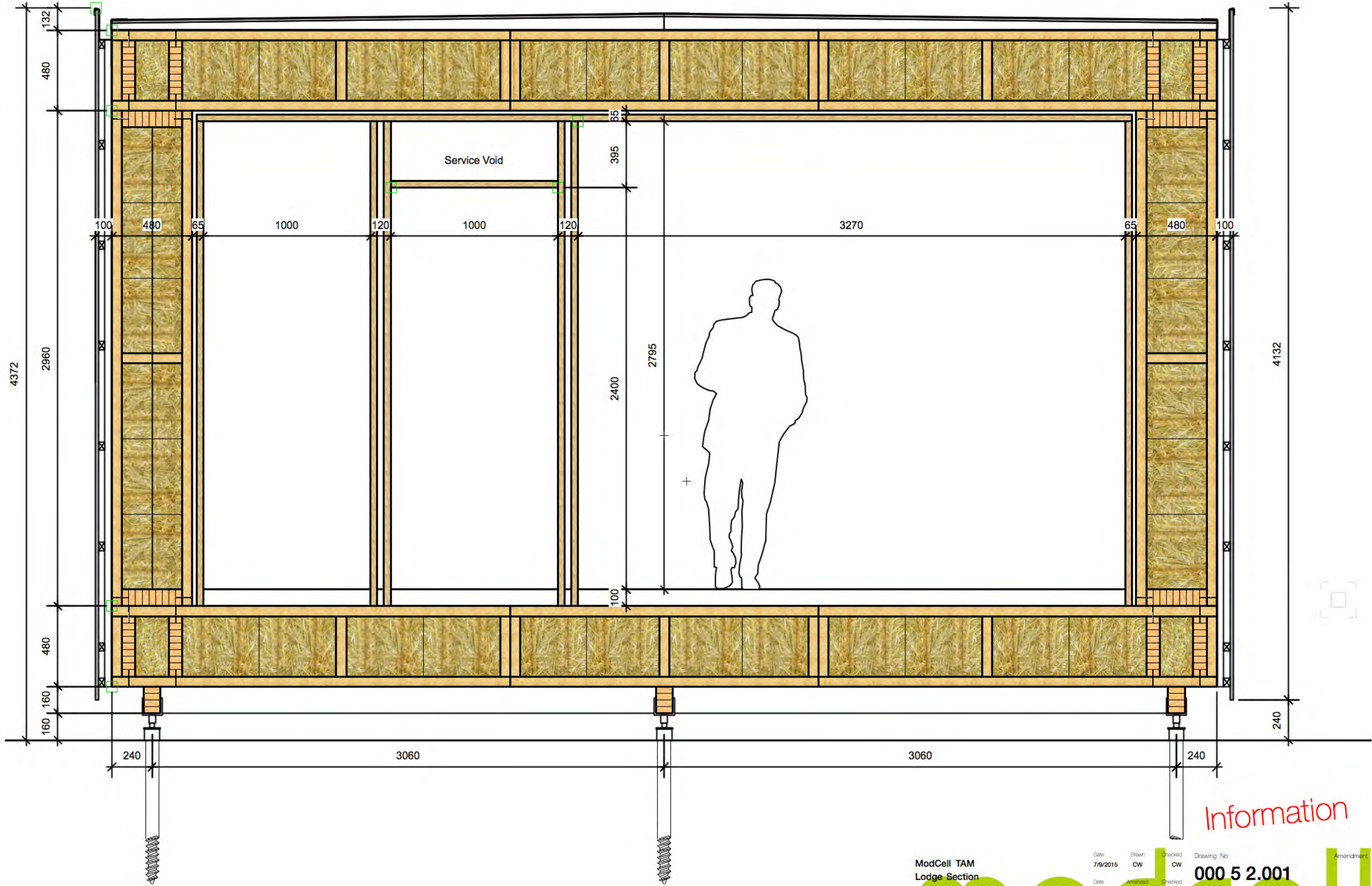
000 5 4.240

Information
Concept Design

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ModCell TAM
Lodge Section
Section Through Corridor

Date: 7/9/2015
Drawn: CW
Checked: CW
Date: 7/9/2015
Amended: CW
Scale: 1:20 @ A3

Information

Drawing No: 000 5 2.001
Status + Work Stage: Information
Strategic Definition

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