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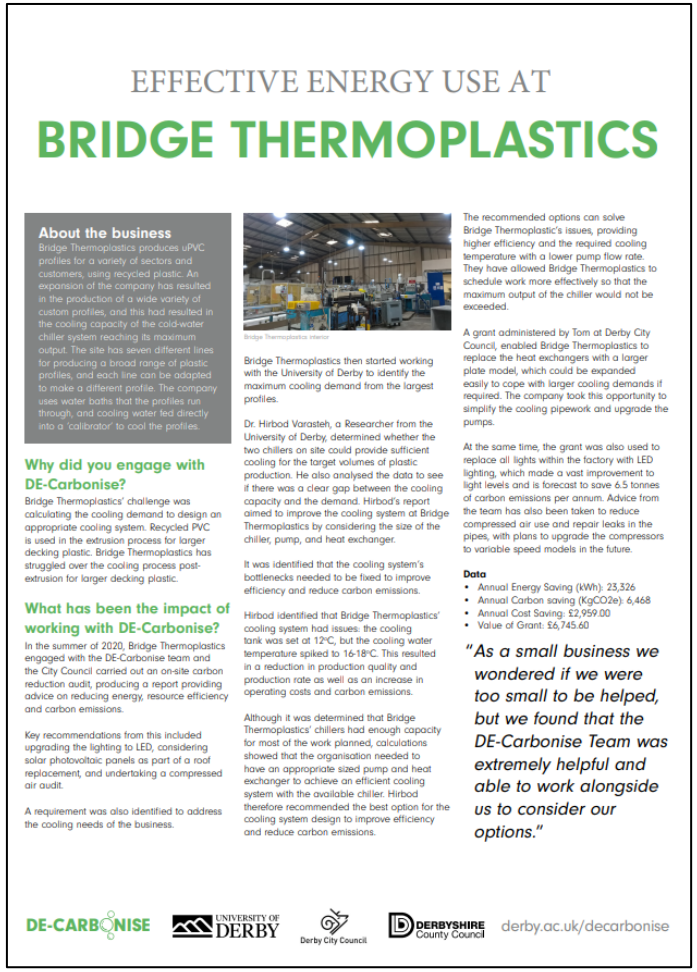
Effective Energy Use at Bridge Thermoplastics

Bridge Thermoplastics



EFFECTIVE ENERGY USE AT

BRIDGE THERMOPLASTICS

About the business

Bridge Thermoplastics produces uPVC profiles for a variety of sectors and customers, using recycled plastic. An expansion of the company has resulted in the production of a wide variety of custom profiles, and this had resulted in the cooling capacity of the cold-water chiller system reaching its maximum output. The site has seven different lines for producing a broad range of plastic profiles, and each line can be adapted to make a different profile. The company uses water baths that the profiles run through, and cooling water fed directly into a 'calibrator' to cool the profiles.

Why did you engage with DE-Carbonise?

Bridge Thermoplastics' challenge was calculating the cooling demand to design an appropriate cooling system. Recycled PVC is used in the extrusion process for larger decking plastic. Bridge Thermoplastics has struggled over the cooling process post-extrusion for larger decking plastic.

What has been the impact of working with DE-Carbonise?

In the summer of 2020, Bridge Thermoplastics engaged with the DE-Carbonise team and the City Council carried out an on-site carbon reduction audit, producing a report providing advice on reducing energy, resource efficiency and carbon emissions.

Key recommendations from this included upgrading the lighting to LED, considering solar photovoltaic panels as part of a roof replacement, and undertaking a compressed air audit.

A requirement was also identified to address the cooling needs of the business.

Bridge Thermoplastics then started working with the University of Derby to identify the maximum cooling demand from the largest profiles.

Dr. Hirbod Varasteh, a Researcher from the University of Derby, determined whether the two chillers on site could provide sufficient cooling for the target volumes of plastic production. He also analysed the data to see if there was a clear gap between the cooling capacity and the demand. Hirbod's report aimed to improve the cooling system at Bridge Thermoplastics by considering the size of the chiller, pump, and heat exchanger.

It was identified that the cooling system's bottlenecks needed to be fixed to improve efficiency and reduce carbon emissions.

Hirbod identified that Bridge Thermoplastics' cooling system had issues: the cooling tank was set at 12°C, but the cooling water temperature spiked to 16-18°C. This resulted in a reduction in production quality and production rate as well as an increase in operating costs and carbon emissions.

Although it was determined that Bridge Thermoplastics' chillers had enough capacity for most of the work planned, calculations showed that the organisation needed to have an appropriate sized pump and heat exchanger to achieve an efficient cooling system with the available chiller. Hirbod therefore recommended the best option for the cooling system design to improve efficiency and reduce carbon emissions.

The recommended options can solve Bridge Thermoplastic's issues, providing higher efficiency and the required cooling temperature with a lower pump flow rate. They have allowed Bridge Thermoplastics to schedule work more effectively so that the maximum output of the chiller would not be exceeded.

A grant administered by Tom at Derby City Council, enabled Bridge Thermoplastics to replace the heat exchangers with a larger plate model, which could be expanded easily to cope with larger cooling demands if required. The company took this opportunity to simplify the cooling pipework and upgrade the pumps.

At the same time, the grant was also used to replace all lights within the factory with LED lighting, which made a vast improvement to light levels and is forecast to save 6.5 tonnes of carbon emissions per annum. Advice from the team has also been taken to reduce compressed air use and repair leaks in the pipes, with plans to upgrade the compressors to variable speed models in the future.

Data

- Annual Energy Saving (kWh): 23,326
- Annual Carbon saving (KgCO2e): 6,468
- Annual Cost Saving: £2,959.00
- Value of Grant: £6,745.60

"As a small business we wondered if we were too small to be helped, but we found that the DE-Carbonise Team was extremely helpful and able to work alongside us to consider our options."

DE-CARBONISE · UNIVERSITY OF DERBY · Derby City Council · DERBYSHIRE County Council · derby.ac.uk/decarbonise

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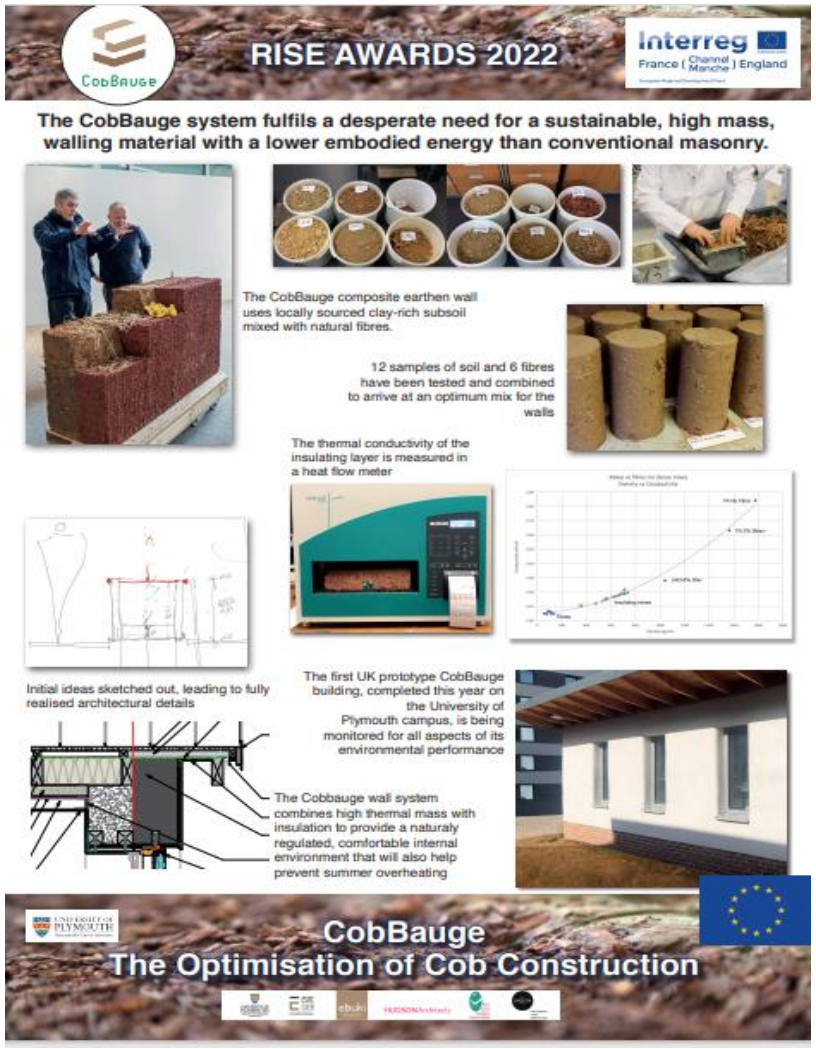
Field and Laboratory Research

Winner

The CobBauge system fulfils a desperate need for a sustainable, high mass, walling material with a lower embodied energy than conventional masonry

Jim Carfrae



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Design, Innovation and Creativity

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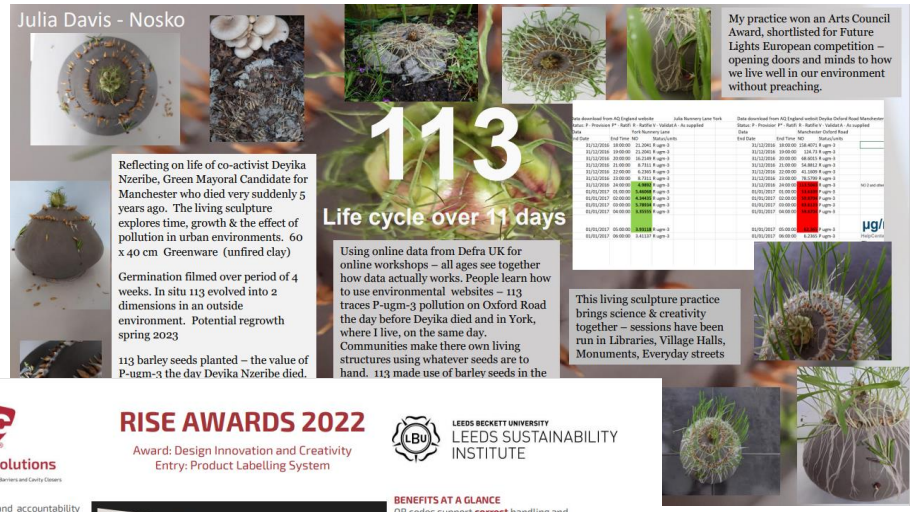

113 Life cycle over 11 days

Julia Davis

Product Labelling System

ARC Building Solutions

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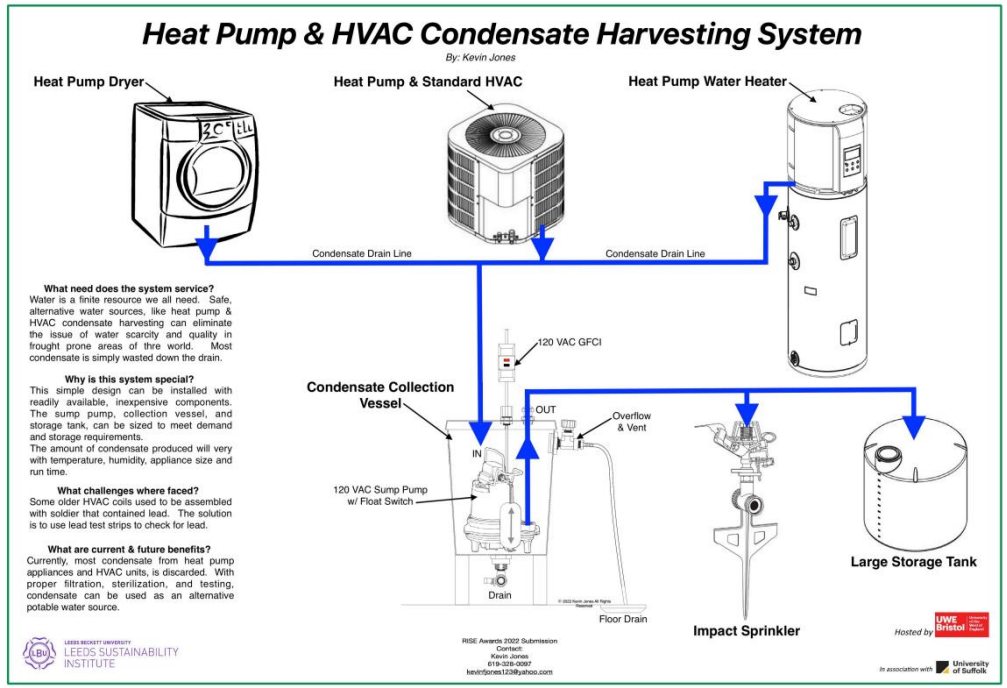
Heat Pump and HVAC Condenstate Harversting System

Kevin Jones



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New Technologies and Building Materials

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New Technologies and Building Materials

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Reliable Energy Performance Certificates (EPCs) of Buildings through optimising the Monitoring and Control Systems (MCS) to estimate reliable Heat Loss Coefficient (HLC)

Catalina Giraldo-Soto

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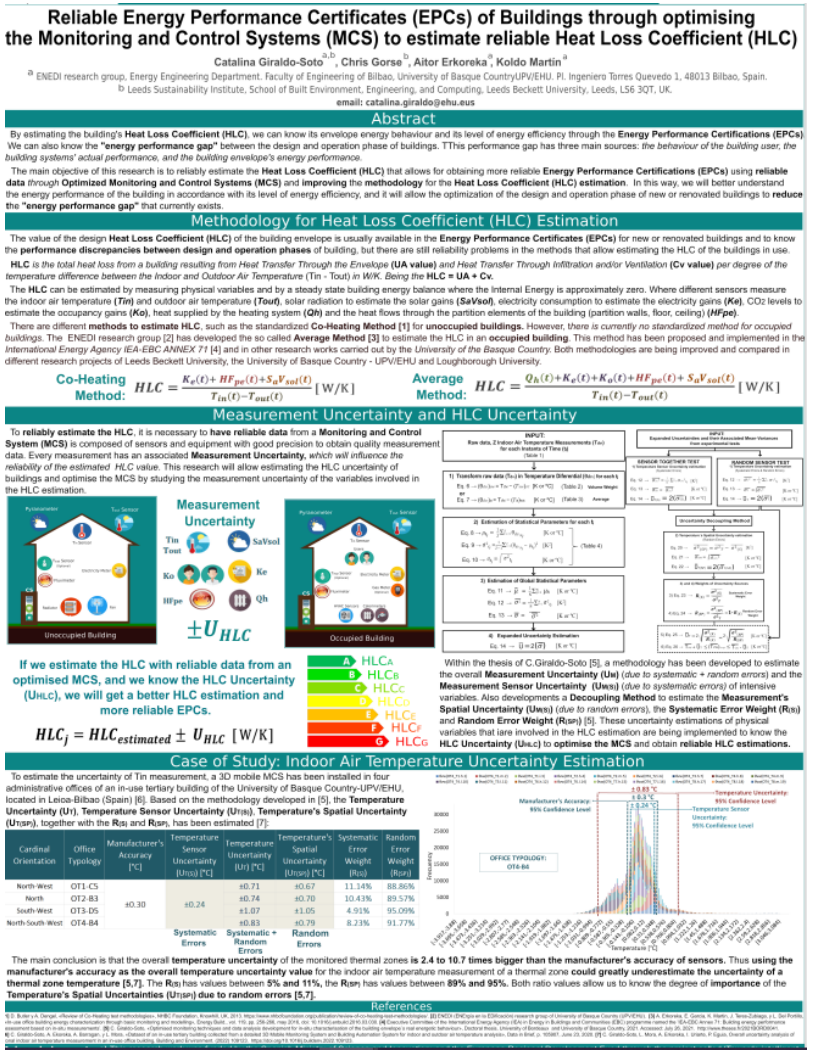

Reliable Energy Performance Certificates (EPCs) of Buildings through optimising the Monitoring and Control Systems (MCS) to estimate reliable Heat Loss Coefficient (HLC)

Catalina Giraldo-Soto [a,b], Chris Gorse [b], Aitor Erkoreka [a], Koldo Martin [a]

[a] ENEDI research group, Energy Engineering Department. Faculty of Engineering of Bilbao, University of Basque CountryUPV/EHU. Pl. Ingeniero Torres Quevedo 1, 48013 Bilbao, Spain.
[b] Leeds Sustainability Institute, School of Built Environment, Engineering, and Computing, Leeds Beckett University, Leeds, LS6 3QT, UK.
email: catalina.giraldo@ehu.eus

Abstract

Methodology for Heat Loss Coefficient (HLC) Estimation

Measurement Uncertainty and HLC Uncertainty

Case of Study: Indoor Air Temperature Uncertainty Estimation

References

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New Technologies and Building Materials

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Development of sustainable prefabricated composite walling elements for volumetric constructions

Ravijanya Chippagiri

DEVELOPMENT OF SUSTAINABLE PREFABRICATED COMPOSITE WALLING ELEMENTS FOR VOLUMETRIC CONSTRUCTIONS

Visvesvaraya National Institute of Technology, Nagpur, India
Civil Engineering Department

Prologue

Raw Material - Suitability

Experimental and Computational study of walling material

On-field application

Implications

Sustainability
Energy efficient
Quality & Waste Management
Time Saving
Value to the Society

Publications

Ravijanya Chippagiri[1], Ana Bras[2], Rahul V. Ralegaonkar[3]

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Sustainable Developments

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Sustainable Developments

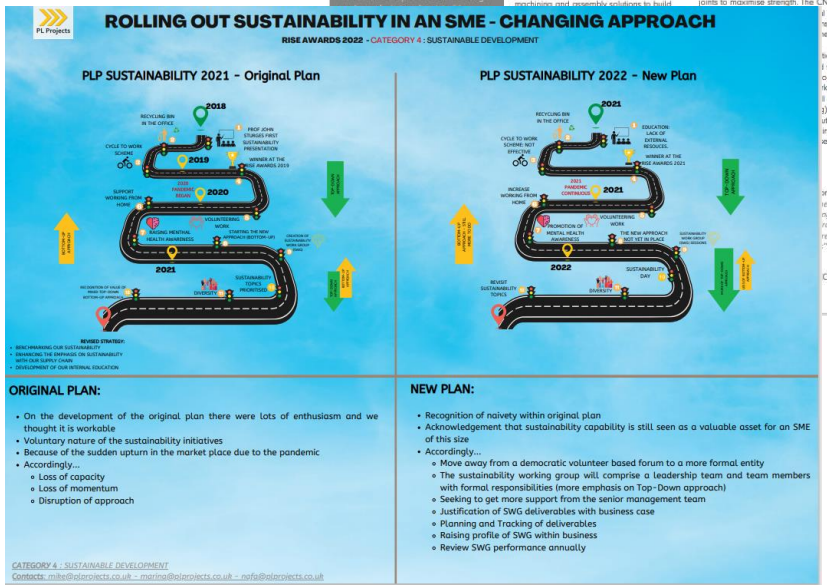
Highly Commended

Eco-Board: Light but just as strong evolution composites

Evolution Composites

Rolling out sustainability in an SME - Changing approach

Nafa Duwebi



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Sustainable Developments

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St Richard’s Hospice Build

Speller Metcalfe

SpellerMetcalfe

CLIENT
ST RICHARD'S HOSPICE

LOCATION
WORCESTER

SCOPE
NEW BUILD / REFURB

ARCHITECT
ASSOCIATED ARCHITECTS

PQS
FIRMINGERS

VALUE
£1.8M

DATES
JANUARY 2020 - MARCH 2021

DURATION
60 WEEKS

ST RICHARD'S HOSPICE, BUILD 2020

Speller Metcalfe was appointed to deliver Stage 2 of repeat-client St Richard's Hospice's 'Build 2020' project.

The project saw the creation of a range of specialist therapeutic rooms to expand the Hospice's 'Living Well' centre, including an exercise studio, art studio, horticultural therapy room, occupational training therapy kitchen and music and film therapy room. The works also comprised an infill to an enclosed courtyard with construction of a Glulam timber frame structure with lattice-work roof carrying glazed roof lights known as The Green.

A key challenge at St Richard's Hospice was managing the logistics of installing a timber frame to an internal courtyard with no direct access to the outside, whilst also located within the confines of a live hospice - a sensitive environment where special consideration had to be given to minimising disruption at all times for the patients and their families.

Clear communication and an open and honest approach of our site management team was required to coordinate works effectively so as to minimise disruption, utilising our experience of working in similar environments, including numerous phases of work at the Hospice (including building the original hospice many years prior) to phase and plan the works effectively.

The works were delivered during the Covid-19 pandemic where stringent measures were put in place to allow works to continue whilst ensuring the safety and security of the vulnerable residents.

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Heritage Award for Restoration or Retrofit

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Heritage Award for Restoration or Retrofit

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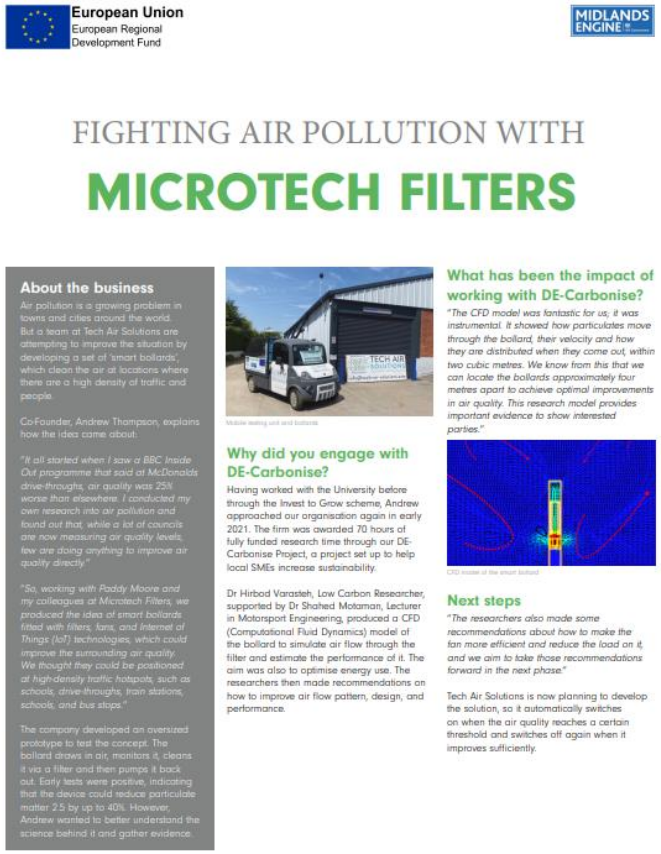
Fighting air pollution with Microtech Filters

Microtech Filters



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Behavioural Change

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Behavioural Change

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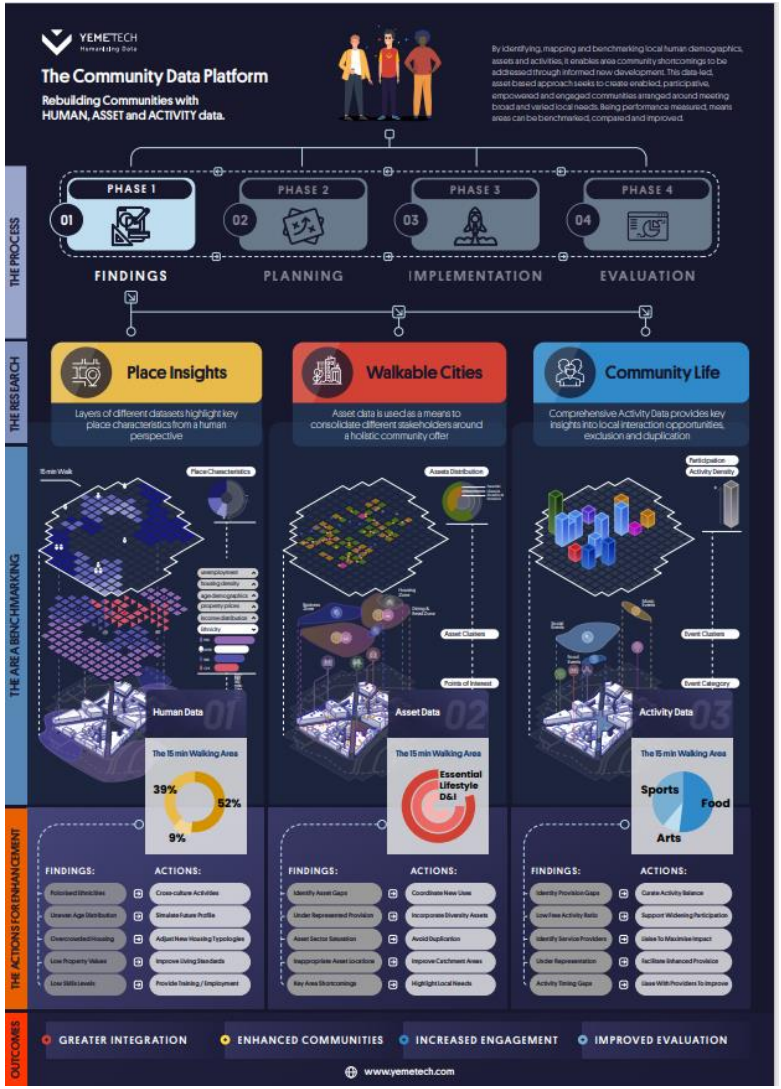
The Community Data Platform Rebuilding Communities with HUMAN, ASSET and ACTIVITY data

Yeme Tech



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Behavioural Change

Winner

The sun is shining on Trusty Pets

Trusty Pets

European Union
European Regional Development Fund

MIDLANDS ENGINE

THE SUN IS SHINING ON

TRUSTY PETS

About the business

Trusty Pet Supplies is a family-run pet supply business based in Derby since 1999, consisting of 3 generations of family, with over 50 years of experience in the pet trade as well as experience with a variety of animals, including dogs, cats, rabbits, guinea pigs, hamsters, gerbils, and fish.

Why did you engage with DE-Carbonise?

Trusty Pet Supplies identified a business case for becoming more energy-efficient and has made an ongoing commitment to becoming low carbon by investing in measures to reduce their energy consumption and carbon emissions. The firm has invested over £30,000 in a 31kWp solar photovoltaic (PV) system, to meet the company's electricity demand from renewable solar energy and LED lighting.

The solar system produces over 25,500kWh of electricity per year, saving 5.5 tonnes of carbon emissions. Moving to LED has reduced a further 7 tonnes of carbon emissions.

When the company purchased a new site in 2021, they contacted the DE-Carbonise team to enquire about making the new site more energy efficient.

What has been the impact of working with DE-Carbonise?

A carbon reduction audit identified an opportunity to make significant cost and energy savings by upgrading the lighting in their premises.

Trusty Pets therefore decided to invest in energy-efficient LED lighting which reduced their energy consumption by 25,195 kWh and resulted in an annual carbon saving of 7 tonnes a year. They received a grant for £9,950.00.

Following the energy efficiency measures achieved by changing to LED, the company then applied for a second grant from the project and were awarded £9,840 towards the cost of installing a 31kWp solar photovoltaic system on their new unit.

The energy efficient and energy generating measures fitted at the new unit save Trusty Pet Supplies Ltd over £9,500 per year and reduce their annual carbon emissions by 12.6 tonnes.

The new site now has LED lights controlled by occupancy sensors and is generating its own electricity.

David Carlin, the company's DE-Carbonise Champion has been extremely happy with the scheme and is looking at other areas that could improve energy efficiency.

Data

Grant 1

- Annual Energy Saving (kWh): 25,195
- Annual Carbon saving (KgCO2e): 6,986
- Annual Cost Saving: £4,956
- Value of Grant: £9,950.00

Grant 2

- Annual Energy Saving (kWh): 24,521
- Annual Carbon saving (KgCO2e): 5,667
- Annual Cost Saving: £4,659
- Value of Grant: £9,840.00

Next steps

The company are interested in investing in an electric vehicle in the future and will continue to identify further carbon and resource saving measures within its site and business activities as opportunities arise.

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Social Value

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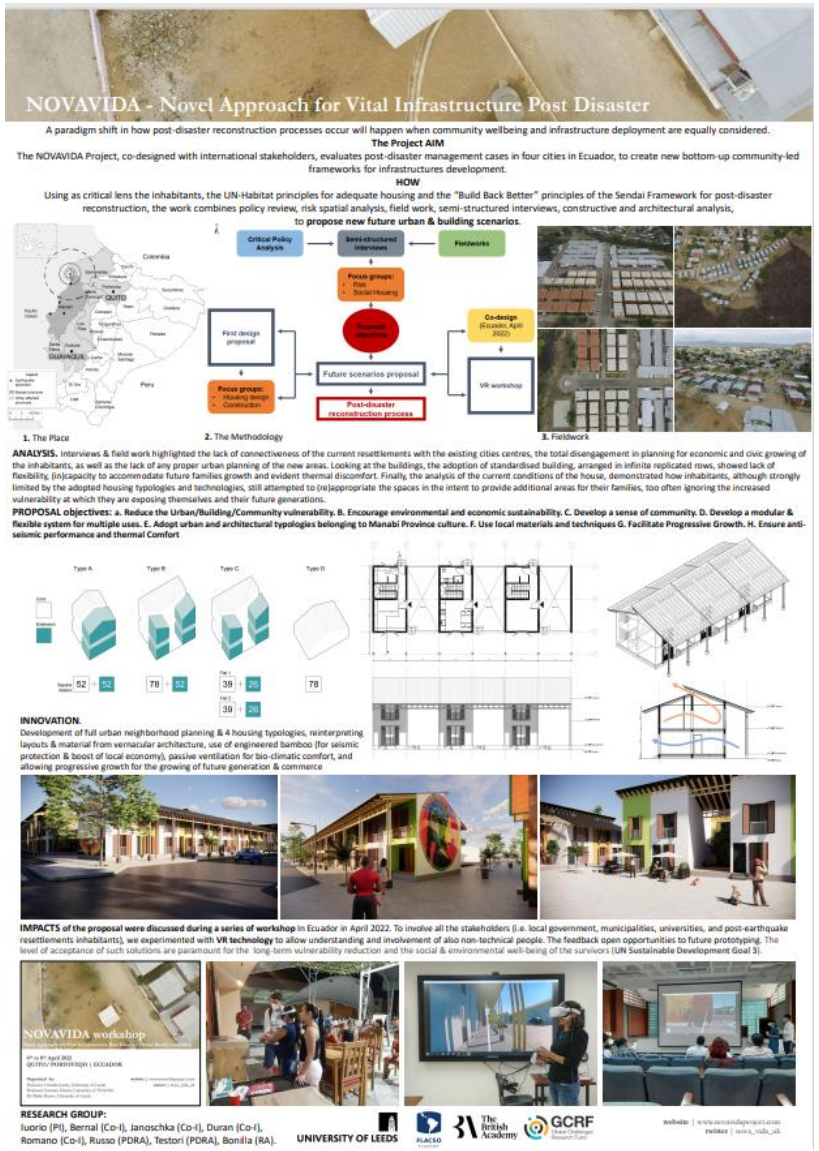
Social Value
Highly Commended

NOVAVIDA - Novel Approach for Vital Infrastructure Post Disaster

NOVAVIDA - Ornella Iuorio



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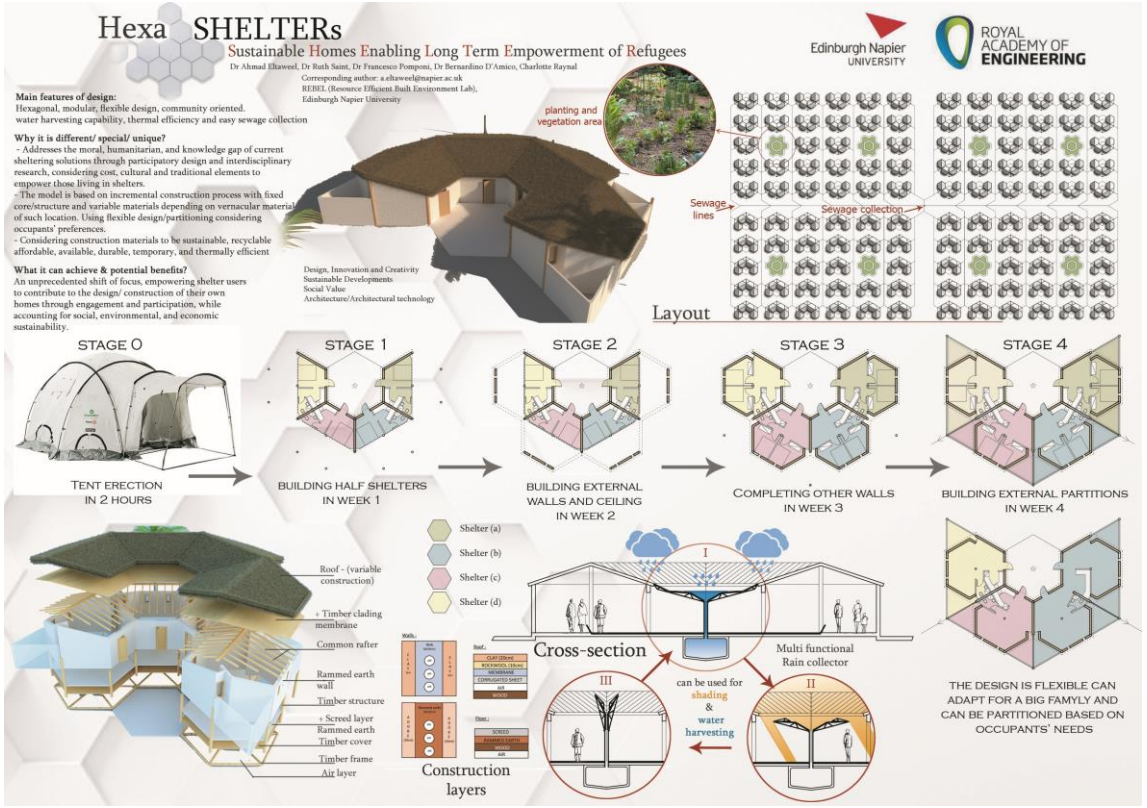
Social Value
Winner

Sustainable Homes Enabling Long Term Empowerment of Refugees

Ahmad Eltaweel



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Enterprise

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Enterprise
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Collaborating for carbon reduction

Rosemary Horry

European Union
European Regional Development Fund

COLLABORATING FOR CARBON REDUCTION

1. INTRODUCTION

- **The De-Carbonise Project** is a partnership between the University of Derby, Derby City Council & Derbyshire County Council.
- **The project** matches new-to-the-low carbon economy to specialist advice focusing on SMEs, De-Carbonise supports low-carbon initiatives through awarding grants.
- **Key areas** include improvements in energy efficiency, increasing deployment of renewables & low carbon production & manufacturing.
- **Objective** is to increase economic resilience in the East Midlands through lowering the cost-base of SMEs, simulating demand for low CO_2 economy goods & services, assisting the region to meet its greenhouse gas reduction & renewable energy targets.

2. APPROACH

- **We enable SMEs** to take their carbon reduction activities forward with formal plans & research and development opening up supply-chain & procurement opportunities.
- **Grants of up to £20,000** (to a maximum of 40% cost) enabled the installation of low carbon technologies including LED lighting, localised energy generation (PV) & heat recovery.

https://www.derby.ac.uk/business-services/funding/de-carbonise-project/

3. ACHIEVMENTS

Regional SME benefits achieved to date:

- Over **453 SMEs have received support** through DE-Carbonise & many more have received environmental audits.
- Financial support provided to **166 SMEs**
- Over **3,451,140 kWh** per year in energy savings and cost reductions of £834,990 per year.
- GHG savings of over **32,465 tonnes** per annum against a target of 2,401 tonnes per annum.
- Over **36 SMEs** engaged in long term research & development activity
- An **average of 901 tonnes** per year per SME.
- Building a **community of practice** with SMEs sharing their learning & supporting each other through workshops & events.



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Enterprise
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Energy Efficiency as a Service: A shared-savings solution to energy use reduction

SMARTech Energy Ltd

SMARTech energy

Energy Efficiency as a Service

A shared-savings solution to energy use reduction

Case study:
STEM college situated in South West England

The college buildings mainly contain staff offices and lecture rooms spread over two floors. There are also workshops used for practicing science, technology and engineering. The college is equipped with a heating ventilation and air conditioning system and renewable energy in the form of solar photovoltaic. The college wished to reduce its carbon emissions and improve its sustainability credentials, however it did not have a budget to do this.

To overcome its budgetary constraint, the college entered into a 10 year EEaaS contract in early 2021. The initial strategy features energy monitoring, replacement LED lighting, motor optimisation, heating system controls and base load reduction. Data from the first year of the scheme assessed using IPMVP methodology suggests the following reductions will be achieved over the length of the contract period:

43% energy reduction
237 tonnes carbon reduction
£200k overall cost reduction
(split with SMARTech energy)

Why Energy Efficiency as a Service?

SMARTech energy's experience shows that many businesses want to reduce energy use, cut carbon emissions and reach sustainability goals, however, many cannot commit to the capital expenditure or lease costs required to invest in low-energy technology and renewable energy generation. With mounting financial, legislative, contractual and ethical pressure on UK manufacturing to be more sustainable, SMARTech energy looked to develop a solution to remove the financial barriers from energy reduction schemes. We call this Energy Efficiency as a Service (EEaaS).

How does it work?

Essentially, if enough energy savings can be identified to cover the cost of external investment in low-energy technologies over the length of a contract, we can provide the investment required to implement the changes at the client's buildings, undertake monitoring and verification (M&V) to evaluate effectiveness, provide ongoing consultancy to optimise savings and deal with compliance requirements and reporting legislation. There is no requirement for capital expenditure, finance or leasing, nevertheless, the client is able to demonstrate to customers, potential customers and in tendering for contracts that real action has been taken to reduce carbon emissions.

After an initial assessment of energy use data and existing technologies and work practices, we can predict if EEaaS will work for an organisation. The potential savings must be high enough to cover the costs of the scheme and provide a share for the client. In outline, the scheme will then follows this path:

- Electrical monitoring installed to provide a detailed picture of energy use
- Full site survey and evaluation of utility billing and energy use data
- Report to client on projected actions and anticipated savings
- Agreement to go forward, with the cost savings shared between SMARTech energy and the client for the term of a contract
- Installation of energy saving technology chosen from a portfolio comprising of 33 solutions, along with renewable energy generation where appropriate.
- M&V undertaken using the International Performance Measurement and Verification Protocol (IPMVP®) to verify performance and savings throughout the length of the contract. Savings payments adjusted annually in line with the performance of the scheme
- Ongoing consultancy provided to identify further efficiencies and help with compliance and legislative responsibilities where appropriate (ie. ESOS, SECR).

To sum up

We believe that the inability of many businesses and organisations to invest in energy saving technologies is hampering the journey to Net Zero in the UK. By utilising the gap between potential and current energy spend to finance energy reduction measures, SMARTech energy provides an innovative solution to this problem.

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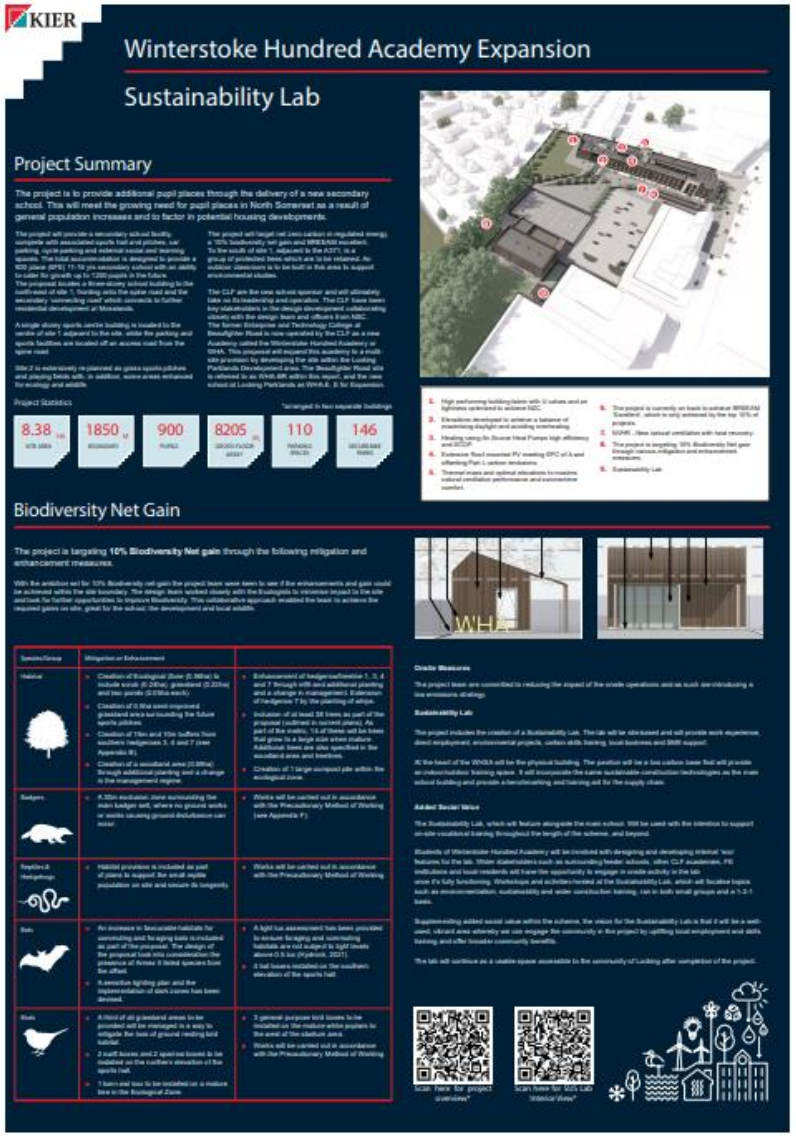
Winterstoke Hundred Academy Expansion - Sustainability Lab

Kier Construction



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How can MMC contractors' business models communicate confidence to public clients?

Ali Saad

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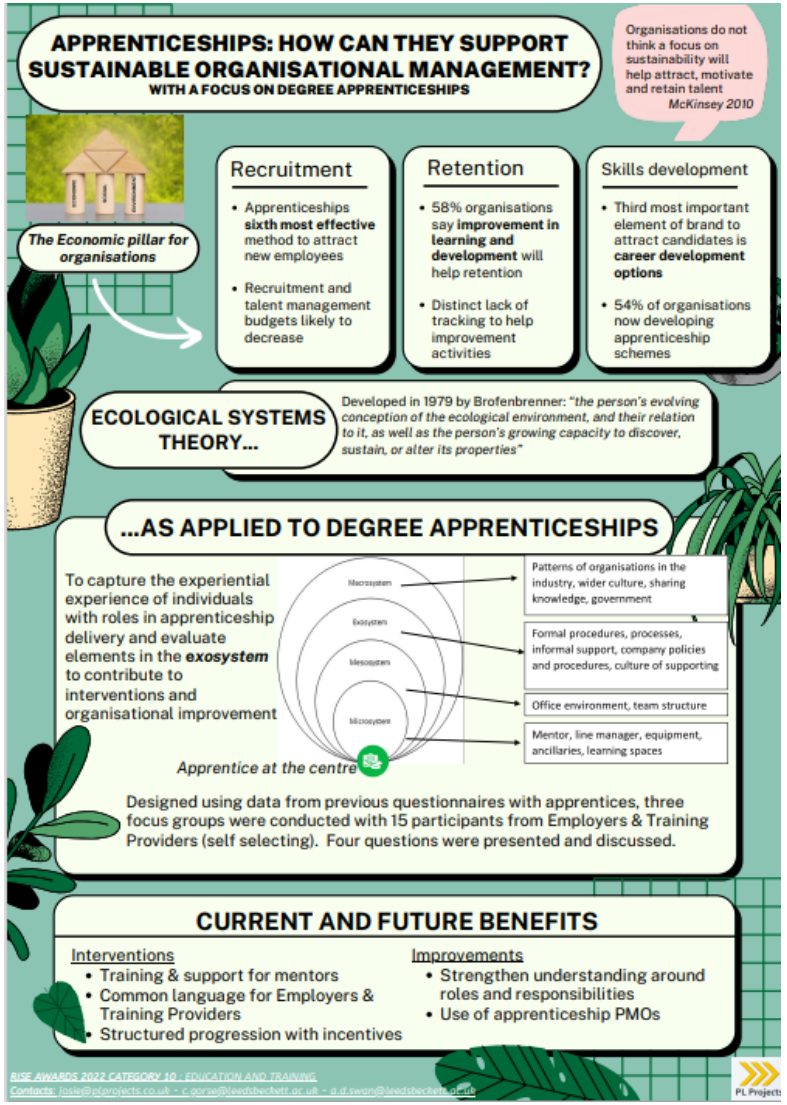
Apprenticeships: how can they support sustainable organisational management? With a focus on degree apprenticeships

PI Projects – Josie Rothera



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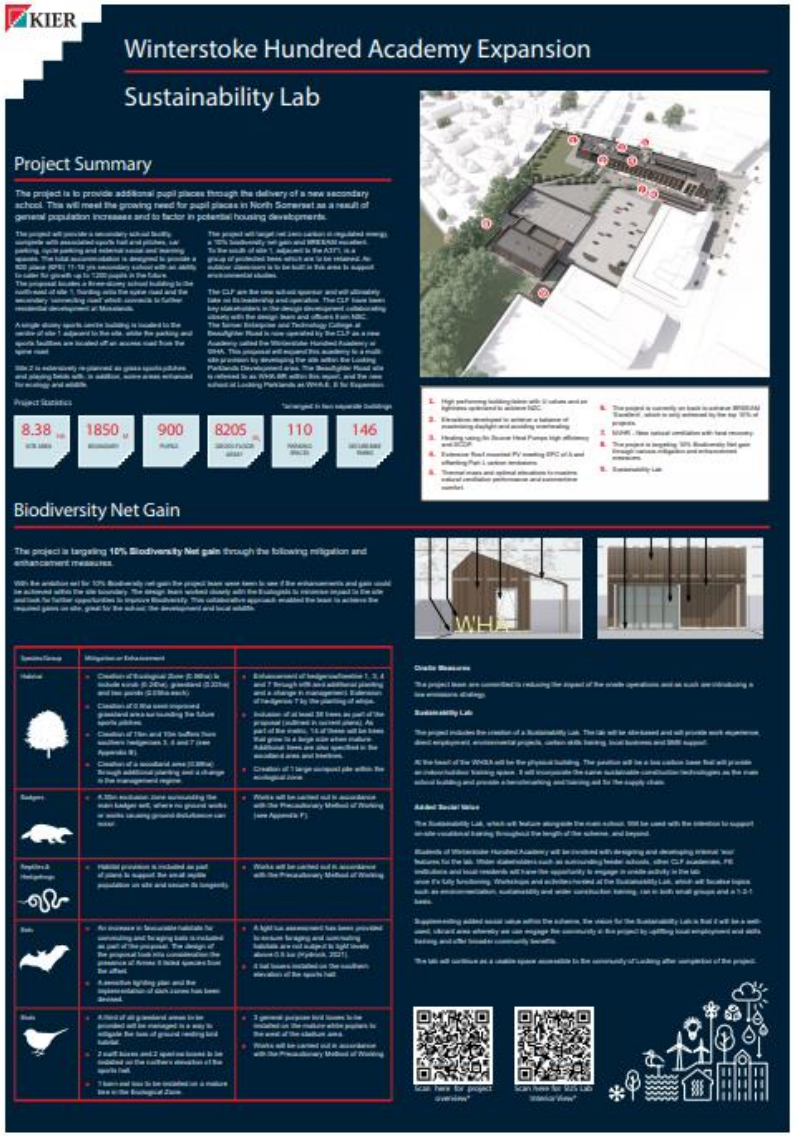

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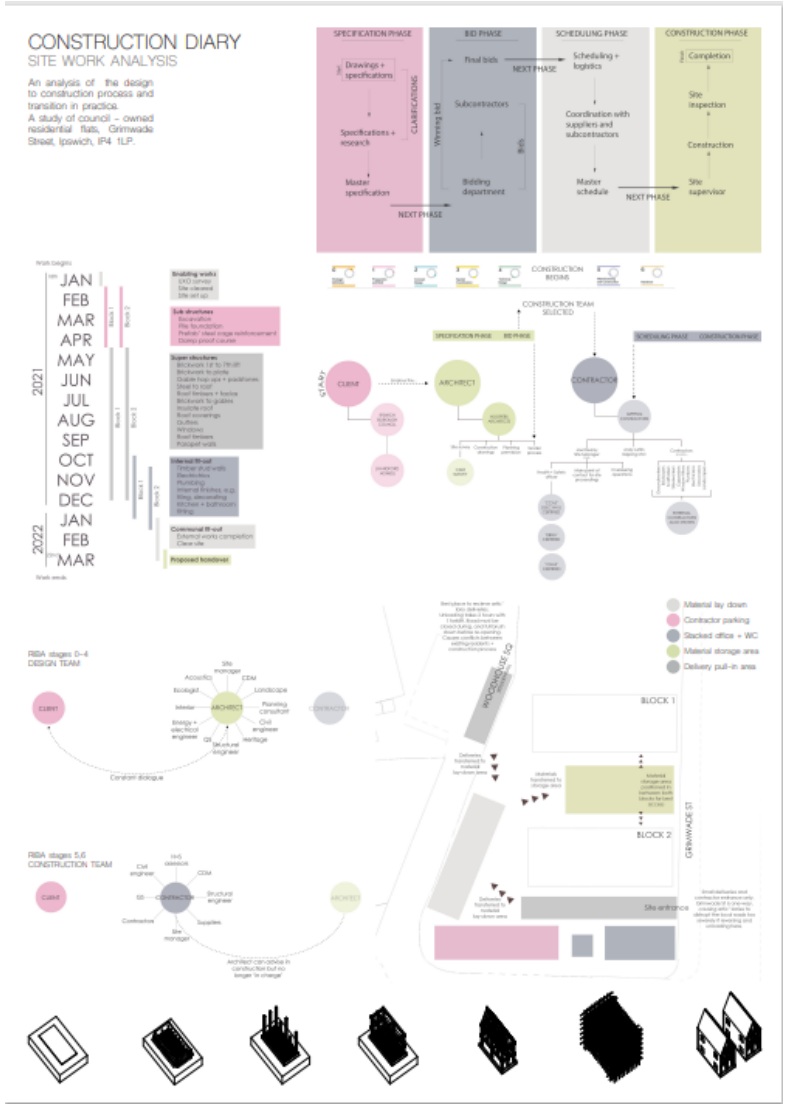
CONSTRUCTION DIARY

Lois Whitnell



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ARC Open State Cavity Barrier

ARC Building Solutions

ARC Building Solutions

Award-winning manufacturers of Cavity Fire Barriers and Cavity Closers

ABOUT Unveiled in November 2021, ARC's **Open State Cavity Barrier** (OSCB) solution has been specifically designed to stop the spread of fire in ventilated cavities.

Compliant to ASFP TGD19 standards, the OSCB is highly effective at **preventing vertical fire spread** within a building's external cavity as it has a reactive intumescent layer that rapidly expands when exposed to heat in a fire event, closing off the air gap.

Helping to eliminate installation errors, ARC has also taken many innovative steps to support OSCB installers on-site. **Quick Reference (QR) codes** are printed onto the product which when scanned allow customers to access easy-to-follow tutorials on the correct handling and installation of the cavity barrier whilst on site.

To make product identification and traceability easy, the OSCB is **also colour coded** and key information such as the batch code, product code and size, is individually **printed onto the barrier** meaning that even when removed from its packaging or installed, it is easily identifiable.

COMPETITVE EDGE
ARC is the first manufacturer to link QR codes **directly** to its own installation videos and not to a third party app.

The instant access this system provides to information supports installer knowledge and usability of the product.

RISE AWARDS 2022
Award: Fire and Safety
Entry: ARC Open State Cavity Barrier

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WHY CREATED The OSCB has been developed in response to **market demand**, providing contractors with a robust fire stopping solution that still allows air movement within external wall cavities on properties with ventilated facades, yet delivers a resilient and fire-safe building.

The new labelling system has also been implemented as a result of customer feedback which brought to light the issue that many installers are **uncertain of the installation techniques** required for different cavity barrier products. Requirements vary between each product and if a fire-stopping solution isn't installed correctly it can have a detrimental effect on performance. By printing QR codes onto the product, customers can access all handling and installation advice needed whilst on site. Quick and convenient, the QR codes are **accessible to all** and support installers to achieve greater accuracy at the touch of a button.

Providing **traceability** and the **'Golden Thread'** of information is another reason why the new labelling system was devised; initiated in light of the new Building Safety Bill. Traditionally, product information such as the batch code, product code and size are printed onto secondary packaging which can get thrown away at the early stages of a project, meaning vital information is lost. Customers raised their concerns around this which prompted ARC to find a way of printing information onto the barrier itself, meaning that even when removed from its packaging or installed, it **is easily identifiable**.

BENEFITS AT A GLANCE

- ASFP **TGD19** compliant
- Offers either **60min or 120min** fire integrity
- **25mm or 44mm** air gap for ventilated cavity
- Fixing brackets included as standard
- Suitable for use horizontally
- QR codes support **correct** handling and installation, preventing error and ineffective performance
- Colour coding and clear product markings support **easy product identification and traceability** – even when removed from packaging

TESTIMONIAL *"When ARC first introduced the QR codes onto their products, we realised that this was going to be of **huge benefit** for our contractors and installers. ARC already offer on-site training for our teams but the QR code gives them instant access to extended guidance.*

*"Search engines and product websites can often be difficult and time consuming to navigate. Having the QR codes that take you directly to specific product pages and videos really simplifies the process. Our teams are more likely to use these to access the extended guidance and for us, that helps to achieve the **correct installation**. We are looking forward to seeing ARC roll them out across all their products."*
Dale Saunders Technical Compliance Director, Taylor Wimpey

Claire Long, ARC Building Solutions,
Gildersome Spur, Leeds, LS27 7JZ
www.arcbuildingsolutions.co.uk 0113 252 9428.

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CAWARDEN CO. LTD's driving green for a better future

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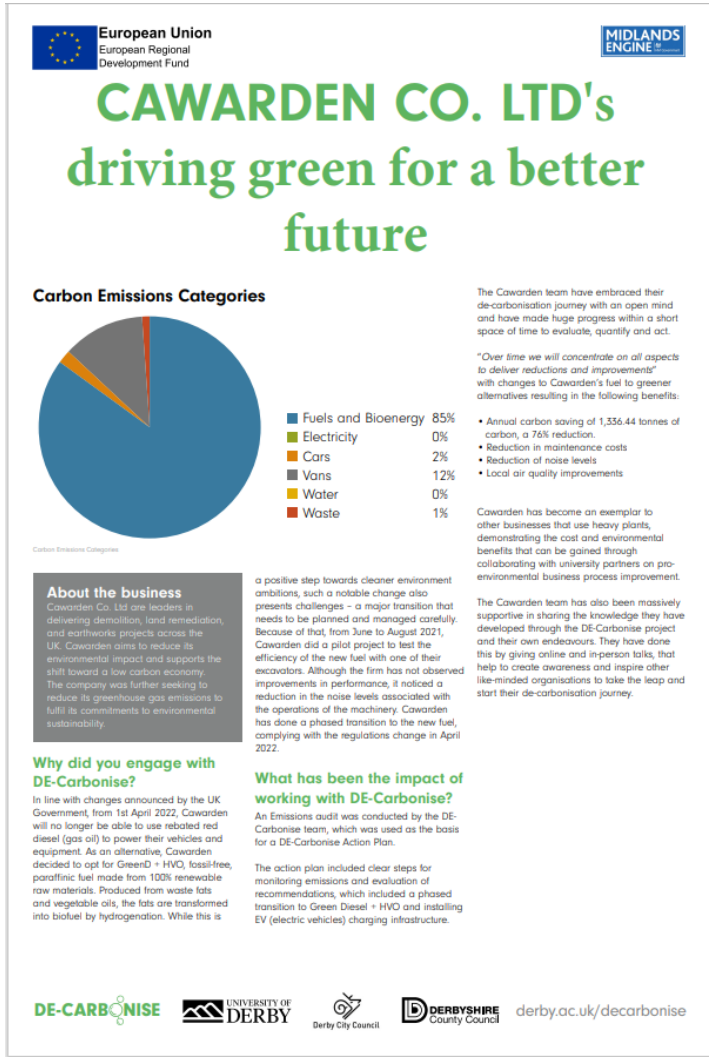

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CAWARDEN CO. LTD's driving green for a better future

Carbon Emissions Categories

Fuels and Bioenergy	85%
Electricity	0%
Cars	2%
Vans	12%
Water	0%
Waste	1%

The Cawarden team have embraced their de-carbonisation journey with an open mind and have made huge progress within a short space of time to evaluate, quantify and act.

"Over time we will concentrate on all aspects to deliver reductions and improvements" with changes to Cawarden's fuel to greener alternatives resulting in the following benefits:

- Annual carbon saving of 1,336.44 tonnes of carbon, a 76% reduction.
- Reduction in maintenance costs
- Reduction of noise levels
- Local air quality improvements

Cawarden has become an exemplar to other businesses that use heavy plants, demonstrating the cost and environmental benefits that can be gained through collaborating with university partners on pro-environmental business process improvement.

The Cawarden team has also been massively supportive in sharing the knowledge they have developed through the DE-Carbonise project and their own endeavours. They have done this by giving online and in-person talks, that help to create awareness and inspire other like-minded organisations to take the leap and start their de-carbonisation journey.

About the business

Cawarden Co. Ltd are leaders in delivering demolition, land remediation, and earthworks projects across the UK. Cawarden aims to reduce its environmental impact and supports the shift toward a low carbon economy. The company was further seeking to reduce its greenhouse gas emissions to fulfil its commitments to environmental sustainability.

a positive step towards cleaner environment ambitions, such a notable change also presents challenges – a major transition that needs to be planned and managed carefully. Because of that, from June to August 2021, Cawarden did a pilot project to test the efficiency of the new fuel with one of their excavators. Although the firm has not observed improvements in performance, it noticed a reduction in the noise levels associated with the operations of the machinery. Cawarden has done a phased transition to the new fuel, complying with the regulations change in April 2022.

Why did you engage with DE-Carbonise?

In line with changes announced by the UK Government, from 1st April 2022, Cawarden will no longer be able to use rebated red diesel (gas oil) to power their vehicles and equipment. As an alternative, Cawarden decided to opt for GreenD + HVO, fossil-free, paraffinic fuel made from 100% renewable raw materials. Produced from waste fats and vegetable oils, the fats are transformed into biofuel by hydrogenation. While this is

What has been the impact of working with DE-Carbonise?

An Emissions audit was conducted by the DE-Carbonise team, which was used as the basis for a DE-Carbonise Action Plan.

The action plan included clear steps for monitoring emissions and evaluation of recommendations, which included a phased transition to Green Diesel + HVO and installing EV (electric vehicles) charging infrastructure.

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Energy Efficiency as a Service:
A shared-savings solution to energy use reduction

SMARTech Energy Ltd

V-elo city

Lucelia Rodrigues

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EFFECTIVE ENERGY USE AT BRIDGE THERMOPLASTICS

Bridge Thermoplastics

European Union
European Regional Development Fund

MIDLANDS ENGINE

EFFECTIVE ENERGY USE AT

BRIDGE THERMOPLASTICS

About the business

Bridge Thermoplastics produces uPVC profiles for a variety of sectors and customers, using recycled plastic. An expansion of the company has resulted in the production of a wide variety of custom profiles, and this had resulted in the cooling capacity of the cold-water chiller system reaching its maximum output. The site has seven different lines for producing a broad range of plastic profiles, and each line can be adapted to make a different profile. The company uses water baths that the profiles run through, and cooling water fed directly into a 'calibrator' to cool the profiles.

Why did you engage with DE-Carbonise?

Bridge Thermoplastics' challenge was calculating the cooling demand to design an appropriate cooling system. Recycled PVC is used in the extrusion process for larger decking plastic. Bridge Thermoplastics has struggled over the cooling process post-extrusion for larger decking plastic.

What has been the impact of working with DE-Carbonise?

In the summer of 2020, Bridge Thermoplastics engaged with the DE-Carbonise team and the City Council carried out an on-site carbon reduction audit, producing a report providing advice on reducing energy, resource efficiency and carbon emissions.

Key recommendations from this included upgrading the lighting to LED, considering solar photovoltaic panels as part of a roof replacement, and undertaking a compressed air audit.

A requirement was also identified to address the cooling needs of the business.

Bridge Thermoplastics then started working with the University of Derby to identify the maximum cooling demand from the largest profiles.

Dr. Hirbod Varasteh, a Researcher from the University of Derby, determined whether the two chillers on site could provide sufficient cooling for the target volumes of plastic production. He also analysed the data to see if there was a clear gap between the cooling capacity and the demand. Hirbod's report aimed to improve the cooling system at Bridge Thermoplastics by considering the size of the chiller, pump, and heat exchanger.

It was identified that the cooling system's bottlenecks needed to be fixed to improve efficiency and reduce carbon emissions.

Hirbod identified that Bridge Thermoplastics' cooling system had issues: the cooling tank was set at 12°C, but the cooling water temperature spiked to 16-18°C. This resulted in a reduction in production quality and production rate as well as an increase in operating costs and carbon emissions.

Although it was determined that Bridge Thermoplastics' chillers had enough capacity for most of the work planned, calculations showed that the organisation needed to have an appropriate sized pump and heat exchanger to achieve an efficient cooling system with the available chiller. Hirbod therefore recommended the best option for the cooling system design to improve efficiency and reduce carbon emissions.

The recommended options can solve Bridge Thermoplastic's issues, providing higher efficiency and the required cooling temperature with a lower pump flow rate. They have allowed Bridge Thermoplastics to schedule work more effectively so that the maximum output of the chiller would not be exceeded.

A grant administered by Tom at Derby City Council, enabled Bridge Thermoplastics to replace the heat exchangers with a larger plate model, which could be expanded easily to cope with larger cooling demands if required. The company took this opportunity to simplify the cooling pipework and upgrade the pumps.

At the same time, the grant was also used to replace all lights within the factory with LED lighting, which made a vast improvement to light levels and is forecast to save 6.5 tonnes of carbon emissions per annum. Advice from the team has also been taken to reduce compressed air use and repair leaks in the pipes, with plans to upgrade the compressors to variable speed models in the future.

Data

- Annual Energy Saving (kWh): 23,326
- Annual Carbon saving (KgCO2e): 6,468
- Annual Cost Saving: £2,959.00
- Value of Grant: £6,745.60

"As a small business we wondered if we were too small to be helped, but we found that the DE-Carbonise Team was extremely helpful and able to work alongside us to consider our options."

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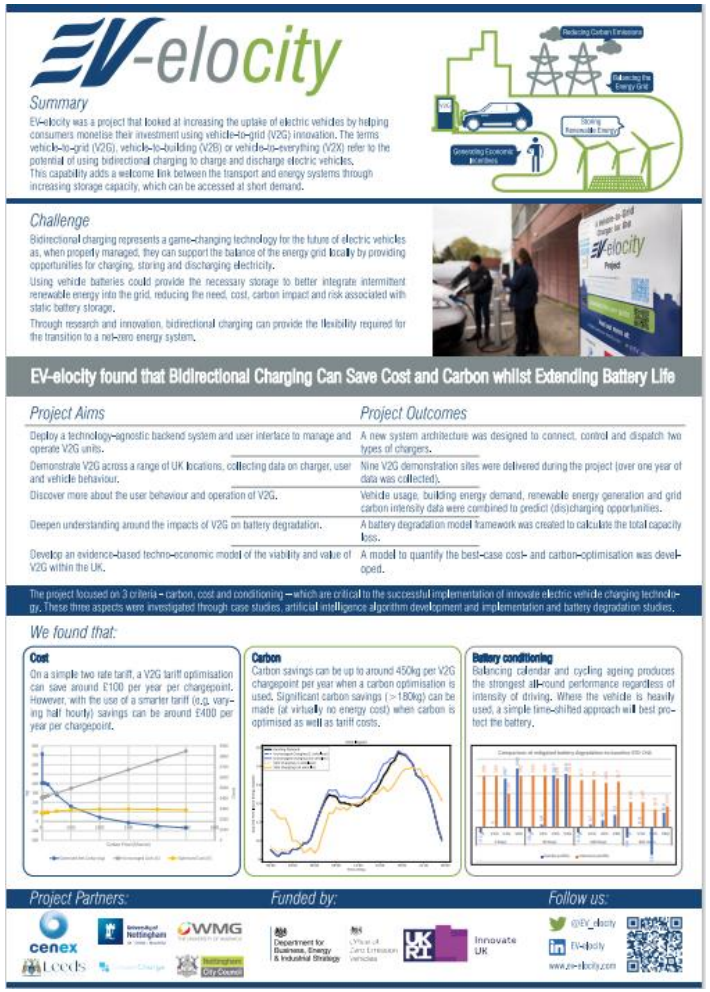

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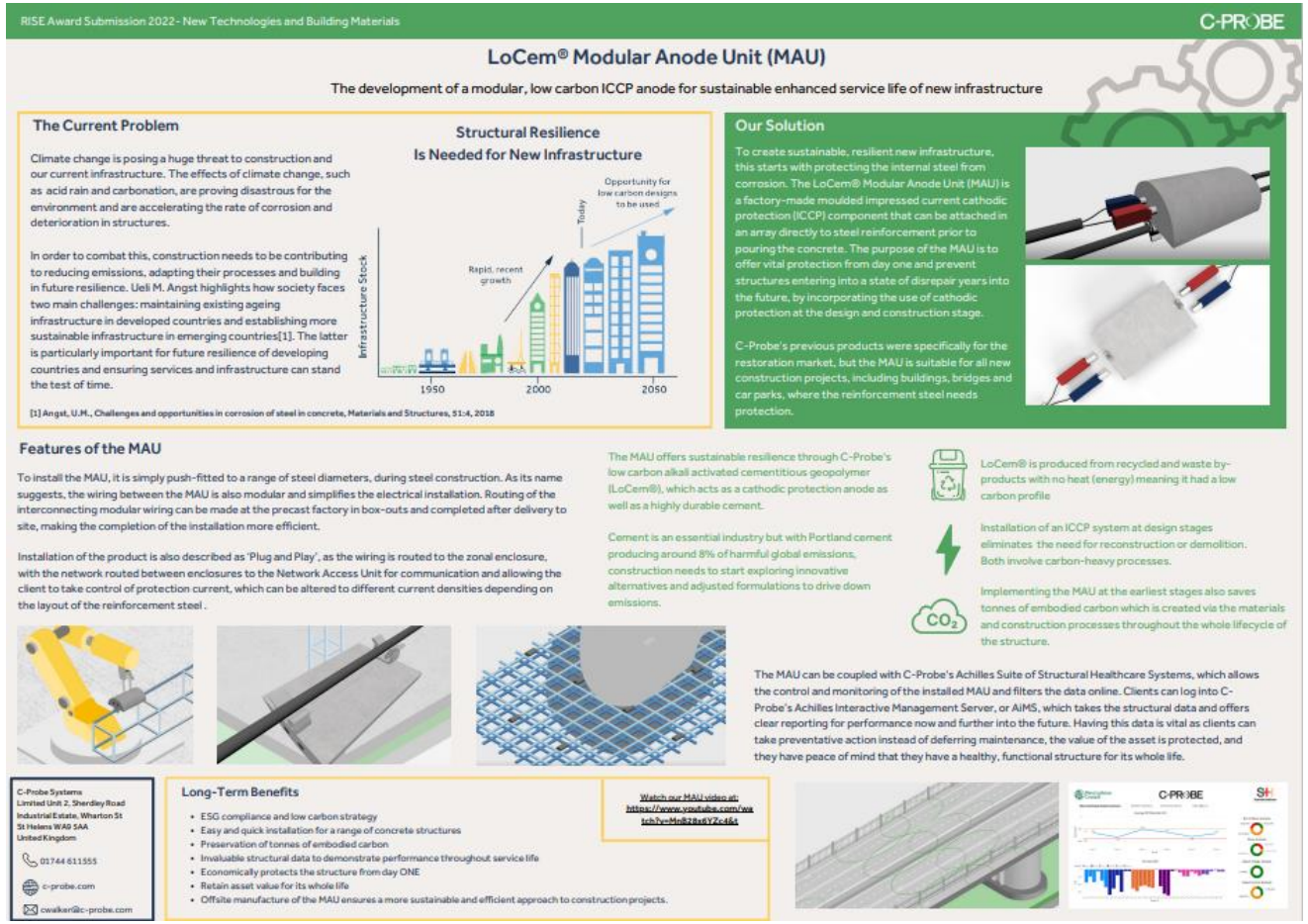

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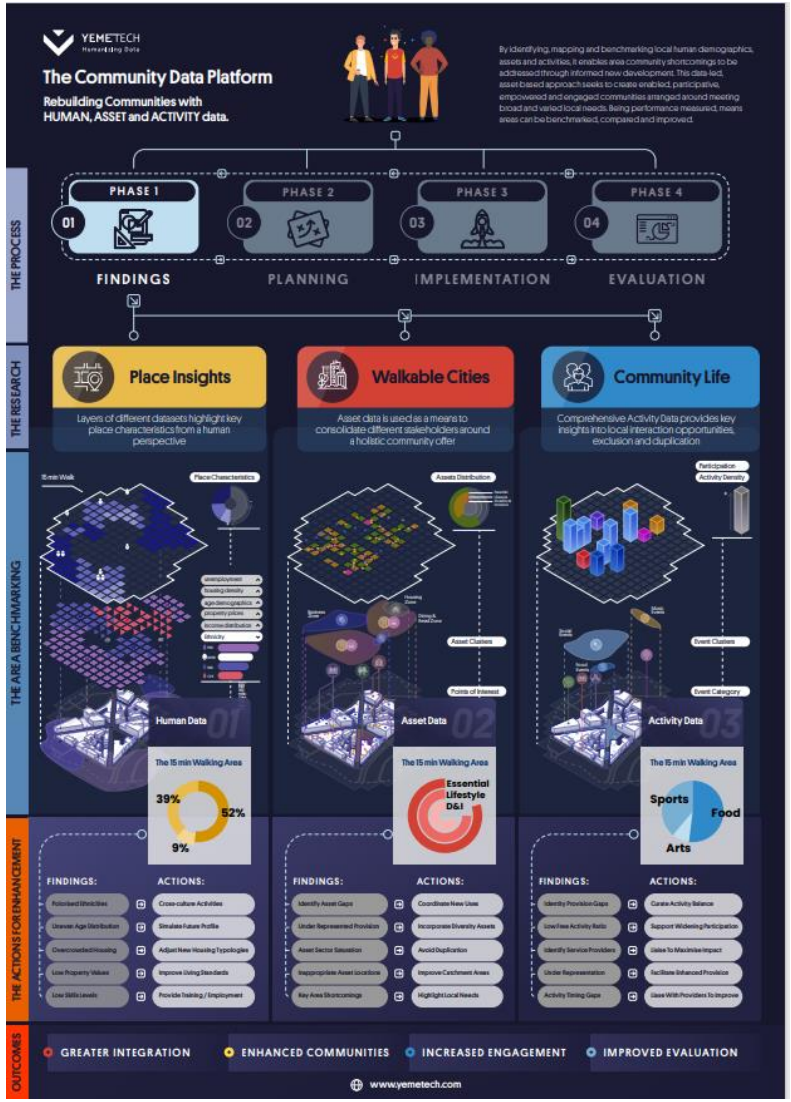

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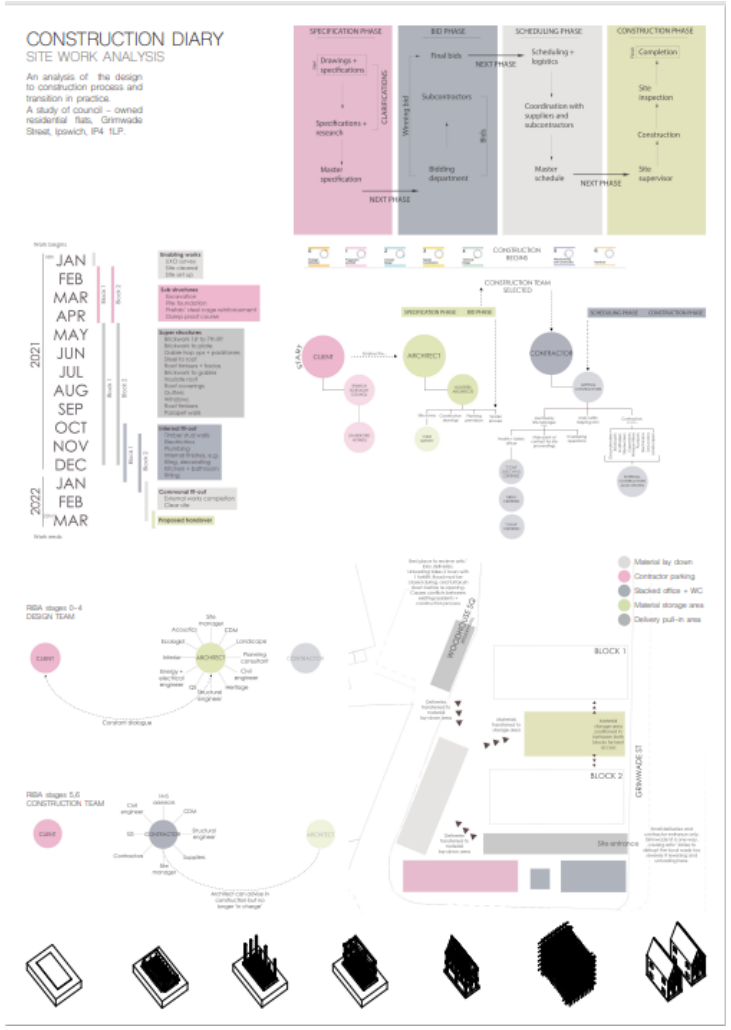

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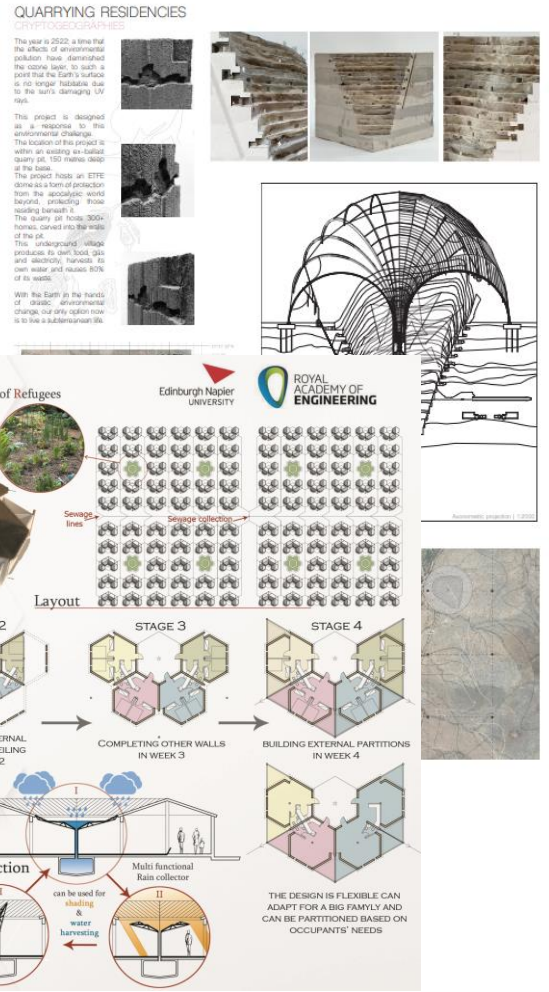

QUARRYING RESIDENCIES

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Sustainable Homes Enabling Long Term Empowerment of Refugees

Ahmad Eltaweel

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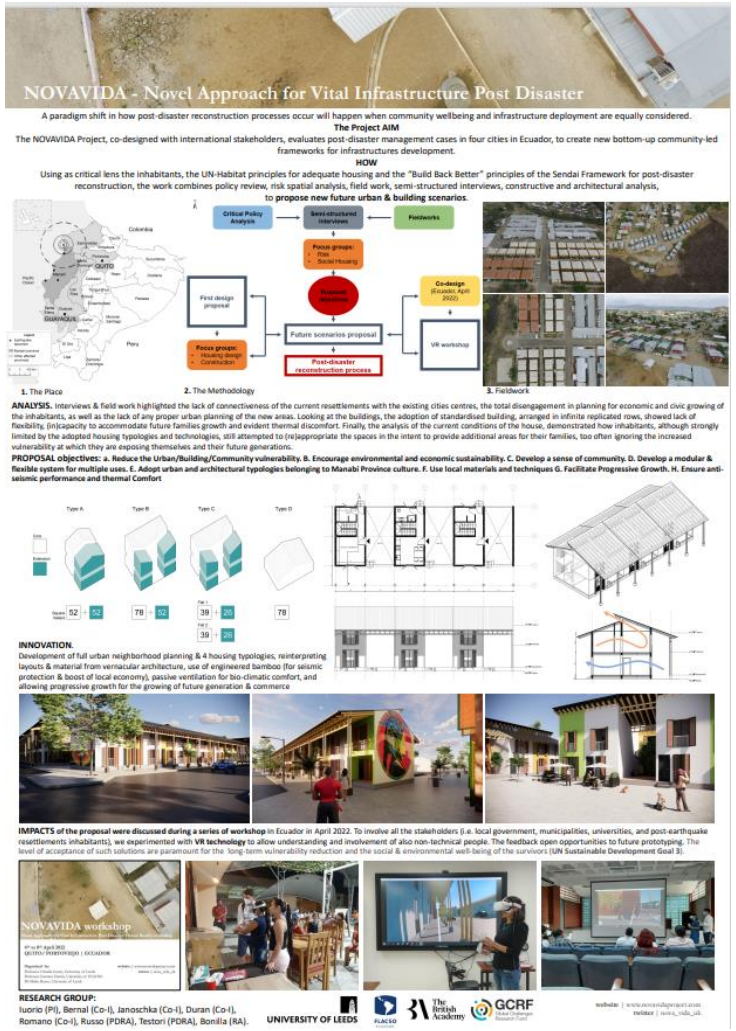
NOVAVIDA Project – Ornella Iuorio



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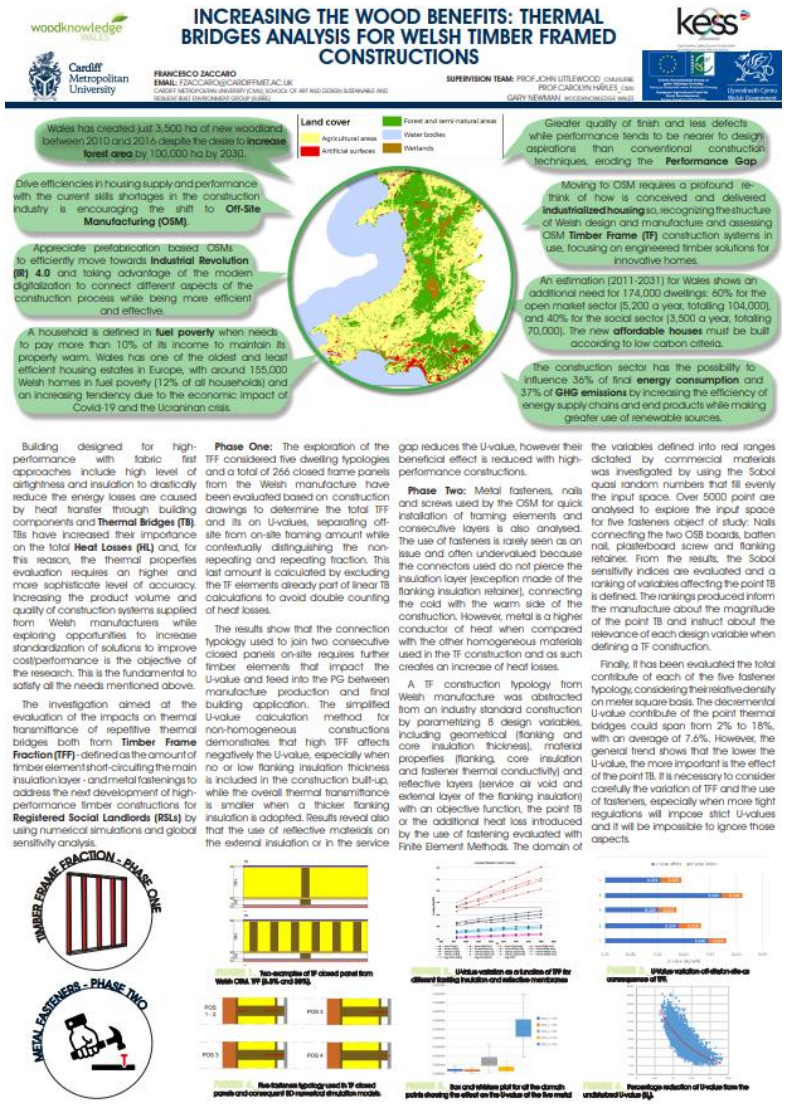
INCREASING THE WOOD BENEFITS: THERMAL BRIDGES ANALYSIS FOR WELSH TIMBER FRAMED CONSTRUCTIONS

Zaccaro Francesco



INCREASING THE WOOD BENEFITS: THERMAL BRIDGES ANALYSIS FOR WELSH TIMBER FRAMED CONSTRUCTIONS

woodknowledge WALES

kess

Cardiff Metropolitan University

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CARDIFF METROPOLITAN UNIVERSITY (CMU), SCHOOL OF ART AND DESIGN SUSTAINABLE AND RESILIENT BUILT ENVIRONMENT GROUP (SURE)

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Wales has created just 3,500 ha of new woodland between 2010 and 2016 despite the desire to **increase forest area** by 100,000 ha by 2030.

Land cover: Forest and semi-natural areas; Agricultural areas; Water bodies; Artificial surfaces; Wetlands

Greater quality of finish and less defects while performance tends to be nearer to design aspirations than conventional construction techniques, eroding the **Performance Gap**.

Drive efficiencies in housing supply and performance with the current skills shortages in the construction industry is encouraging the shift to **Off-Site Manufacturing (OSM)**.

Moving to OSM requires a profound re-think of how is conceived and delivered **industrialized housing** so, recognizing the structure of Welsh design and manufactue and assessing OSM **Timber Frame (TF)** construction systems in use, focusing on engineered timber solutions for innovative homes.

Appreciate prefabrication based OSMs to efficiently move towards **Industrial Revolution (IR) 4.0** and taking advantage of the modern digitalization to connect different aspects of the construction process while being more efficient and effective.

An estimation (2011-2031) for Wales shows an additional need for 174,000 dwellings: 60% for the open market sector (5,200 a year, totalling 104,000), and 40% for the social sector (3,500 a year, totalling 70,000). The new **affordable houses** must be built according to low carbon criteria.

A household is defined in **fuel poverty** when needs to pay more than 10% of its income to maintain its property warm. Wales has one of the oldest and least efficient housing estates in Europe, with around 155,000 Welsh homes in fuel poverty (12% of all households) and an increasing tendency due to the economic impact of Covid-19 and the Ucraninan crisis.

The construction sector has the possibility to influence 36% of final **energy consumption** and 37% of **GHG emissions** by increasing the efficiency of energy supply chains and end products while making greater use of renewable sources.

Building designed for high-performance with fabric first approaches include high level of airtightness and insulation to drastically reduce the energy losses are caused by heat transfer through building components and **Thermal Bridges (TB)**. TBs have increased their importance on the total **Heat Losses (HL)** and, for this reason, the thermal properties evaluation requires an higher and more sophisticate level of accuracy. Increasing the product volume and quality of construction systems supplied from Welsh manufacturers while exploring opportunities to increase standardization of solutions to improve cost/performance is the objective of the research. This is the fundamental to satisfy all the needs mentioned above.

The investigation aimed at the evaluation of the impacts on thermal transmittance of repetitive thermal bridges both from **Timber Frame Fraction (TFF)** - defined as the amount of timber element short-circuiting the main insulation layer - and metal fastenings to address the next development of high-performance timber constructions for **Registered Social Landlords (RSLs)** by using numerical simulations and global sensitivity analysis.

Phase One: The exploration of the TFF consideered five dwelling typologies and a total of 266 closed frame panels from the Welsh manufacture have been evaluated based on construction drawings to determine the total TFF and its on U-values, separating off-site from on-site framing amount while contextually distinguishing the non-repeating and repeating fraction. This last amount is calculated by excluding the TF elements already part of linear TB calculations to avoid double counting of heat losses.

The results show that the connection typology used to join two consecutive closed panels on-site requires further timber elements that impact the U-value and feed into the PG between manufacture production and final building application. The simplified U-value calculation method for non-homogeneous constructions demonstrates that high TFF affects negatively the U-value, especially when no or low flanking insulation thickness is included in the construction built-up, while the overall thermal transmittance is smaller when a thicker flanking insulation is adopted. Results reveal also that the use of reflective materials on the external insulation or in the service gap reduces the U-value, however their beneficial effect is reduced with high-performance constructions.

Phase Two: Metal fasteners, nails and screws used by the OSM for quick installation of framing elements and consecutive layers is also analysed. The use of fasteners is rarely seen as an issue and often undervalued because the connectors used do not pierce the insulation layer (exception made of the flanking insulation retainer), connecting the cold with the warm side of the construction. However, metal is a higher conductor of heat when compared with the other homogeneous materials used in the TF construction and as such creates an increase of heat losses.

A TF construction typology from Welsh manufacture was abstracted from an industry standard construction by parametrizing 8 design variables, including geometrical (flanking and core insulation thickness), material properties (flanking, core insulation and fastener thermal conductivity) and reflective layers (service air void and external layer of the flanking insulation) with an objective function, the point TB or the additional heat loss introduced by the use of fastening evaluated with Finite Element Methods. The domain of the variables defined into real ranges dictated by commercial materials was investigated by using the Sobol quasi random numbers that fill evenly the input space. Over 5000 point are analysed to explore the input space for five fasteners object of study: Nails connecting the two OSB boards, batten nail, plasterboard screw and flanking retainer. From the results, the Sobol sensitivity indices are evaluated and a ranking of variables affecting the point TB is defined. The rankings produced inform the manufacture about the magnitude of the point TB and instruct about the relevance of each design variable when defining a TF construction.

Finally, it has been evaluated the total contribute of each of the five fastener typology, considering their relative density on meter square basis. The decremental U-value contribute of the point thermal bridges could span from 2% to 18%, with an average of 7.6%. However, the general trend shows that the lower the U-value, the more important is the effect of the point TB. It is necessary to consider carefully the variation of TFF and the use of fasteners, especially when more tight regulations will impose strict U-values and it will be impossible to ignore those aspects.

TIMBER FRAME FRACTION - PHASE ONE

METAL FASTENERS - PHASE TWO

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About the business

Tidyco is a Derby-based manufacturing and engineering business which supplies hydraulic and pneumatic components to the UK rail industry. They also have a climate control division that designs and installs innovative industrial heating and air conditioning systems.

The company exports globally to around 50 countries.

Why did you engage with DE-Carbonise?

Tidyco identified a business case for becoming more energy-efficient and has made an ongoing commitment to becoming low carbon by investing in measures to reduce its energy consumption and carbon emissions. The firm previously invested over £100,000 in a 50kWp solar photovoltaic (PV) system, to meet some of the company's electricity demand from renewable solar energy. The system produces over 38,000kWh of electricity per year, saving 20 tonnes of carbon emissions.

An audit as part of the first phase of the project identified an opportunity to make significant cost and energy savings by upgrading the lighting in their premises. The company received a grant of £16,000. Each year, this investment in LED lighting saves twelve tonnes of carbon emissions. When the company expanded into an adjoining unit in 2021, they contacted the DE-Carbonise team to ascertain how best to make it energy efficient.

What has been the impact of working with DE-Carbonise?

The initial assessment of the new unit resulted in a grant of £11,082 towards more efficient heating and sensor-controlled, dimmable LED lighting saving 7.6 tonnes of carbon annually.

The company applied for a second grant from the project and were awarded £15,423 towards the cost of installing a 46.6kWp solar photovoltaic system on their new unit.

The energy efficient and energy generating measures fitted to the new unit save Tidyco over £11,000 per year and reduce their annual carbon emissions by 16 tonnes. The entire site, comprising three different units, now has LED lights controlled by daylight and movement sensors.

The company also invested in a programmer for LED panels in all their offices, to adjust the lighting level to suit individual staff and business activities in different areas.

"Tidyco has a more efficient lighting system using 60% less energy so it's win-win all round" said Philip Mason, Production Director.

This year, the company achieved the ISO 14001 Environmental Management Standard accreditation and attributed their success in part to the assistance that the DE-Carbonise project provided.

Philip Mason, Tidyco's Production Director, stated: *"So far, we have managed to introduce packaging recycling, EV charging points, solar panels, and LED lighting. This has only been possible through the technical and financial support from Derby City Council's DE-Carbonise initiative to whom we owe a debt of gratitude."*

The company has also entered the electric vehicle sector, by training staff to install electric vehicle charge points and by fabricating metal EV charge point protection barriers.

Next steps

The company will continue to work to maintain their ISO 14001 accreditation and to implement further carbon and resource saving measures within its site and business activities as opportunities arise.

Data

Grant 1
- Annual Energy Saving (kWh): 35,880
- Annual Carbon saving (KgCO2e): 7,567
- Annual Cost Saving: £2,931
- Value of Grant: £9,081.82

Grant 2
- Annual Energy Saving (kWh): 36,702
- Annual Carbon saving (KgCO2e): 8,483
- Annual Cost Saving: £6,871
- Value of Grant: £15,423.02

DE-CARBONISE | UNIVERSITY OF DERBY | Derby City Council | DERBYSHIRE County Council | derby.ac.uk/decarbonise

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Reliable Energy Performance Certificates (EPCs) of Buildings through optimising the Monitoring and Control Systems (MCS) to estimate reliable Heat Loss Coefficient (HLC)

Catalina Giraldo-Soto

Reliable Energy Performance Certificates (EPCs) of Buildings through optimising the Monitoring and Control Systems (MCS) to estimate reliable Heat Loss Coefficient (HLC)

Catalina Giraldo-Soto[a,b], Chris Gorse[b], Aitor Erkoreka[a], Koldo Martín[a]
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[b] Leeds Sustainability Institute, School of Built Environment, Engineering, and Computing, Leeds Beckett University, Leeds, LS6 3QT, UK.
email: catalina.giraldo@ehu.eus

Abstract

Methodology for Heat Loss Coefficient (HLC) Estimation

Measurement Uncertainty and HLC Uncertainty

Case of Study: Indoor Air Temperature Uncertainty Estimation

References

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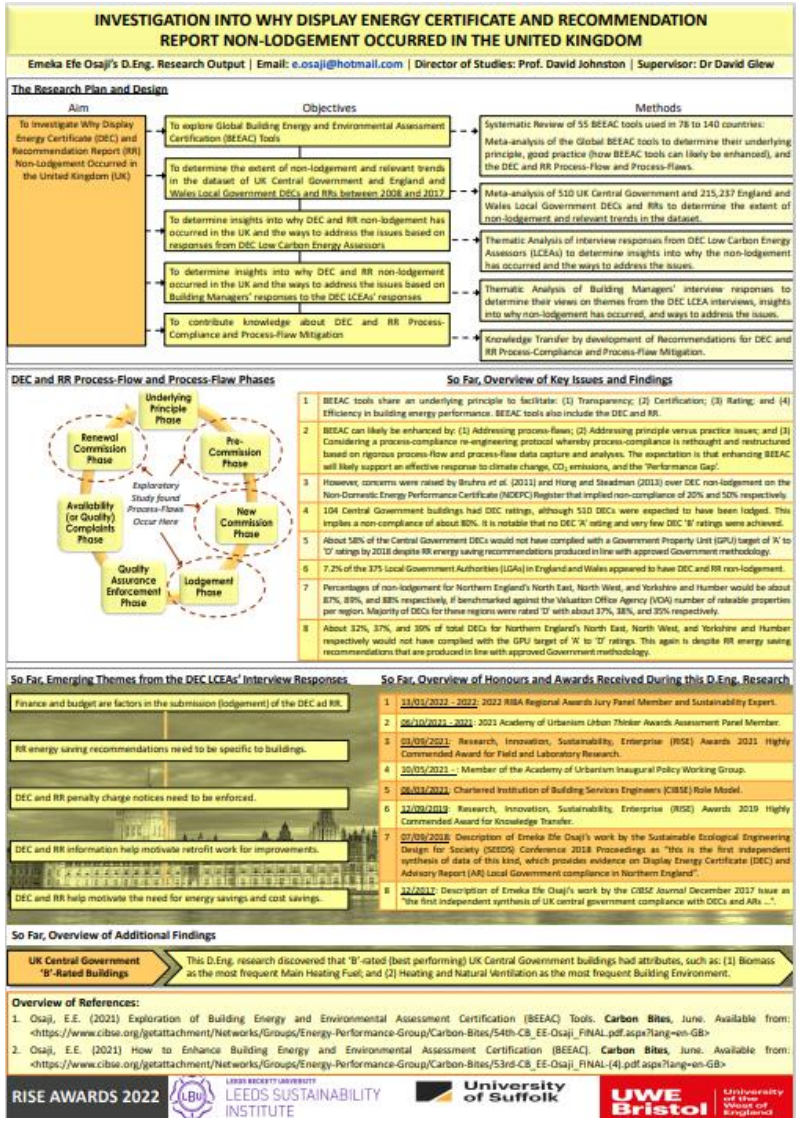
Emeka Efe Osaji



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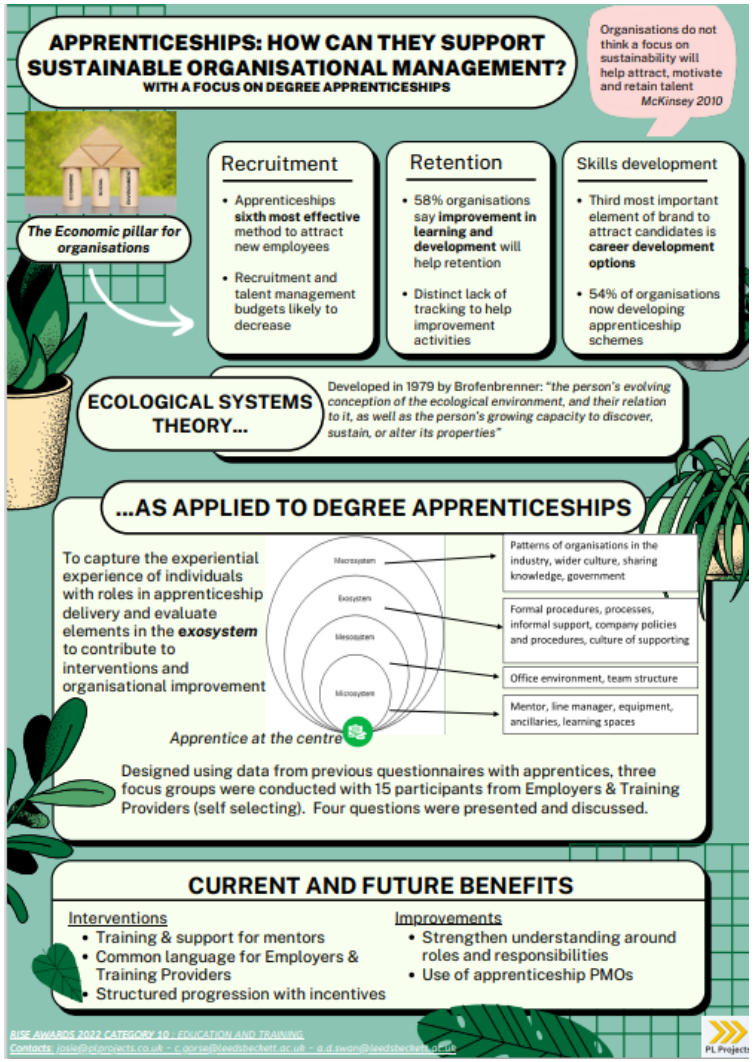
APPRENTICESHIPS: HOW CAN THEY SUPPORT SUSTAINABLE ORGANISATIONAL MANAGEMENT? WITH A FOCUS ON DEGREE APPRENTICESHIPS

Josie Rothera – PI Projects



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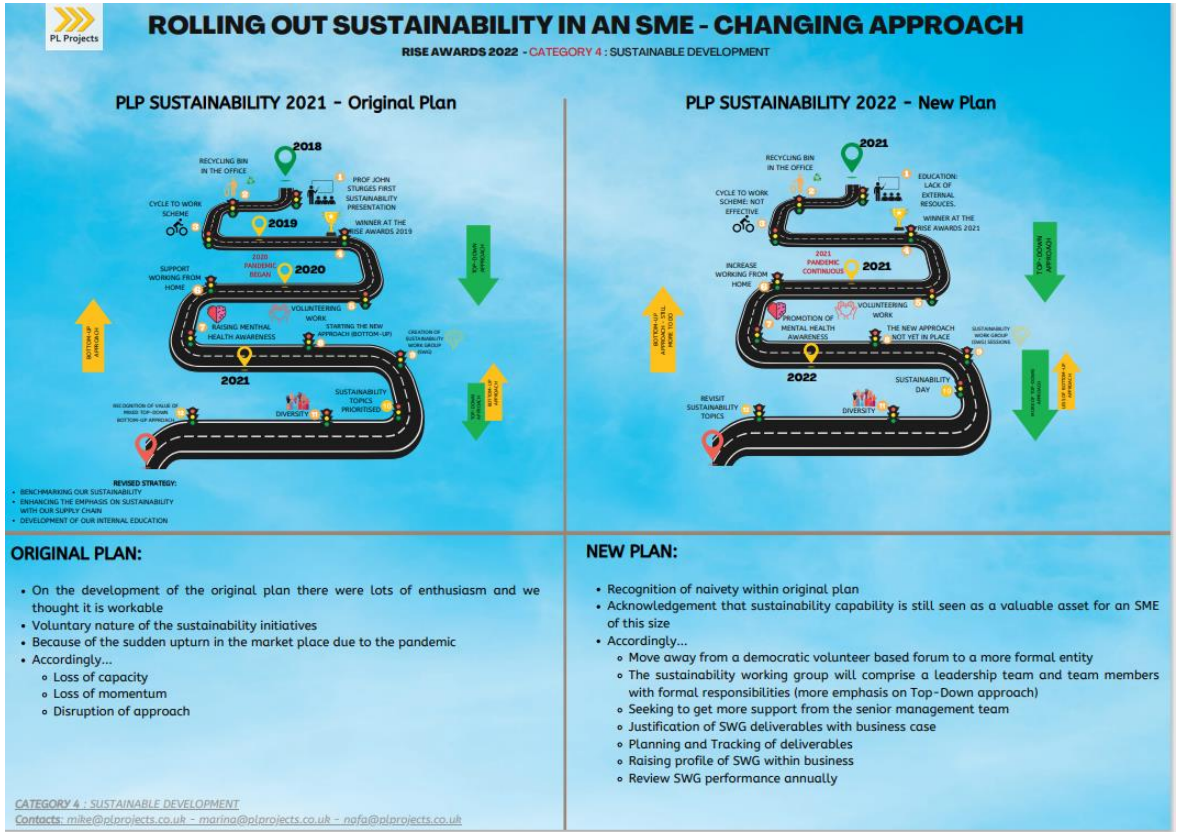
ROLLING OUT SUSTAINABILITY IN AN SME - CHANGING APPROACH

Nafa Duwebi – PI Projects



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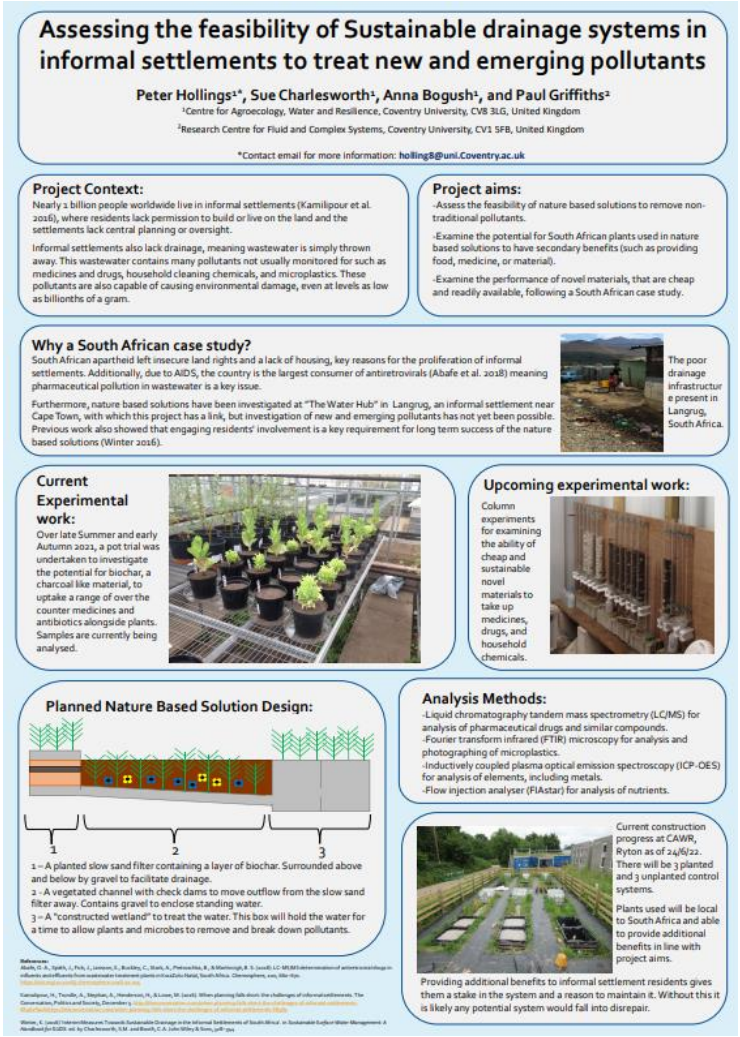
Assessing the feasibility of Sustainable drainage systems in informal settlements to treat new and emerging pollutants

Peter Hollings



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DELIVERING A LOWER CARBON REALITY FOR SUSTAINABLE CONSTRUCTION

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