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# Re-making the energy profile of (Irish) market towns: as if science matters

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# Re-making the energy profile of (Irish) market towns: as if science matters.

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**Abstract.** Reduction of building-related carbon emissions within Ireland is predicated on the implementation of an EU mandated nZEB energy standard which defaults to 'cost optimality' generic solutions such as an A3 rating for new builds, and a B2 rating for renovations. It is estimated that 500,000 existing buildings will need to be refurbished in this way, within 10 years and that 60% of these are urban in nature. Despite such extensive resource use, the nZEB standard is not set to significantly reduce operational energy which will, in conjunction with 950,000 new electric cars being operational by 2030, place a significant burden on our increasingly decarbonised electrical power grid. Such challenges present opportunities. One opportunity is to significantly expand the renewable capacity of the grid and strengthen its European interconnectivity, while another is to remake our rural market towns and villages with energy considerations and fabric at the centre of the process. Doing both offers an optimal solution. We can amplify societal benefits, community empowerment with grid resilience and community ownership of utilities, efficient local use of energy and low carbon transport. It so doing we ensure buildings and power grid, capable of effectively serving our 2050 energy needs.

## 1. Introduction.

The Irish market town and village has lost its traditional role as the commercial and social focus of its community. This is an international phenomenon, well documented by sociologists like Robert D. Putman and urban theorists like Jane Jacobs [1]. The lost is greater than simple commerciality, but rather reflects what has been a long term hollowing out of social engagement, and a lost opportunity to live a resilient low carbon lifestyle, either 'above the shop' or in established communities. While Ireland contributes only 0.1% to global carbon emissions and 1.3% toward European emissions (2009-2018), nevertheless our average carbon footprint is c.17.5 tonnes per person, compared to an international average of 4.8 tonnes, (2017). Additionally Irish dwellings have the fourth largest average floor area (104 m2) in the EU, and the greatest number of rooms (5.6) per person, (2002). In 2016 the average size of a detached house built in Ireland was 241sqm, which reflected a floor area growth of 60% since 2002. In 2018 Ireland ranked second-last across all EU countries in regard to achieving our renewable energy targets for 2020, and our energy consumption per dwelling is among the highest in Europe [2] . Clearly Ireland need to radically change the way it uses energy. The residential sector is key to this. It currently accounts for 27% of all energy usage in the country emitting c. 10.5 million tonnes of $CO_2$ annually.

After transport, this is the single largest source of emissions. One way of addressing both these emissions collectively, is to repopulate our urban towns and villages through renovation. Since 63.7% of dwellings are in urban areas it makes sense to set ambitious standards for their renovation and reduce dependency on private cars. In Ireland, as an EU member state we assess the energy performance of buildings through the nearly Zero Energy Building (nZEB) standard. This standard is blind to community benefits, [3].

## 2. The challenge of the nZEB performance metric.

The nZEB standard is an asset rating tool which facilitates new buildings having a predictable level of energy operational efficiency. However this can be quite inaccurate as indicated in research by (i) Timm, (ii) Colclough, and (iii) O Riain and Harrison, all of whom identify sub-optimal prediction, due to a variety of reasons, not least being poor fabric performance. nZEB policy is calibrated by reference to cost optimality and energy use only, as required by the EU EPBD 2010/31 and as defined by regulation No 244/2012c. Because the nZEB standard measures operational energy only, it fails to recognise the interdependence of non-operational issues, including fabric upgrade and embodied carbon. Significant resources are required to construct low energy buildings, and the embodied energy of those resources are increasingly a dominant feature of such buildings, in some cases being substantially greater than the operational energy used over their lifetime. In response to the inadequacy of cost optimality in measuring these embodied carbons, Moran et al., (2017) [4] considered this question across a range of Life Cycle Assessment (LCA) softwares, and found unequivocally that high performing fabric solutions are an optimal renovation solution for a domestic semi-detached house, or end of terrace house, in a cool temperate climate like Ireland. They note also the need for a more robust assessment methodology for evaluating sustainability, rather than relying on the cost optimal nZEB methodology alone. Chastas et al., (2017 & 2020), [5] affirm that LCAs should be considered in energy efficiency regulations along with further standardization of measurements. It is these metrics that point unequivocally toward the need to renovate out traditional towns and villages through the lens of LCA's. This is important as it is acknowledged that renovation is key to addressing climate change and grid change, [6].

## 3. The win-win of urban renovation.

In Ireland the typical (town) household carbon footprint is 11.6 $CO_2$-eq t/year and is dominated by three aspects of life, private transport (19%), food (20%) and housing energy (17%) [7]. Across Europe town and city living is estimated to give rise to an immediate household reduced carbon footprint of 3% and 7% respectively, over rural living. This is before we introduce possibilities of energy-plus developments, smart local power grids, and PV and battery storage on the demand side of the grid [8]. In Ireland presently over 250,000 properties lie vacant, this is a vast resource, [9]. Data collected by Cork City Council, in support of their 2015 'Living Cities' initiative, identified some 140 vacant upper floors in the city centre alone having the potential to create up to 400 new homes. Since its launch, the scheme has seen the Cork city centre population increase by 19% and residential vacancy decrease by 26%. Studies have suggested that a comprehensive programme of such renovation across Ireland, could create between 23,000-32,000 new direct jobs, [10]. Concentrating redevelopment efforts into village and town centre sites has a number of other direct benefits also. The renovation of buildings protects their embodied carbon, along with their social and cultural history. It avoids demolition, which in itself is a labour and energy intensive activity; of the 14 million tonnes of waste generated in Ireland in 2018, 44% was construction related, of which only 9% lent itself to up-recycling. It can take approximately eighty tonnes of carbon emissions to build a typical two-bed cottage style house in the UK, as noted by Berners-Lee (2010), while refurbishing a similar type of cottage, from the 1930's/40's, would attract a carbon budget as low as eight tonnes. Even allowing for calculation variables, it is clear that demolishing older buildings can no longer be considered unimportant to the global carbon challenge. The greenest building therefore is one that already exists, albeit requiring renovation.

## 4. Renovating the existing buildings of our market towns.

The question is however calibrating the energy standard necessary for such renovations to optimise resource use and avoid 'lock-in'. As many as 1.5 million Irish homes are considered energy inefficient, requiring significant upgrade work between now and 2050 . This issue is even more acute in the private rental market where 55% of private rented dwellings have a BER of D or lower. Improving the energy efficiency performance of the private rental sector is hence important in alleviating energy poverty. Also because the annual rate of renovation is only averaging 1% to 2% across the EU, 70% of our existing buildings will still be operational in 2050, at a time when their energy profile needs to be zero carbon in use. Since the nZEB metric can be up to 80% poorer in overall performance terms, relative to standards such as Passivhaus (PH), particularly related to fabric, [11], we are losing the opportunity of reducing peak grid energy demand by optimising energy-plus developments, albethey new or renovated, with PV and battery storage linked to EV usage; evidenced by the Core4Grid research project in the UK, (2020).

## 5. Renovation is a long term policy.

If our renovation policies are to operate in an optimal way, with integral PH fabric performance, then it must be with a long term aim similar to policies pursued in Brussels (2005 to 2015) as part of their PH initiative. Over reliance on wind and PV to decarbonise our electrical power grid, without consideration of fabric performance, is to lose the benefit of such buildings to act as local 'virtual power stations' and 'energy batteries' to support EV, and compliment as needed the surrounding poorly performing fabric of our market towns. This makes sense scientifically and symbolically so as to (a) achieve the benefit of 'early movement', (b) buy time to allocate resources to deep-renovate our older buildings, and (c) contribute to minimising the peak loads required of our electrical grid. If climate change is to be tackled within our built environment, *as if science matters,* then the difficult renovations and reuse of our urban fabric is necessary and needs to be policy driven. The way ahead is clear. 'Energy policy' needs to be re-interpolated as 'carbon policy', 'cost optimality' needs to reflect 'carbon optimality', and all buildings in urban settings, in particular new ones, need to be developed to an energy-plus standard cohesively designed from fabric, through to PV, battery and thermal storage with all supporting ancillary services.

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