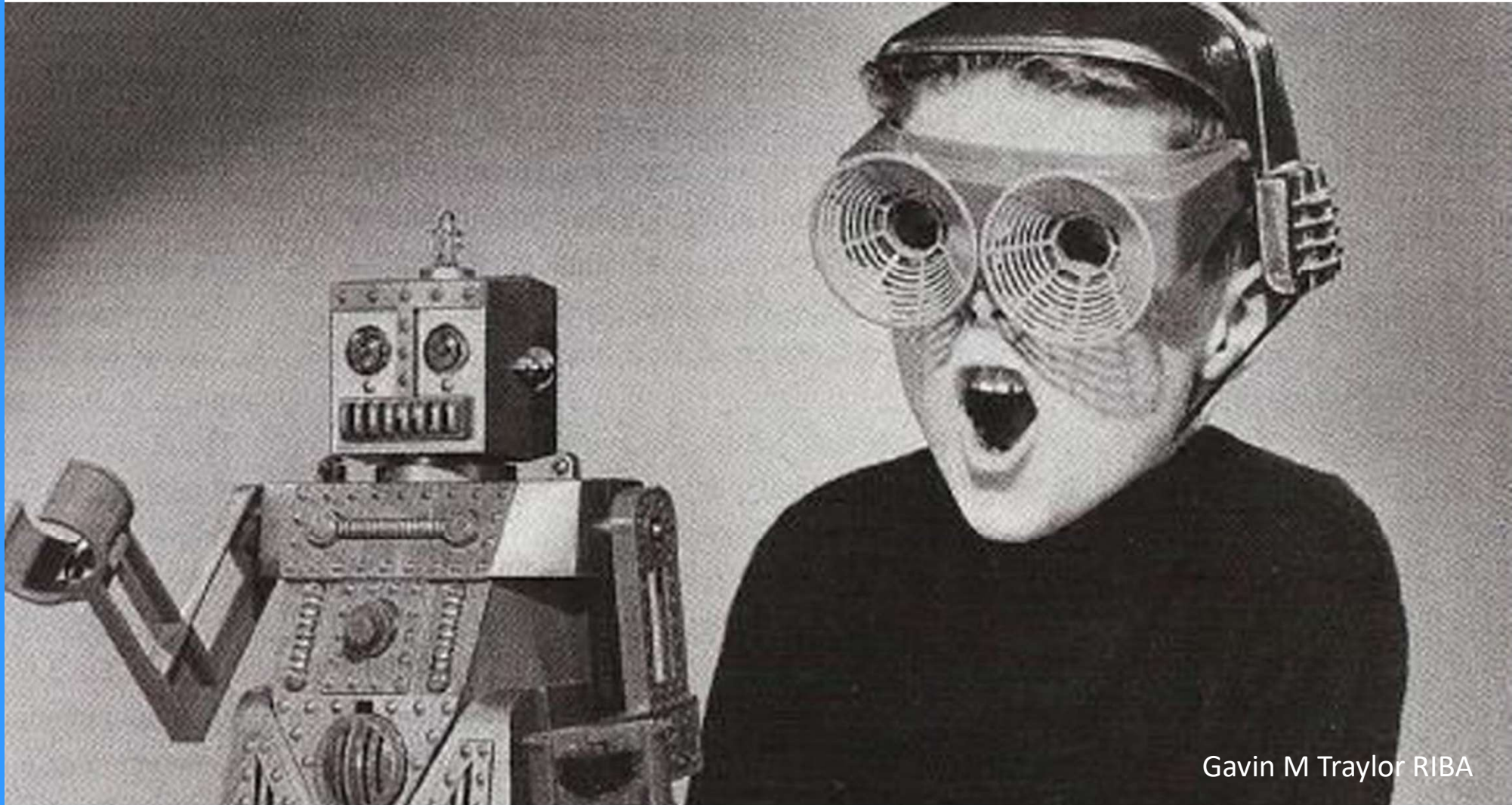


Session 3: Advanced Technology



Gavin M Traylor RIBA

Activity

Chat

Teams

Assignments

Calendar

Calls

OneDrive

mC
mConnect

...

Apps

< All teams

SY

SSoA Year 4_M.Arch_2025-26_GRP

...

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Grades

Reflect

Insights

▼ Main Channels

General

ACAA6005 Advanced Technology

ACAA6006 Architecture Studio A

ACAA6007 Current Issues

ACAA7000 Architecture Studio B

ACAA7001 Architecture Studio C

ACAA7002 Research Methods for Architects

Program of Studies Handbook

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ACAA6005 Advanced Technology

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ACAA6005 Advanced Technology

Name ▾	Modified ▾	Modified By ▾	+ Add column
Assessments	A few seconds ago	Gavin Traylor	
Lecture Notes	A few seconds ago	Gavin Traylor	

What is it all about?

AIM(S)

- To review the principles of structural design, building construction and environmental science covered in the Part 1 qualification and encountered during professional experience.
- To allow students to investigate and share the latest developments in structural design, building materials, construction techniques, Fire and Safety Design and sustainable design.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to:

- demonstrate a systematic understanding of the main concepts of structural design, building construction and environmental science as they relate to the construction of buildings, including the science of fire, smoke generation and spread and design principles to minimise the risk of smoke and fire;
- outline the main current developments in structural design, building materials, construction techniques and sustainable design;
- explain the methods of investigation and information resources available to establish the state of current knowledge in construction technology;
- communicate the methods of utilising fabric first thermal efficiency, regenerative design solutions and ethical sourcing of products.

Core Themes

Understanding Buildings
Technology for creating data rich building stock
How Buildings Learn
Retrofit
Elemental Construction Methods
Structural Systems and Frames
Offsite
Material Science
Environmental & Low Carbon Approach
Fire Safety

Assessed through a Case Study
CW1 Technical Portfolio
CW2 Presentation

Week 3 Overview:

The story so far....

- BIM Design Construct Operate and Maintain - One truth
- Challenging Questions of BIM
- Use of Digital Technologies as Interoperable platforms
- Challenges of existing Building Stock, Decarbonisation and Building Typology

How Buildings Learn – Parallel Ideology

Decarbonisation New Technologies - Early Adopters Buildings as Power Stations?

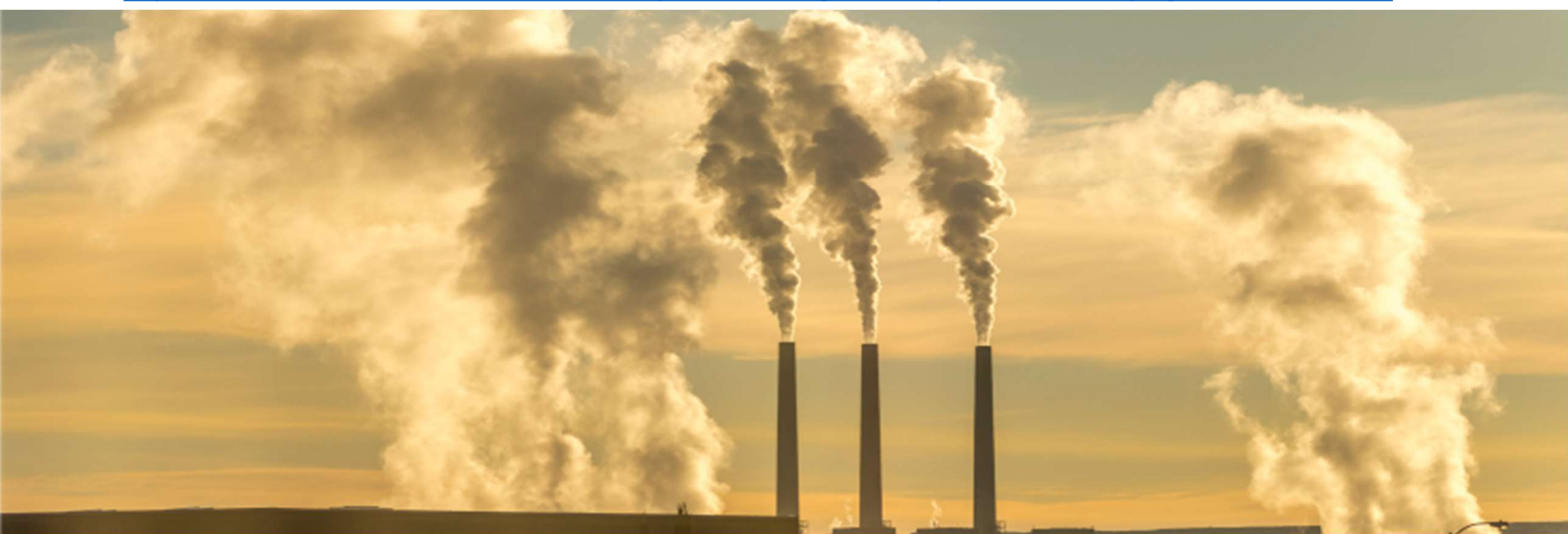
What about existing building stock?
What challenges do we face?

Challenges of Decarbonisation

Speaking at the CN [Decarbonising Construction](https://www.constructionnews.co.uk/sustainability/consultant-urges-delivery-of-mass-retrofit-programme-30-09-2020/) conference, Sonal Jain warned viewers that the UK Government's target of a net-zero carbon economy by 2050 is at risk because 80 per cent of the buildings that will be around in that year have already been built.

Jain said: "Because 80 per cent of the building stock for 2050 already exists, we cannot deliver on our net-zero goal without fully upgrading this. There is a limited time to upgrade the existing building stock, and delivering net-zero will require deep retrofits of these buildings."

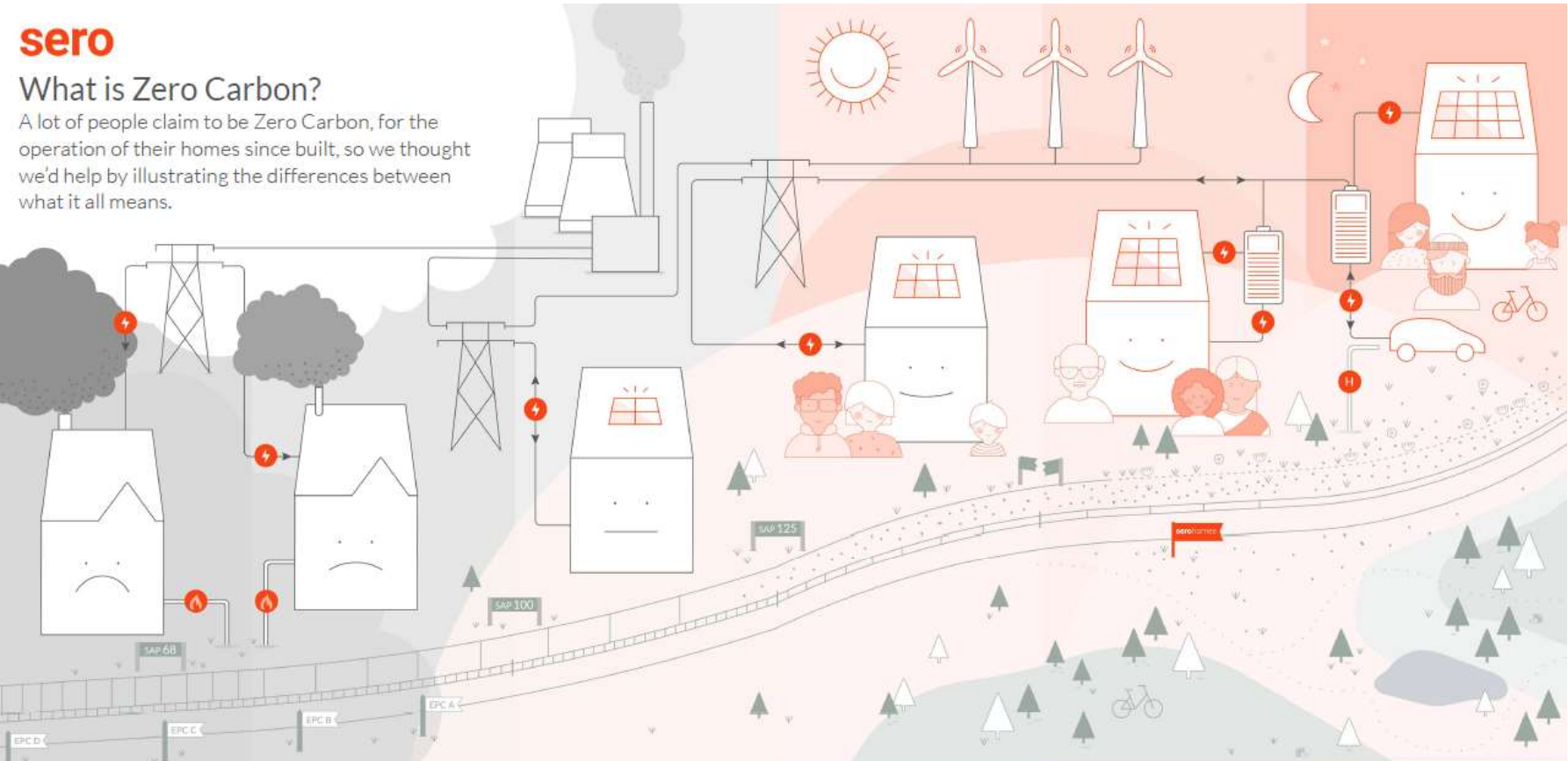
<https://www.constructionnews.co.uk/sustainability/consultant-urges-delivery-of-mass-retrofit-programme-30-09-2020/>



sero

What is Zero Carbon?

A lot of people claim to be Zero Carbon, for the operation of their homes since built, so we thought we'd help by illustrating the differences between what it all means.



8,159 kgCO_{2e}

2,704 kgCO_{2e}

1,165 kgCO_{2e}

143 kgCO_{2e}

0 kgCO_{2e}

... kgCO_{2e}

Average Home

What's average? Well, every home is different, but for this we've used a typical 100m² 1930's UK semi-detached home with a family of four living in it, using an efficient gas condensing boiler for heating and hot water. We've used reliably published data for occupancy energy demand and National Grid electricity carbon intensity data for 2019 (thanks www.CarbonIntensity.org.uk/!)

New Build Home

We've transported our family of four into a new home that's the same size, built to 2014 Building Regulations with an efficient gas boiler for heating and hot water. We've assumed the house is actually built as it was designed, so haven't made an allowance for any issues with construction faults or failures (we know, that might be a bit optimistic of us!).

Zero Regulated Energy

This is basically everything without a plug socket. So it includes extract fans, fixed lights, heating and hot water, but not washing machines, floor lamps and so on. The oven is in, the fridge & freezer isn't! Zero means that over a year, the home generates as much energy as it needs to power the regulated equipment. To do this, our family are now in a matching size home that has a 14 panel photovoltaic array on the roof, facing South.

Zero Energy

This is the first level to allow our family's to plug in their stuff = home + humans! All the energy used in the home over the course of a year, whether from kettles, games consoles, heating, lights or mobile phone charging, is balanced by the same amount of power being generated. Our much-relocated family have now moved into an efficient home with a pretty big PV array on the roof, generating just over 9MWh of electricity a year!

Zero Carbon

Our family can finally settle down! Their zero carbon home goes beyond the zero energy home by using energy storage, so the electricity they generate can be stored for their use, or exported to the National Grid when it can help avoid the most carbon emissions. This supports the National Grid to decarbonise their large scale generation, and with intelligent energy services from Sero, our family also get cheaper electricity bills too.

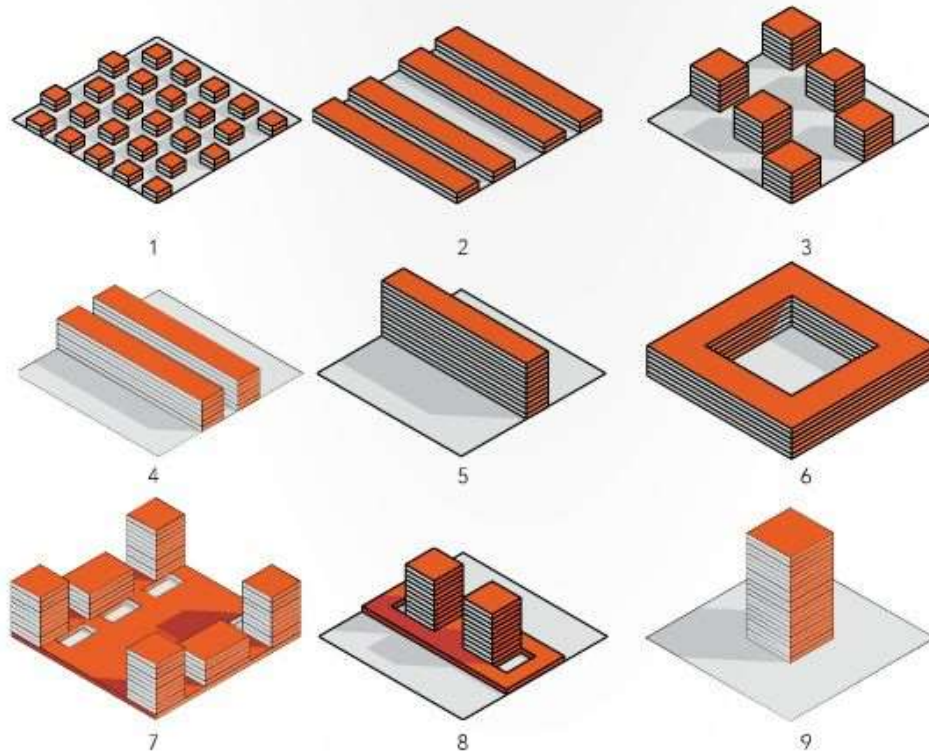
Beyond Zero Carbon

At Sero, we're aiming to go beyond zero carbon homes with humans in them, we also want to cover our family for their transport. With electrification of cars and bikes, we're working to include the energy demands of these into our intelligent systems. So our families can live, work and play, knowing they're effortlessly zero carbon and saving money. Happy Days!

seroenergy.com

We're happy to discuss our workings if you'd like to get in touch. We might even buy the coffee...

Challenges of Building Typologies



Functions of Buildings

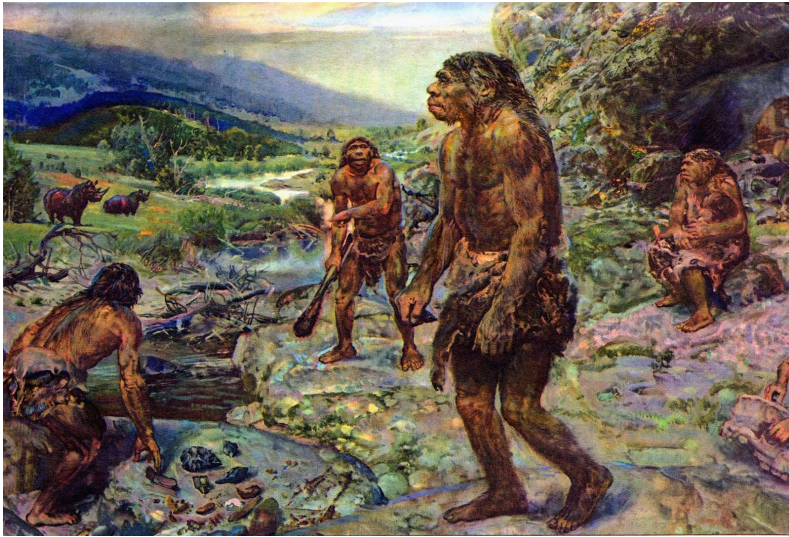
Why do we Build?

The use of buildings as protective structures or enclosures.

Since fire was first used by primitive people to provide light and heat, the use of energy to aid in environmental moderation has developed internal environments that reduce the effects and extremes in the external climate.



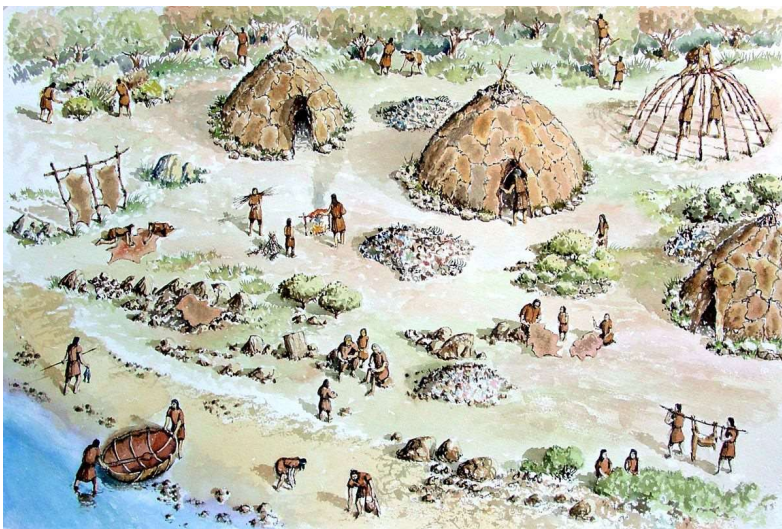
https://i.dailymail.co.uk/i/pix/2015/07/03/14/2A338A5800000578-3148511-image-a-21_1435930837225.jpg



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https://kise.i3investor.com/files/my/blog/img/b1338_gonnersdorfsettlement.jpg



<https://i.pinimg.com/originals/41/ce/63/41ce63be5c59f90e1150a7ea6d97de51.jpg>



<https://museum.wales/stfagans/buildings/bryneryr/>

The use of buildings to house people, equipment and processes have resulted in the development of buildings that can control these internal environments with greater accuracy.

As well as protection and enclosure we can now consider:

- Thermal Insulation and temperature control
- Acoustic insulation
- Provision of Light (natural and artificial)
- Controls for humidity and ventilation
- Exclusion of contaminants.



Case study 1: Styles of buildings

Thermally light structures in Thailand

These dwellings are located in Thailand. The lightweight construction form is created by the use of locally available materials. The large openings allow air to pass through the building to cool the interior quickly. Thermally light structures of this type are common throughout the Far East. They utilise local materials that are readily available. However, with the advent of more modern construction forms and the incorporation of air conditioning systems they are now restricted to rural areas.



European vernacular buildings

These are examples of heavyweight construction forms found in England and France. The use of local stone and slate for the walls and roofing reflects regionally available materials, although the 'gothic' style of the building above is actually a copy of earlier styles. The building was constructed in the Victorian period. The windmill, in contrast, is typical of simple rural building styles.



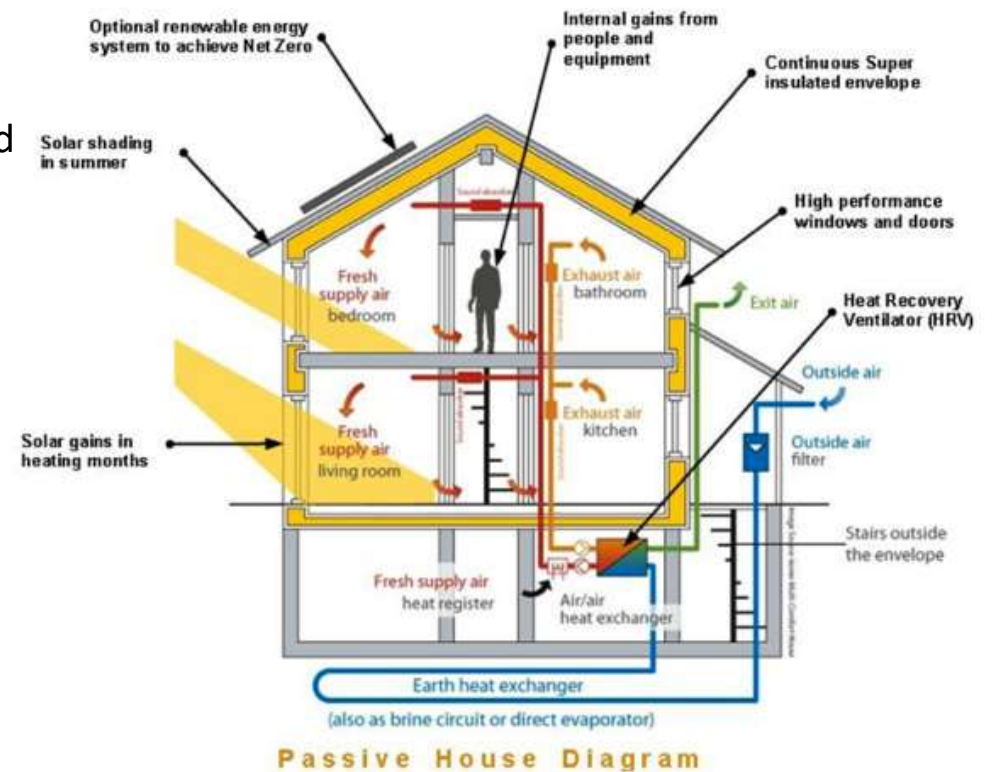
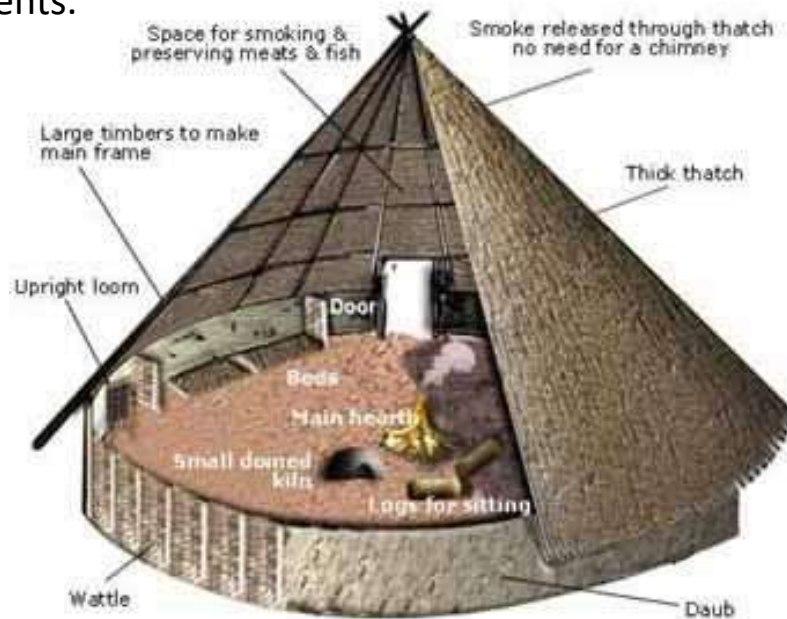
A simple cottage dwelling located in the North of England is above. The use of slate for the roof and brick for the external walls is typical of many buildings of this age and type. In contrast, the buildings in the right-hand picture reflect an earlier form of building in which a structural timber frame is used rather than loadbearing external walls. Note that the upper floors project outwards over the street. This allows more floor area to be created within the dwelling while minimising the area of land utilised. This style was actually driven by economics rather than functionality. At the time of its construction taxes were based on the ground floor area of the building.



Building Styles:

A vernacular building style is specific to a region and uses the local materials available in its construction to form the building fabric.

Modern House construction uses a wide variety of materials and techniques and is not specific to any particular region. Construction methods, materiality of the building envelope and performance of the building fabric can be modified to suit the requirements.



Thermally Light V's Thermally Heavy:

Thermally light buildings are physically light in weight and have a fabric which has little capacity to absorb heat. Such buildings respond quickly to changes in external temperatures.



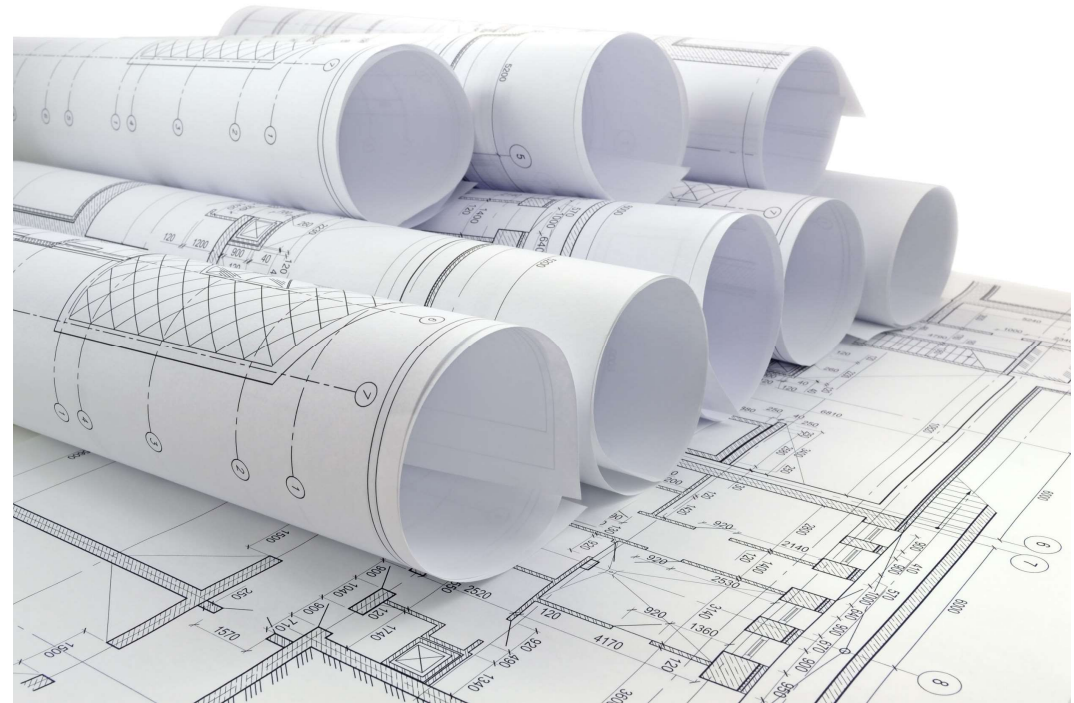
By contrast thermally heavy often have a heavy dense fabric which reflects some heat and absorbs much of the rest. They insulate the interior by reacting slowly to variations in external temperature.



Performance Requirements of the Building Fabric

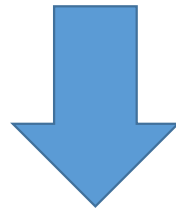
What are the key drivers in providing a building that is suitable for the need?

- Structurally Stable
- Durability
- Thermal insulation
- Protection from weather and exclusion of moisture
- Acoustic performance
- **Flexibility to change to changing needs**
- Aesthetics
- Buildability
- Sustainability

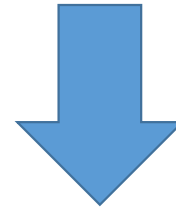


Trigger events?

Flexibility to change to changing needs



How Buildings Learn



How Digital Technologies can Assist

Creating a Data Rich Building Stock

FOCUS ON NEW BUILD

Other methods are useful for digitizing an estate

Data Availability

New Build

- Accurate geometry
- Asset data available



Laser Scan and Model

- Accurate geometry
- Very limited data available



Conversion of Existing 2D information

- Inaccurate geometry
- Data limited to drawing notes





St Mary's Church – Grade II listed.



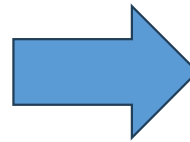
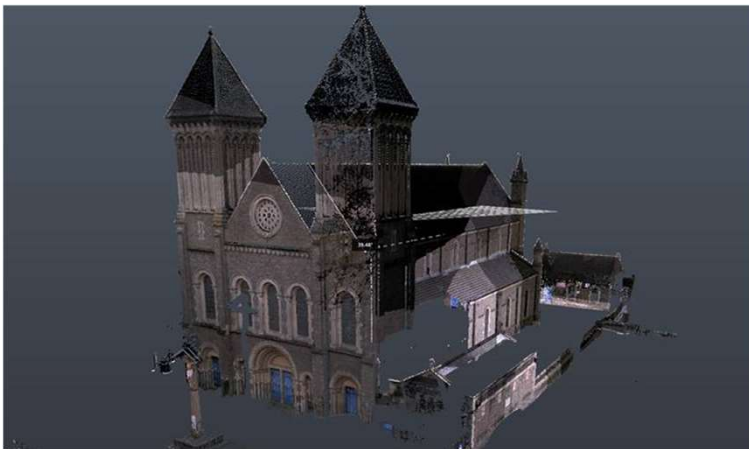
St Mary's Church – Grade II listed.



St Mary's Church – Grade II listed.

Swansea city to Youtube here: <https://youtu.be/uYdlqqvqhsW>

A full building scan <https://youtu.be/pyfHtGJyxU0>



How can we create data rich intelligent models?

Tools such as Revit enable intelligent 3D Modelling that can be linked into a BIM Process.

 **AUTODESK®
REVIT®**



Origins in UK



Sir Michael Latham described as 'ineffective', 'adversarial', 'fragmented' and 'incapable of delivering for its customers'.



Flexibility to change to changing needs
How Buildings Learn

FLOW

<https://youtu.be/maTkAcDbrEY>

<https://learningonscreen.ac.uk/ondemand/playlists/384826>



CHANGE

<https://youtu.be/ZSaWdp833YM>

<https://learningonscreen.ac.uk/ondemand/playlists/384826>



**Every building
is a prediction
and every prediction
is wrong.**

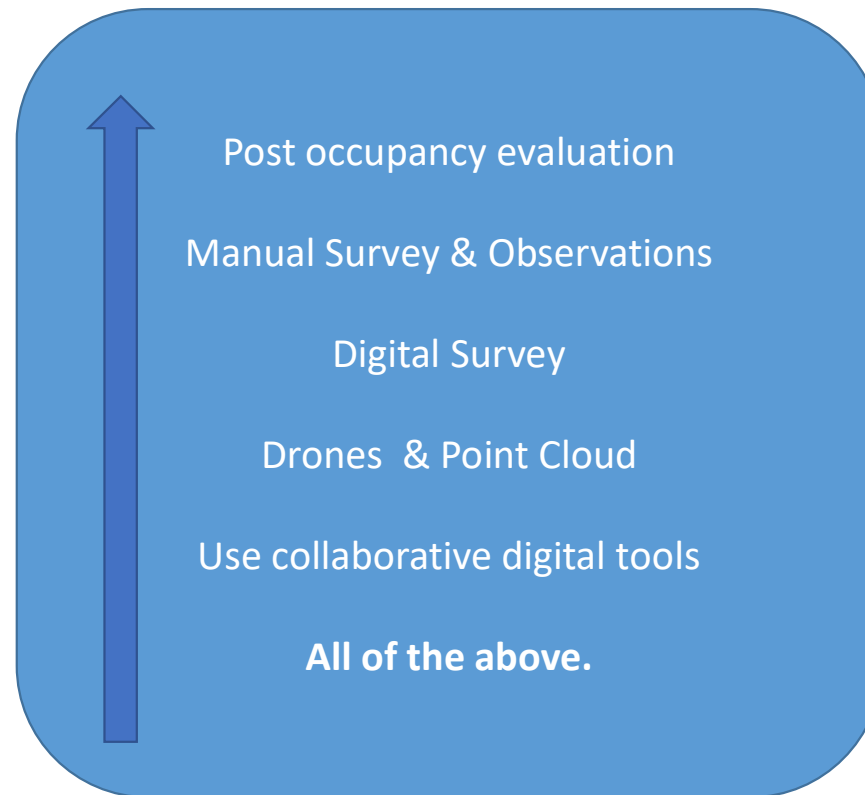
Stewart Brand — 'How buildings learn'

How do we evaluate?

How can we improve?

What can we learn?

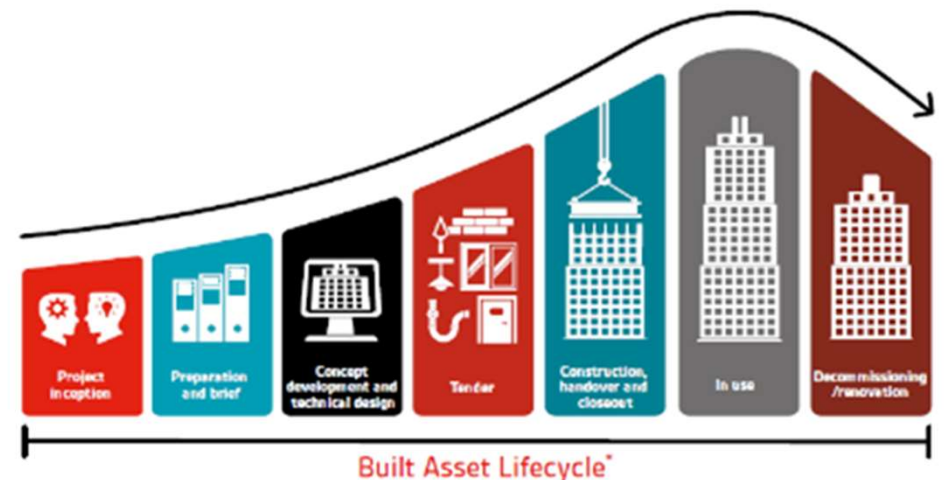
How do we evaluate?



How is this managed?

Life Cycle of the Asset that considers:

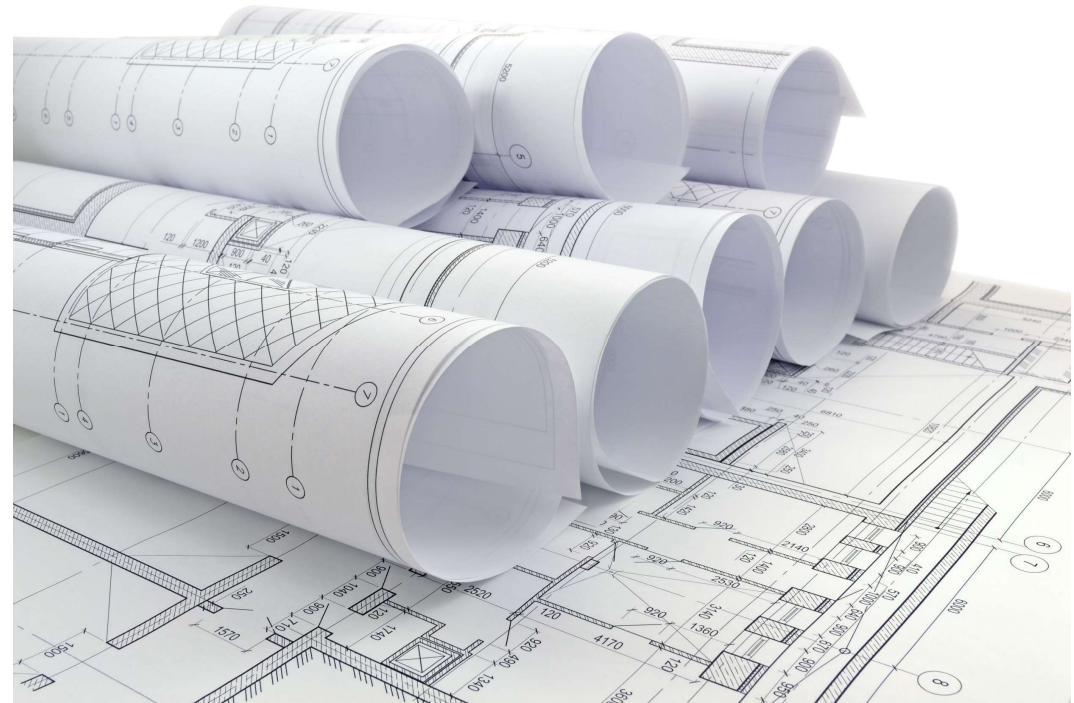
- Management and Controls for Maintenance
- Introduction of Sustainability Measures
- Monitoring Energy Performance
- Health and Safety - Statutory Observations
- Management of Alterations, Adaptations and Refurbishment
- Introduction of New Technologies



Performance Requirements of the Building Fabric

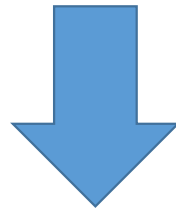
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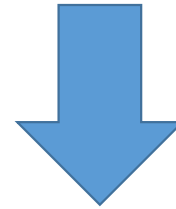


Trigger events?

Flexibility to change to changing needs



How Buildings Learn



How Digital Technologies can Assist

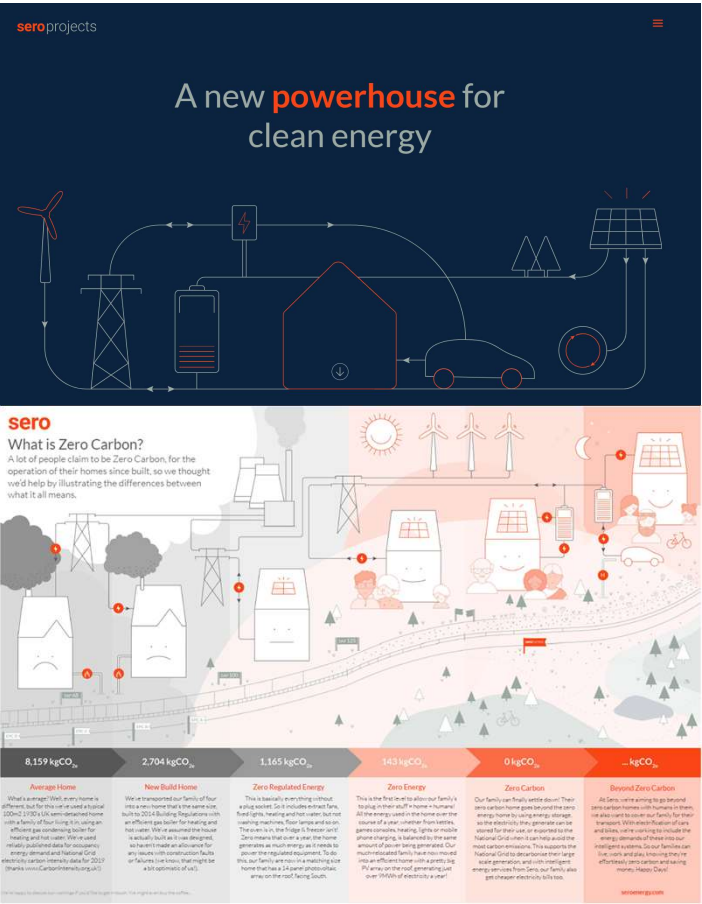
Challenges and Opportunities



New Technology (Early Adopters – Driving Change)

Our Vision - Sero Homes

Homepage - Parc Hadau (parc-hadau.wales)



Our Work - Active Building Centre

<https://www.activebuildingcentre.com/>



OUR CHALLENGE

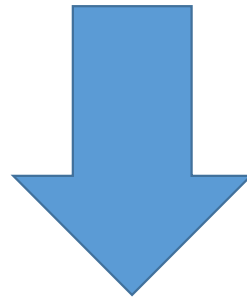
The UK Government is committing to ambitious targets for the UK to reach net zero carbon emissions by 2050.

Funded through the Transforming Construction Challenge, the Active Building Centre seeks to transform the way the UK designs, constructs and operates buildings.

Active Buildings have the potential to substantially reduce both the operational costs of buildings and their demand on the UK energy infrastructure.



There is a limited time to upgrade the existing building stock, and delivering net-zero will require deep retrofits of these buildings.



Can BIM tools help us evaluate our Building Stock?

Creating a Data Rich Building Stock

Methods for digitizing an Estate

New Build

- Accurate geometry
- Asset Data available

Existing Buildings:

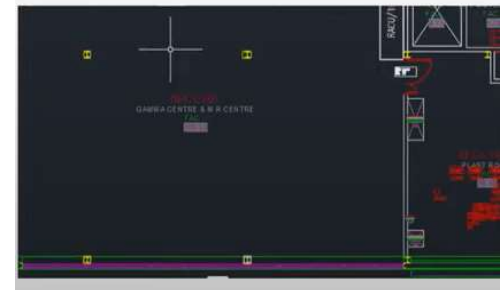
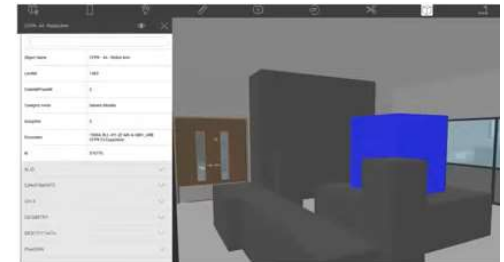
Laser scan and Model

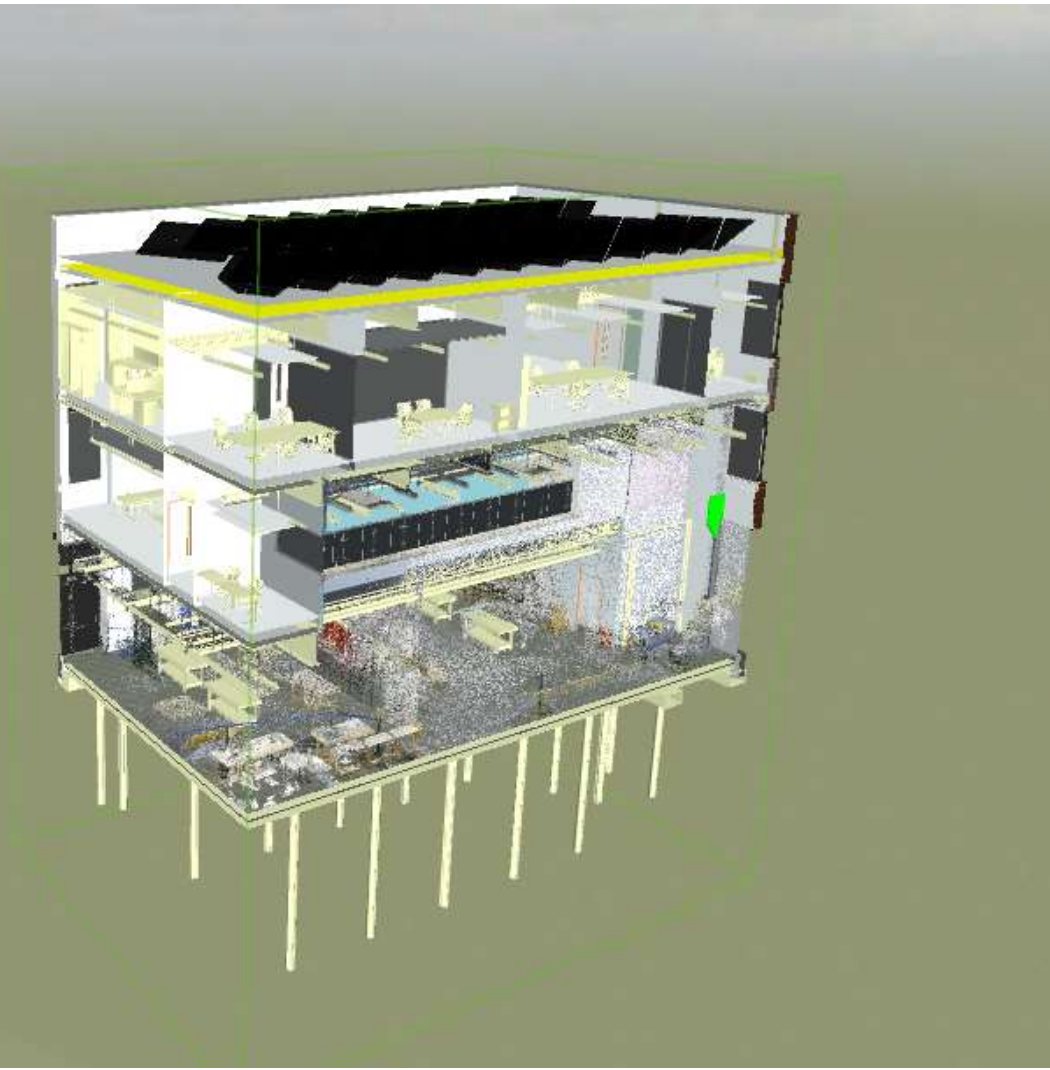
- Accurate geometry
- Limited data

Conversion of Existing 2D records

- Inaccurate Geometry
- Data limited to annotations

Data Availability





Creating a Data Rich Building Stock

Taking Precedent:

Utilizing collaborative platforms to assist with



- Accurate geometry
- Accurate Data
- Snagging, Defects
- Monitoring / Reporting / Allocating
- Asset Tagging (QR codes)

Creating a Data Rich Building Stock

Putting Theory into Practice

Utilizing collaborative platforms to assist with



revizto™

- | | | |
|---------------------------------------|---|-------------------|
| • Accurate geometry | → | Laser Scan |
| • Accurate Data | → | Add Asset Data |
| • Snagging, Defects | → | Create Stamps |
| • Monitoring / Reporting / Allocating | → | Assign Issues |
| • Asset Tagging | → | Generate QR Codes |