Impact Report 2

1st Oct 2025 – 30th April 2026

Cenz-HighDB is funded by UKRI (Green Economy Centre)

CeNZ-HighDB

THE UNIVERSITY of EDINBURGH

University of Glasgow

Edinburgh Napier UNIVERSITY

University of Strathclyde Glasgow

UNIVERSITY OF THE WEST of SCOTLAND UWS

Built Environment – Smarter Transformation

Contents

Overview

CeNZ-HighDB is a leading research centre dedicated to advancing Net Zero solutions for high-density buildings and urban streetscapes and is funded by the UKRI. The Centre brings together researchers, industry partners and communities to accelerate the transition toward more sustainable, energy-efficient cities. Through innovative research and real-world testing, CeNZ-HighDB develops and evaluates new prototypes, retrofit strategies and integrated technologies designed to reduce carbon emissions and improve building performance. Its work spans the use of low-carbon construction materials, advanced heating and cooling systems, renewable energy integration and energy storage technologies that support resilient and future-ready urban environments.

Building on the foundations established in the first Impact Report, this second report showcases the substantial progress and growing impact of the Centre's work. It highlights a range of completed projects delivered across four thematic working groups, demonstrating how collaborative research is generating practical solutions for industry and communities alike. The report reflects the Centre's commitment to innovation, knowledge-sharing, and measurable outcomes that contribute to national and global sustainability goals.

To date, CeNZ-HighDB has approved more than 40 research projects, each focused on addressing key challenges in the transition to Net Zero urban living. This Impact Report highlights the projects successfully completed between October 2025 and April 2026.

Professor Sean Smith – Centre Director
Serena Lambley – Centre Manager

Members of the team on a site visit

Professor Gioia Falcone speaking at the SPEERI Conference in Edinburgh

Thematic Working Group I

Building Fabric and Performance

Innovation of UK-grown wood wool as a novel and sustainable insulation material

1st August 2025 – 28th February 2026

This project explored the feasibility of using wood wool as a locally sourced, sustainable insulation material for the UK construction sector. Addressing the current reliance on imported insulation products, the study focused on developing insulation boards from UK-grown resources and evaluating their thermal and acoustic performance.

The results demonstrate that wood wool insulation can be produced at pilot scale, although process adjustments were required to achieve stable manufacturing. Thermal testing showed conductivity values in the range of 0.040–0.042 W/m·K, placing the material within the performance range of natural and fibrous insulation materials and suitable for typical building applications. Acoustic testing also revealed strong sound absorption, particularly at mid- to high frequencies, with some compositions performing comparably to conventional materials such as mineral wool.

The project highlighted important manufacturing considerations, including material behaviour and compatibility with existing production systems. The need for secondary fibres to support processing indicates that further optimisation is required to fully understand the performance of wood wool alone.

Overall, the findings suggest strong potential for wood wool as a low-carbon, bio-based insulation material. Its compatibility with breathable construction makes it particularly relevant for retrofit and high-density building applications.

Main outcomes

- Demonstration that wood wool can be produced locally using lower-energy processes while delivering both thermal and acoustic performance. This benefits UK insulation manufacturers, the construction and retrofit industry, and homeowners and occupants.

- Green, carbon and knowledge benefits include:
  - ✓ Reduced embodied carbon through lower-energy production and use of UK-grown biomass.
  - ✓ Reduced reliance on imported insulation materials.
  - ✓ New technical knowledge linking fibre composition to thermal and acoustic performance.
  - ✓ Community and Occupant Benefits:
  - ✓ Enhanced indoor acoustic comfort, particularly for speech and everyday noise.
  - ✓ Support for retrofit of traditional buildings using breathable materials.
  - ✓ Contribution to local supply chains and green job creation in the UK.

Next steps

- Continued engagement with industry partners to support knowledge transfer and facilitate the transition from pilot-scale production to the development of market-ready products.

- Future research will focus on identifying and accessing manufacturing facilities that are compatible with the material, enabling further testing using individual wood wool fibre grades with minimal reliance on secondary fibres.

- Contribution to wider dissemination and uptake by sharing findings with stakeholders across the construction sector.

- Supporting the development of a locally produced, low-carbon insulation material, and advancing its readiness for adoption in both retrofit and new-build applications.

Climate chamber containing samples (left), insulation batts produced in factory and the surface images, acoustic test set up using impedance tubes (right)

Thematic Working Group II

Heating-Cooling and Energy Storage within Buildings

Scoping and Technology Repository Development with Changeworks

14th July 2025 – 30th January 2026

This project has successfully delivered a robust evidence base to support the decarbonisation of Scotland's social housing through informed deployment of low-carbon heating and hot water technologies. Working in partnership with Changeworks, the University of the West of Scotland, Fife Council and technology providers, the Centre for Net Zero High Density Buildings (CeNZ-HighDB) has developed a comprehensive and scalable repository of emerging and established solutions.

The project combined technical data, real-world case studies and stakeholder insight to evaluate performance, cost, carbon impact and suitability across different housing contexts. This has created a practical decision-support tool that enables housing providers, local authorities and third-sector organisations to compare technologies, understand deployment risks and identify the most appropriate options for different building types and communities.

Beyond the technical outputs, the project has established a strong cross-sector partnership that links research, innovation and delivery. It provides a clear pathway from evidence to action, supporting live trials and future investment in low-carbon heat. The work lays a solid foundation for scaling up solutions that are not only environmentally effective but also affordable, reliable and appropriate for the people who live in Scotland's high-density and social housing.

Main outcomes

- Applied research and technology assessment to support the decarbonisation of Scotland's social housing through better-informed deployment of low-carbon heating and hot water systems.
- Providing a structured, evidence-based decision-making tool to guide strategy, investment and partnership development.
- Environmental and carbon benefits achieved by enabling more accurate selection of technologies that deliver verified emissions reductions and improved resource efficiency.
- Community and occupant benefits arising from identifying solutions that are more reliable, affordable and appropriate for social housing residents.

Next steps

- The strong evidence base and delivery-ready platform created will now be taken forward by Changeworks/CeNZ-HighDB and partners to support real-world deployment of low-carbon heating and hot water systems in social housing.
- Use the completed technology repository and recommendations to identify priority technologies and housing archetypes for live trials.

"Working with CeNZ has been really valuable for the project. It has led to a wider scope and different methodologies being used, which has enhanced the project."

- Sophie Burgess, Senior Consultant at Changeworks

Thematic Working Group II

Heating-Cooling and Energy Storage within Buildings

Allume Energy SolShare feasibility study (Common building stock)

3rd November 2025 – 18th February 2026

The project successfully demonstrated the technical and financial viability of Allume SolShare technology across multiple social housing building types in Scotland. Building on the initial feasibility study for Building Type 1, the work extended analysis to additional high-priority building typologies, producing practical insights into system performance, suitability, and cost-effectiveness.

Through collaboration between Allume Energy, the University of the West of Scotland, CeNZ-HighDB, and East Ayrshire Council, the project combined housing data, energy usage profiles, and technical expertise to develop replicable assessment models and retrofit strategies

Main outcomes

- The project has now been completed and has delivered evidence on the suitability of Allume SolShare technology across additional social housing building types. The work has benefited housing providers, tenants, technology providers, and research partners by expanding the understanding of how shared rooftop solar can be deployed in multi-dwelling buildings beyond the initial Building Type 1 assessment.
- Expanded evidence base for shared solar deployment across multiple social housing building types in Scotland.

“The feasibility work confirmed the strong potential for SolShare in social housing and we are excited about the next steps”

- Ethan Clarke, Head of Installation Services at Allume Energy

Next steps

- Future plans include developing demonstration projects or pilot installations in selected multi-dwelling buildings, using real-world data to validate energy savings, occupant benefits, and system performance. These pilots will provide tangible case studies for wider adoption and support evidence-based decision-making by housing authorities and policymakers.
- The project also aims to share knowledge more broadly through collaboration with additional housing providers to promote equitable access to rooftop solar.
- SolShare solution has been carried forward into a deep retrofit across three midrise blocks which East Ayrshire Council have started due to this completed feasibility study. Planned follow on CeNZ-HighDB project to capture the entire retrofit

“The project went smoothly and gave us valuable insights into how shared solar can support our retrofit goals and reduce energy costs to tenants”

– East Ayrshire Council

CeNZ-HighDB visit to BE-ST

Thematic Working Group III

District / Community Heating-Cooling

Evaluating the effect of residential; retrofitting on different thermal system options for bespoke project areas in Glasgow

1st August 2025 – 16th December 2025

This project enhanced the open-access Centralisation Assessment Tool for Heat Pump Systems (CATHeaPS), allowing it to integrate openly accessible EPC data for Glasgow to assess how retrofitting impacts the techno-environmental-economic performance of thermal systems. The systems evaluated include 4th generation district heating, ambient networks with decentralised booster heat pumps, individual air source heat pumps, and individual gas boilers.

CATHeaPS supports local councils and stakeholders in evaluating thermal systems, providing insights into costs, emissions, and electrical capacity requirements. This facilitates informed decision-making for urban decarbonization.

Accessible via GitHub, CATHeaPS 3.0 includes the Govanhill dataset and video tutorials to help public sector bodies plan low-carbon systems and assess retrofitting effects, advancing a just transition for Glasgow. An open-access journal submission is planned for early 2026.

Main outcomes

- The developed open access tool can help local councils and other stakeholders to evaluate the feasibility of different systems with residential retrofitting measure for their bespoke areas, through preliminary techno-environmental-economic outputs. It conducts a complete network routing exercise based on the bespoke linear heat density of the project area and provides a comprehensive cost and technical database.
- The model can provide a thorough understanding of retrofitting importance for any specified area in Glasgow. It also provides an understanding of nominal and levelised costs involved and their impact in different thermal systems, with a breakdown of cost components (CAPEX, OPEX, REPEX, FUELEX, retrofit costs). Furthermore, it provides information on CO2 emissions for each thermal system and the electrical capacity requirements in kVA. All these metrics are presented before and after proposed retrofit measures from the EPC data.
- Overall, the model can facilitate knowledge increase with preliminary results for key decarbonisation thermal system options, helping the efforts for a just transition.

Next steps

- Create guiding videos on how to use the model, taking an example from scratch. This will reside within the repository.
- Analysis of further area with different characteristics to understand the impact of different factors in the results.
- Analysis of the impact of various levels of retrofitting to observe the impact on the results for each thermal system.
- Preparation of an open access journal publication of the work in a Q1 journal for submission in February 2026.

Thematic Working Group VI

EDI, Skills and Training

Transforming Timber – Retrofit

November 2024 – February 2026

TT-R is a retrofit showcase case study of the art of the possible using advanced timber and renewable energy technologies. It is an exemplar timber MMC project that, in combination with other “Living Lab” projects, has enabled the full commercialisation of UK sourced mass timber and the development of a digitised kit of parts capable of responding to a range of contexts. The TT-R case study encapsulates the ethos of MMC by:

- Showcasing a collaborative procurement model and then capturing and presenting the value return from the retrofit and upgrade measures relative to capital investment.
- Demonstrating innovative proof of concept offsite timber technology solutions for retrofit and extension which have been tested and validated and further combined with renewable options.
- Capturing and presenting the whole life value impact of the interventions considering embodied and operational carbon to help inform the decision-making processes of future retrofit, extension, and renewable integration projects.
- Acting as the catalyst for factory investment and the commercialisation of UK sourced advanced timber technologies capable of responding to a range of contexts fully embracing the ethos of MMC.

CeNZ funding has enable the capture and codification of these outputs in a range of materials (video, webinar etc) and academic publications to broaden outreach and impact including the creation of educational outputs.

Main outcomes

Beneficiaries of the project outcomes:

- The framework of partners provided input and support towards the project outputs this has helped to establish relationships and create opportunities for future collaboration.
- The project was submitted and shortlisted for a Construction News Award under “MMC Project of the Year” and was also shortlisted for an Offsite Construction Award and Structural Timber Award. Although the project did not win these awards being shortlisted raised the profile. It did, however, go on to win Scotland's Home of the Year 2026 (BBC).
- The range of case study outputs and publications have raised the profile of the associated net zero carbon interventions
- The work undertaken on this project has enabled the commercialisation of green carbon solutions by supporting the scaling up of the home-grown engineered timber products of EcoSystems Technologies with an emphasis their utilisation for retrofit.
- Additionally the project incorporated renewables and demonstrate how to optimise the use of a SunAmp heat battery as a combi-boiler pre-heat solution for decarbonisation involving Worcester Bosch.

Green / Carbon / Knowledge / Community / Occupant benefits resulting:

- Findings of the project have been used to demonstrate net zero transition for the purposes of upskilling and reskilling via the published and educational outputs.
- Case study outputs have been structured in a way that will enable the decision-making process of others wishing to invest in upgrade and extension works.
- Owner occupiers can access the information created in a number of different formats made available to inform future net zero transition upgrade decisions.
- The range of outputs have been brought together in a consolidate manner that are capable of being used for standalone CPD or that can be incorporated into existing educational offering. Both of these approaches have been piloted with success and the outputs can be further distributed via Skills Knowledge Hub being established with CeNZ High DB funding support.

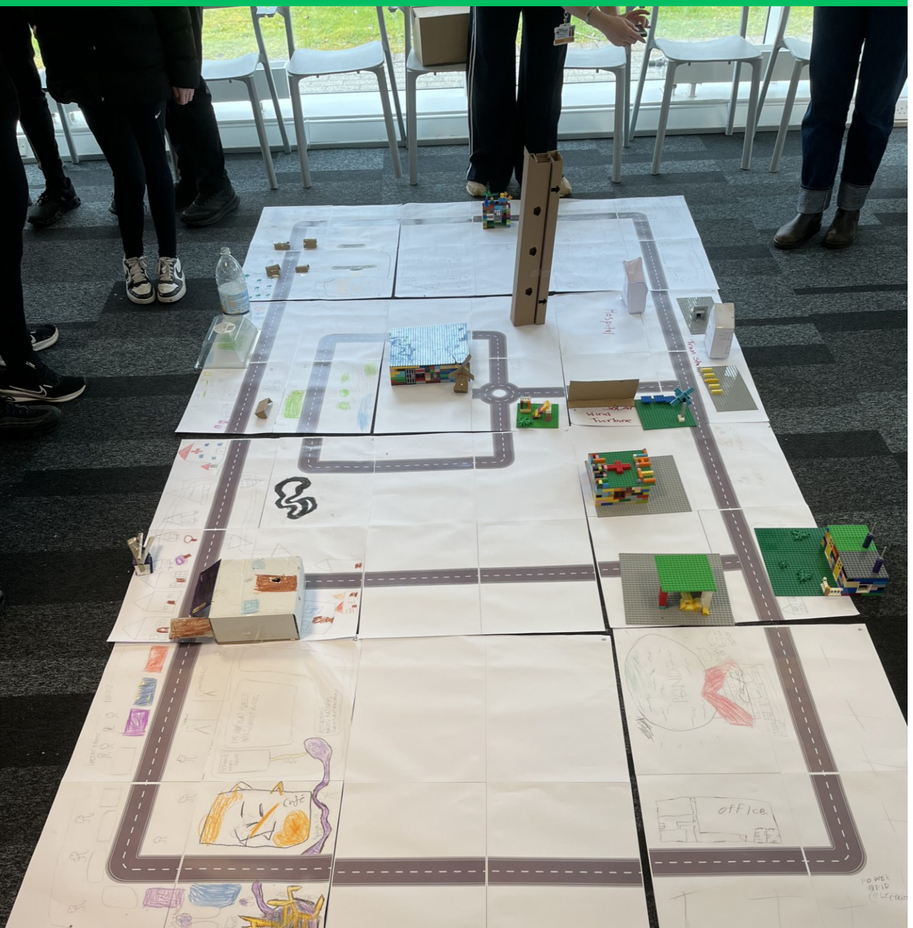
Next steps

Now that the range of outputs for the project have been completed the next proposed step is to have all this information fully consolidated and either contained or sign posted today via the development of the Skills Knowledge Hub. By centrally hosting the information and linking to relevant external sources the project outputs will be more readily accessible which will facilitate full impact delivery.

Transforming Timber - Retrofit (from laboratory prototype into real homes)

Thematic Working Group VI

EDI, Skills and Training



NextGen Summit

September 2025 – March 2026

The Next Gen programme successfully delivered an engaging, inclusive learning experience for 60 pupils from ASN schools in North Lanarkshire who participated in a full-day hands-on design challenge, developing knowledge of sustainable construction, teamwork and problem-solving skills. The programme successfully increased awareness, supporting equity, diversity and inclusion objectives.

Feedback highlighted strong engagement with practical, hands-on learning, as well as the value of collaboration and peer interaction across schools. Participants demonstrated increased confidence, improved understanding of materials and construction concepts, and high levels of enjoyment throughout the day.

The project highlights the value of experiential learning and cross-sector collaboration in addressing skills gaps, inspiring the next generation, particularly to consider pathways into construction and the built environment that they may not have previously seen as accessible or relevant. It also demonstrates how early, targeted engagement can help build confidence, raise aspirations, and create more inclusive talent pipelines for the sector.

Main outcomes

The project achieved its primary objective of delivering an inclusive, sustainability-focused learning experience for young people. Despite the change in delivery approach following the withdrawal of DEC due to scheduling limitations, the programme was successfully adapted without compromising learning outcomes or project costs.

Key outcomes include

- Delivery of full-day workshop to 60+ S1 pupils from ASN schools across North Lanarkshire.
- Increased awareness of sustainable materials, design, and green careers.
- Strengthened collaboration between schools, local authority and industry partners.
- Positive feedback from industry, sponsors, and educators, highlighting improved confidence, teamwork and engagement.

"I learned about different materials and how they function for structures" – pupil from Glencryan School

"It was 10 out of 10. It was fun today!" – pupil from Brannock High School

"I very much enjoyed my first time at BE-ST" – pupil from Glencryan School

Next steps

Building on the success of this delivery, partners intend to refine and scale the programme in the upcoming years across additional ASN/SEND schools and regions.

Future iterations will focus on

- Expanding reach to more schools, particularly in ASN schools in underserved areas.
- Enhancing content with net-zero and retrofit themes

"Very enjoyable and educational visit. Will encourage others to attend in the future." – Glencryan School

"Getting to use the practical skills… and the hands-on activity… was the most valuable part." – Dalziel High School

"Sharing their ideas with other schools and working together." – Glencryan School

"The learners were able to problem solve as teams… great to see them engaged and helping one another." – Caldervale High School

NextGen Summit

Thematic Working Group VI

EDI, Skills and Training

START Hackathon

November 2025 – February 2026

The START Skills Hackathon brought together secondary school students from across Edinburgh for an intensive, hands-on entrepreneurship experience. Hosted at the Edinburgh Futures Institute, the Centre provided venue support and our PDRA as a judge for the workshop.

The Hackathon aimed to introduce students to entrepreneurial thinking while encouraging them to explore real-world challenges, including those linked to the built environment and sustainability. Students arrived with no prior entrepreneurship training and were guided through a structured process of problem identification, user engagement, ideation and solution development. Over the course of a single day the pupils worked collaboratively in teams to develop and pitch innovative ideas, with support from mentors, industry representatives and peers.

Main outcomes

The hackathon demonstrated strong outcomes in both general entrepreneurial skills and sector-specific engagement relevant to CeNZ-HighDB's focus areas.

Overall student feedback indicated

- 86% reported improved understanding of how entrepreneurship benefits their future
- 88% expressed interest in learning more about entrepreneurship
- 75% felt confident in their creativity to solve problems
- 73% gained valuable connections for their future careers
- 70% of students showed interest in pursuing future study or careers in these sectors
- 85% agreed the hackathon helped them see how their ideas could translate into careers or businesses within the built environment or net-zero space

"The hackathon was the highlight of START's journey — a true reflection of what's possible through the support of dedicated mentors and judges. Students left energised, inspired, and ready to turn their ideas into action."

— Phil, Founder of START

START Hackathon, Edinburgh Futures Institute


CeNZ-HighDB