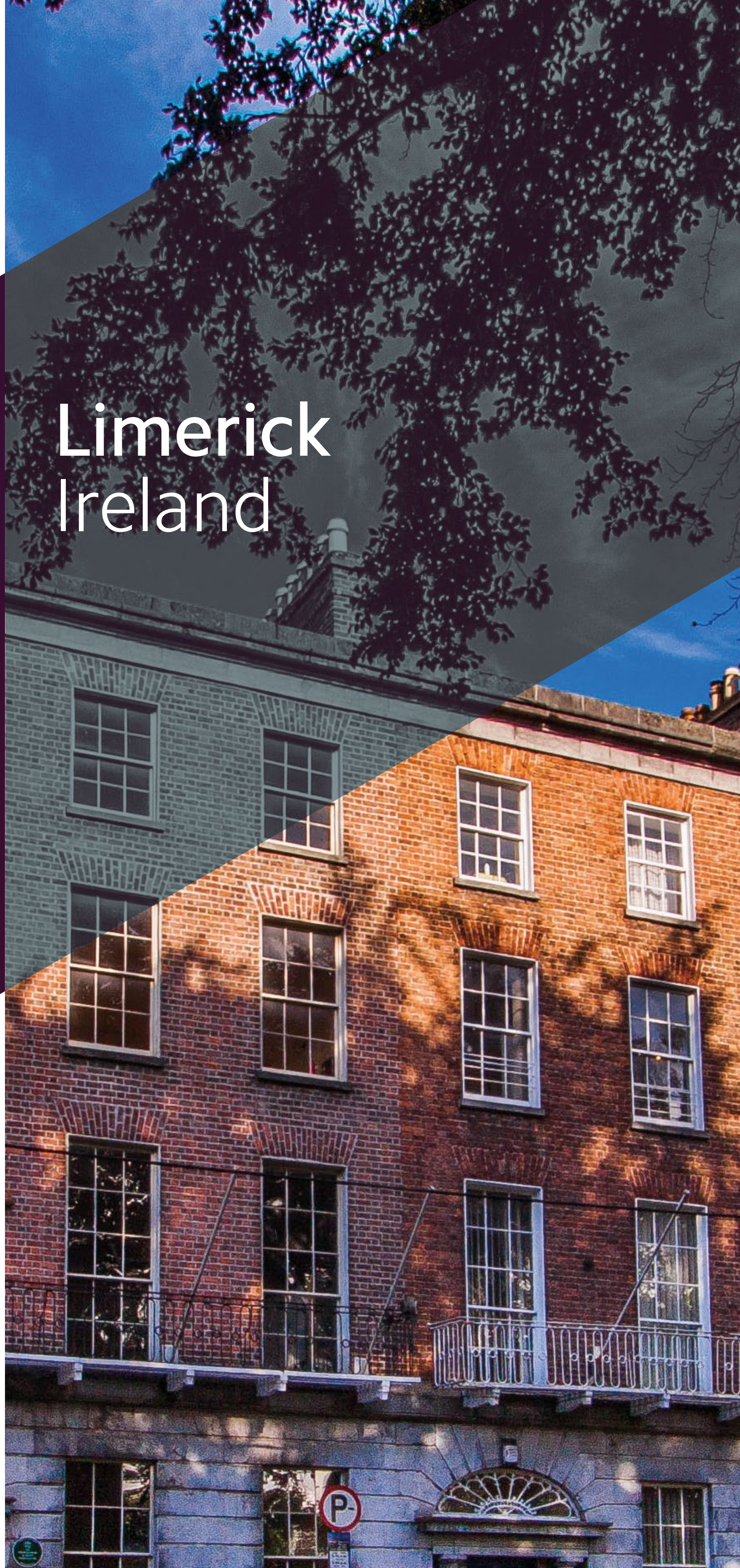
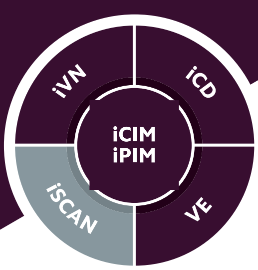
Limerick
Ireland



As part of the pioneering EU Horizon 2020 funded +CityxChange (Positive City Exchange) project, IES have been using their ICL Digital Twin technology to help create Limerick's first Positive Energy Block.



LIMERICK
IRELAND

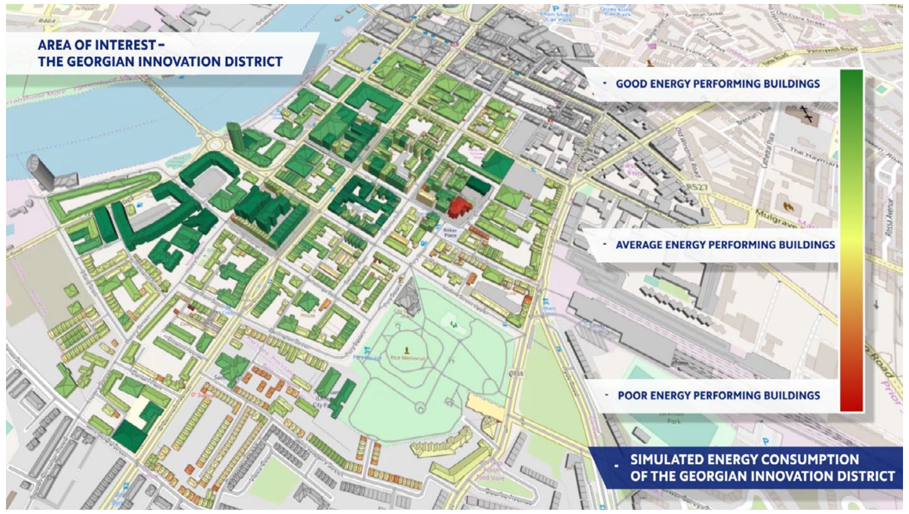
SECTOR: ICL

DATE: April 2020

COUNTRY: Ireland

www.iesve.com/icl

Limerick is one of two Lighthouse Cities selected by the European Union Horizon 2020 +CityxChange project. Together with fellow Lighthouse City, Trondheim, and Follower Cities, Alba Iulia, Pisek, Võru, Smolyan and Sestao, their ambition is to achieve a sustainable urban ecosystem with zero emissions and to establish a 100% renewable energy city-region by 2050.



During the first phase of the project, IES have been applying their innovative ICL digital twin technology and expertise to support the creation of a Positive Energy Block (PEB) within Limerick's Georgian innovation district.

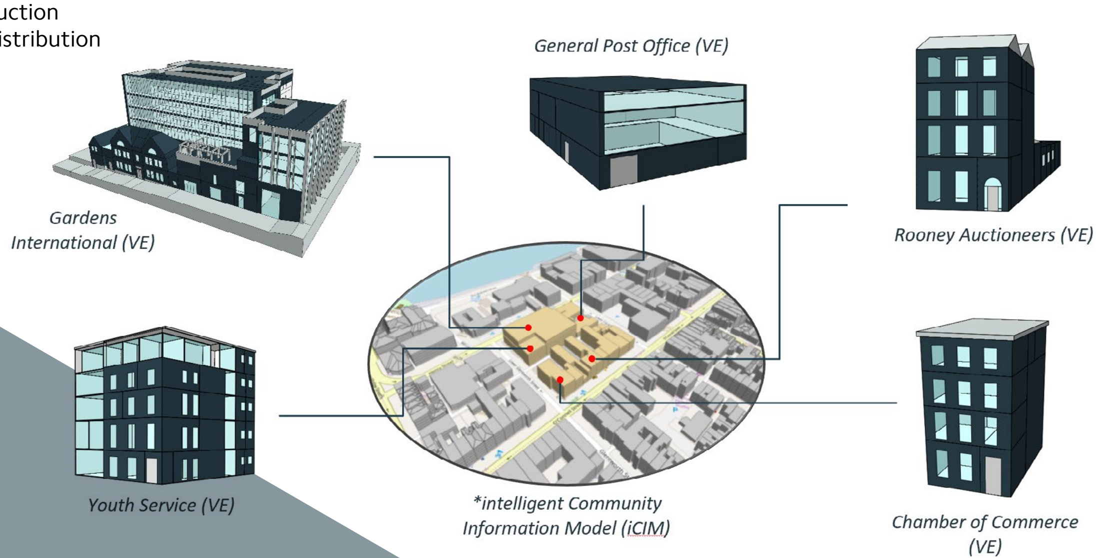
The IES team began their analysis with the creation of an intelligent Community Information Model (iCIM) covering the whole Georgian Innovation District. Using the iCD tool, they were able to create the model very quickly by importing data from a shapefile, provided by Limerick City & County Council, to enrich existing data from Open Street Maps, together with other available socio-economic data. This provided initial top-level understanding of CO_2 production and energy consumption/distribution at a district level.

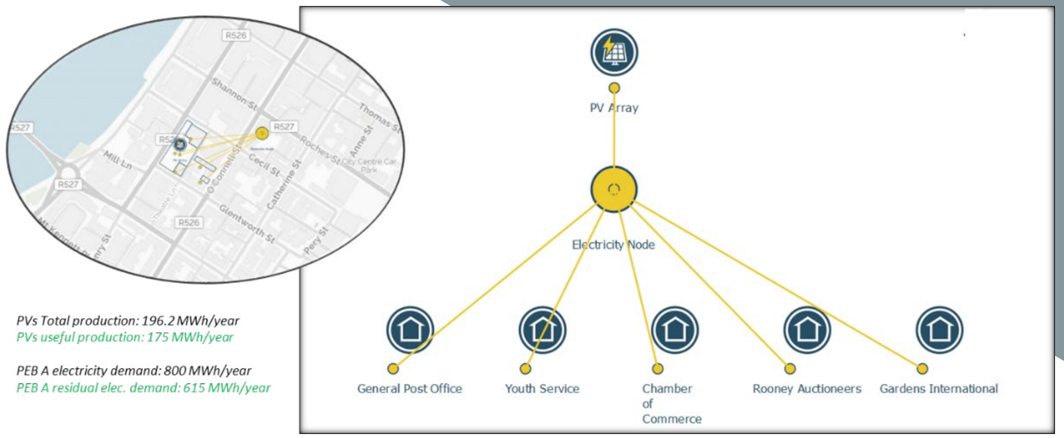
Following this analysis, a block of 5 buildings were chosen to be the first PEB because they had better than average energy efficiency, with engaged and willing participants. The buildings are: a LEED Gold certified office building (Gardens International); a youth services centre; a general post office; an auctioneers; and the city's Chamber of Commerce.

From there, IES used a five-step process to perform more detailed analysis of the buildings identified for the PEB, the aim being to test, identify and group interventions that would aid the transition towards creating Net-Zero Energy Buildings (NZEB).

For each building, the process began with the creation of a Digital Twin using the IES Virtual Environment (IESVE). These virtual energy models were created to replicate the actual buildings as closely as possible, incorporating real world data from the actual buildings, in the form of monthly and bi-monthly energy bills (a process known as calibration). Where real life data was limited or absent, IES were able to fill the missing data gaps using physics-based simulation, integrating a Machine Learning regression algorithm – a key distinction of the IES digital twin technology.

The second step in the process was to identify simple operational measures which the building owners could implement at little or no cost, but which could still result in significant savings (e.g. heating controls, individual room thermostats, reduction of the DHW supply temperature). By implementing these simple operational measures across the five buildings, it was determined that a collective saving of 79MWh/year, amounting to a 5% energy saving, could be achieved. However, it should be noted that, notwithstanding the Gardens International building (which, as a recently completed LEED Gold certified building, offered very limited savings opportunities) a more substantial energy saving of 13% over baseline across the other four buildings combined could be noted.





The third stage involved the assessment of shallow retrofit measures. This included improvements to building airtightness, upgrades to LED lighting systems and dimming controls, as well as boiler upgrades to improve seasonal efficiency and size adjustments. When considered in conjunction with the operational interventions, these shallow retrofit measures brought the combined savings up to 12% (inclusive of Gardens International) and 31% (without).

The fourth stage considered the impact of deeper renovation measures, whilst also considering given listed building restrictions. Measures for historic and conservation buildings were proposed including attic insulation, ground floor insulation, window retrofit (pane only) and changing the gas boiler to an air to water heat pump. When added sequentially with the previous interventions, the total calculated savings amounted to 23% (inclusive of Gardens International) and a significant 64% (without). This would improve the efficiency of the block to a high enough level to reduce the local production required to create a positive annual balance, as well as ensuring the effectiveness of any installed local production.

"Working with IES on Positive City Exchange has been a good example of the innovative cooperation H2020 projects are designed to promote. While the project itself is designed to achieve energy efficiency and production in an urban setting, this isn't possible without accurate modelling in a virtual world to narrow down the options available to trial in the real world. By taking an iterative approach to creating the models of Georgian buildings in Limerick, IES has brought us closer to adapting the historic fabric of our city centre for a carbon neutral future."

Terrence Connolly
Project Manager, Limerick City & County Council

Finally, the fifth stage considered the integration of Renewable Energy Sources (RES), in this case, the placement of photovoltaic (PV) panels on two thirds of the collective roof space. This addition was found to cover 14% of the remaining energy demand of the block. Added up to the previous measures, this would mean decreasing the total energy delivered to the block from external, non-renewable sources by 34% of the remaining energy of the block. All of these measures combined will reduce the total electricity demand for the block to 0.6GHW/yr, which will then be off-set by a new innovative tidal turbine placed in the nearby river. This is estimated to generate 1GWh/yr, enabling the block to produce 0.4GWh/yr in total and therefore become a Positive Energy Block.

Significantly, the five-step process outlined is one which can be replicated by any other district, community or city to help create more positive energy blocks and accelerate progress towards net-zero targets.

As the project progresses, IES will collaborate with project partners to integrate a number of new and innovative features, such as socio-economic modelling, within a real-time operational energy trading and demand response platform. This will ensure that scenarios and analysis conducted for Limerick's Bold City Vision in 2050 not only takes energy into account, but also looks at the impacts on economic growth and the wellbeing of citizens.

KEY FACTS:

- ICL technology used to create a Positive Energy Block of 5 buildings
- Repeatable 5-step process
- First 4 steps improved block energy demand by 23%
- Final step integrates local renewable energy sources to meet reduced energy requirements
- Addition of PV panels reduces block energy demand to 0.6GHW/yr
- Tidal turbine generates 1GWh/yr, resulting in surplus production of 0.4GWh/yr i.e. a Positive Energy Block

Positive Energy Block A - Interventions Summary

	Baseline Model (MWh)	All Operational Intervention (MWh)	Operational & Shallow (MWh)	Operational & Shallow & Deep (MWh)	With PVs (MWh)
PEB A	1,572	1,494	1,382	1,215	1,040
PEB A (without Gardens Intl)	497	434	345	178	3

PLEASE CONTACT

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