



University of Glasgow Scotland, UK

Digital Twin of the Western
Campus Created Through
a Living Lab Estates and
Student Collaboration.



UNIVERSITY OF GLASGOW
SCOTLAND, UK

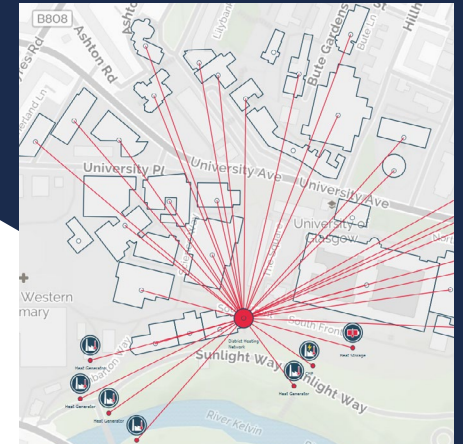
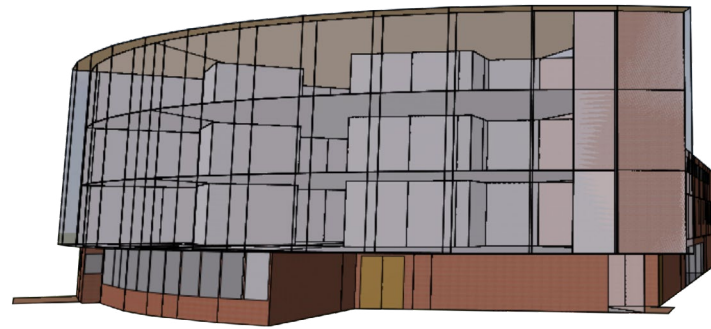
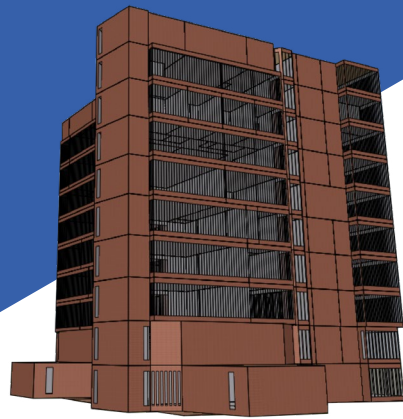
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The University of Glasgow and IES partnership started in early 2019 when IES was engaged through the University's £1bn Smart Campus Initiative to develop a Digital Twin of the Western Campus and three of the most intensely used student buildings.

Currently undergoing a massive re-development to encompass the 14-acre site of the old Western Infirmary, the new campus will sit at the heart of the city's cultural quarter, creating a new public route between the University and the Kelvingrove, Kelvinhall and Riverside museums. The University also has a tough 2030 net-zero target.

IES was already working with the University on the EDigit2Life project focused on creating Digital Twins of the new buildings using their recently launched Intelligent Communities Lifecycle (ICL) platform. However, the Estates team felt it was equally as important to encompass the existing estate buildings, as creating Digital Twins of existing buildings is a much bigger challenge. With older buildings consuming more energy and making up the biggest proportion of the built environment, addressing them from a climate change perspective is particularly important.

Working in partnership was paramount when developing the Digital Twin as the University's Estates team are experts in their buildings and the electronic systems used to control them, whilst IES provide building modelling, twinning expertise and the systems to allow enhanced interrogation for the production of useful and reliable results.

The Estates team also has a long history of working with MEng and MSc students from the Engineering department, in order to build models, gather information and undertake first pass assessments of energy and sustainability initiatives. So a Living Lab collaboration between IES, the School of Engineering and the Estates department was the obvious choice to bring together applied teaching, research and zero-carbon building/campus management within one platform.

"Digital Twinning of buildings and networks is an exciting new space for energy management and we are really pleased to be working with a great team of people in IES to show the art of the possible using our estate both old and new."

Gillian Brown
Energy Manager, University of Glasgow

Using their ICL Digital Twin platform, IES first created a campus level digital twin for the buildings and the district heating system, using their iCD masterplanning and iVN network modelling tools. This encompassed time series electrical and heat demand data generated for each consuming element. The model is being used to understand and set the most efficient boiler sequencing for different periods of the academic and seasonal calendar.

Then three existing campus buildings, the Library, Rankin and Boyd Orr, had detailed calibrated digital twins created in order to enable intelligent energy management, and answer key questions around suitable improvement options. Live operational data from each building was gathered using iSCAN and connected to physics-based VE simulation models.

Finally, a live bespoke command centre of iDashboards, AI, Machine Learning algorithms and an iCIM 3D campus engagement and collaboration model is being created to house and communicate all the project information, as well as deliver detailed insight on building operation that will highlight hidden energy wastage and enable smart operational changes to be made.

The University Library has the highest footfall and is a good representation of what is happening on campus, with lots of replicable areas that can be used as benchmarks, such as catering, research, music, archive storage, and office spaces. A number of areas have been recently refurbished so the Estates team plans to use the project to look at operational level energy conservation options for individual floors.

The Rankin building, as well as being a School of Engineering building, has not been recently refurbished. The BMS does not control it as well as they would like, and with little sub metering and minimal understanding of loads and where energy goes, the building is prone to overheating. Key questions that the Estates team aims to answer through the project are: what could be achieved with a full refurbishment or would a rebuild be better, what operational control improvements are possible, and where power is actually used, alongside an understanding of the high computer and lab loads.

Finally, the Boyd Orr building is interesting as it will be attached in three places to the new JMS building. A complex 1960s/70s building with teaching, labs, offices, large lecture theatres, cafes, and a greenhouse, it has been overlaid and had new windows put in as part of the project. The Estates team wants to investigate how best to adjust and control the heating system now its thermal capacity has been improved, while also adjusting for the connections to the new high-performing JMS building. They also want to understand the benefits that could be achieved if they were to undertake a partial or full refurbishment.

The COVID-19 pandemic has created some challenges during the project, but also opportunities. Initial calibration of the detailed building level Digital Twins was challenging as the meters from the District Heating system had not been working and there was no historic heat data, only data from 2020. This was not ideal as it didn't represent normal running. While there was historic electric data, the lack of metering in some buildings and historic labelling of supply meters that didn't match to current use, led to challenges. However, SSE really worked in partnership with the University and IES to ensure a good connection of live BMS data into the Digital Twin.

Equally, the Digital Twin has allowed the Estates and Finance team to communicate effectively with Senior Management and demonstrate why energy spend did not reduce as much as they had assumed it would during the COVID-19 campus shutdown.

"This is an ongoing project and partnership. A Digital Twin is a living system and requires consistent and continued development, therefore a strong partnership is important to ensure full benefits can be realised both now and in the future. The plan is to bring more buildings into the Digital Twin and create a staged Zero-Carbon plan on how the University will target the right projects, in the right buildings in order to meet our 2030 target."

Gillian Brown
Energy Manager, University of Glasgow

This project is ongoing and the case study will be updated with energy conservation outcomes as it progresses.

KEY FACTS

- Digital Twin of Western Campus
- iVN District Heating Network Model
- Three detailed Building Digital Twins
- Living Lab Academic Collaboration
- Live Command Centre
- 2030 Net-Zero Target





PLEASE CONTACT

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