RMI retro

Building low carbon communities through retrofit of

PLACES, NEIGHBOURHOODS AND BUILDINGS

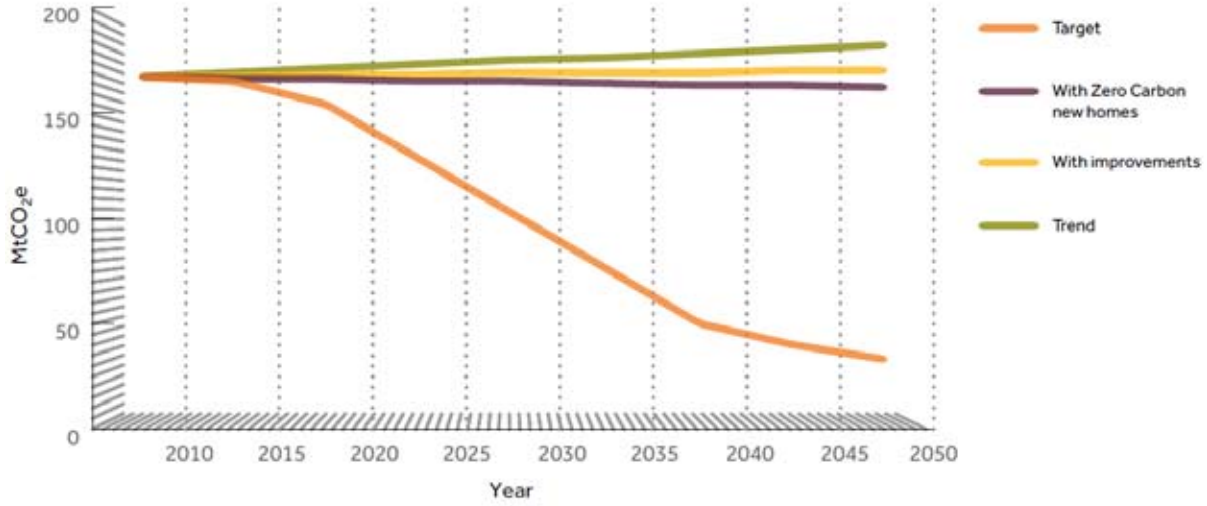


Fig.1 UK domestic GHG emissions and the route to 80% reduction by 2050 (Source: DECC 2011)

How can we transform our existing built environment to create low carbon sustainable communities?

With UK Government targets to reduce CO_2 emissions in the built environment by 80% by 2050 the Green Deal is an important step in the right direction. However achieving deep reductions in CO_2 emissions will require a holistic approach which considers community engagement, retrofit and renewable energy on an area wide basis. The challenge of decarbonising our existing built environment and creating places that are *'fit for purpose'* in the 21st century will require much greater integration between the disciplines of Architecture, Building Engineering, Planning and Energy as the impacts of climate change are increasingly felt and fossil fuels become less readily available. With these challenges in mind RMI Architects have set up **RMI Retro**, a multi-discilinary collaboration which combines best practice and research and is focused on the challenge of reducing CO_2 emissions in the built environment and creating low carbon sustainable communities.

RMI retro

Introduction

RMI Retro is a collaboration of industry and academic research focused on the challenge of how to decarbonise existing buildings and places and make the transition to low carbon sustainable communities. The collaboration is led by RMI Architects with SLR Consulting, Caldwell Consulting and the Centre for Sustainable Technology at the University of Ulster. The collective aim is to combine practice and research and provide a coherent integrated consultancy service in how to reduce carbon emissions in the built environment, reduce dependency on fossil fuels and build stronger, healthier and more resilient communities.

Design Consultancy Services

Based on practice and research RMI Retro offers coherent and fully integrated consultancy service across the retrofit and retroplanning agenda. The collaboration brings together skills and expertise to assist local authorities, registered social landlords and development agencies in designing strategies for building scale retrofit and area based retroplanning, involving village, town and city scale decarbonisation and sustainable development strategies.

Places

- Urban Design, Planning & Masterplanning
- Neighbourhood Regeneration
- Retroplanning (Area based Retrofit Strategies)
- Renewable Energy Strategies
- Community Engagement Strategies
- BREEAM Communities Assessment
- Environmental Impact Assessment

Neighbourhoods & Streets

- Domestic Retrofit Strategies
- DEC; SAP; CSH Assessments
- Green Deal Coordination Services

Buildings

- Architectural and Building Services Design
- Energy & Environmental Auditing
- Building Retrofit & Refurbishment
- EPC; SBEM & BREEAM Assessments
- Dynamic Simulation Modelling

Places

Neighbourhoods

Buildings

Masterplanning a low carbon City

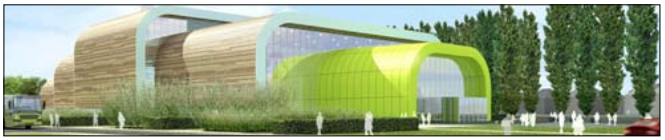
Belfast City Masterplan

SLR was commissioned by Belfast City Council to prepare a Masterplan for the city of Belfast. The strategy identifies policy priorities and strategic projects for the period until 2020. Centred on the sustainable development philosophy embedded in the core city movement, the plan sets out the smart develop-ment principles that will inform the selection of strategic project interventions that will lead the city's regeneration.

Among the policy priorities the plan recommended a shift in emphasis towards opportunities in the low carbon economy and improving environmental quality and competiveness .

The 'Eco city' objective focuses on the economic and environmental advantages of shifting the economic base towards climate change mitigation and adaptation, developing secure and locally available sources of renewable energy and improving energy efficiency.

By promoting a bio economy hub at the City's North Foreshore site, the strategy also provides the basis for a structured approach to developing a new internationally competitive business sector in low carbon economy enterprises – renewables, recycling, energy recovery and environmental management.



Belfast City Masterplan

Retroplanning a carbon neutral Village

Saintfield Community Energy Plan

The Saintfield Community Energy Plan is an ongoing research project led by Rob Jennings of RMI Architects which investigates how an existing village on the outskirts of Belfast could become carbon neutral by 2020 through Community Engagement; Building Retrofit and locally sourced Renewable Energy. The research looks across best practice in behavioural change strategies at the community level, social networking possibilities, area based retrofit strategies and cooperative renewable energy projects across Europe. The project has led to the development of a new methodology for creating sustainable communities in Northern Ireland and presently discussions are taking place with the project partners to develop funding streams to test the methodology in a major pilot project.

10% reduction in CO_2 emissions from Community Engagement

25% reduction in CO_2 emissions from Building Retrofit

65% reduction in CO_2 emissions by converting to locally sourced renewable energy

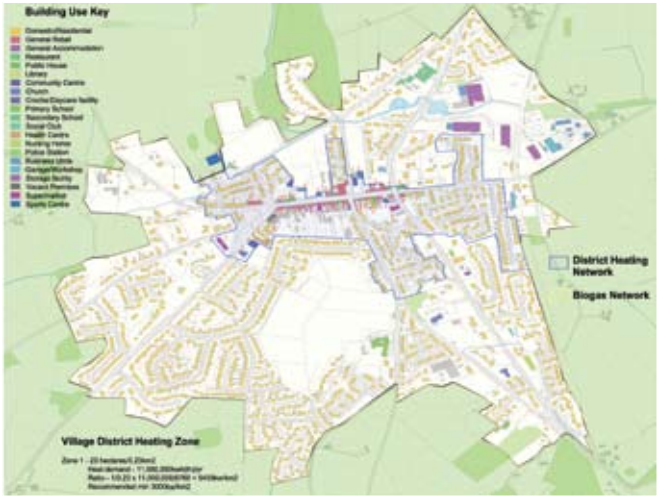


Fig.2 Saintfield District Heating Map

The renewable energy strategy involves the generation of biogas from a new farm based anaerobic digestion facility using grass silage, manure and waste food products as feedstock. The biogas is piped to a 1MW CHP in the village which provides electricity and heat to the village centre via a district heating network. The outer parts of the village are served by a new gas network with biogas upgraded to biomethane and injected to the grid and electricity from 2 wind turbines offsets the remaining electricity consumption.

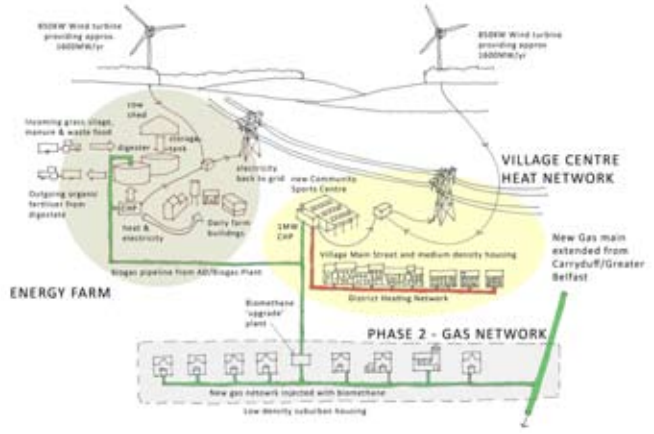


Fig.3 Saintfield Renewable Energy Strategy

Neighbourhoods & Streets

Antrim Road Area of Belfast

Fig.4 Green Deal Retrofit Process

At the heart of the Green Deal the intention is to stimulate the retrofit of neighbourhoods and streets, where economies of scale can begin to take effect. RMI Architects have been involved in the whole house retrofit of existing houses and the building of new terrace houses in the Antrim Road area of Belfast for Clanmil Housing Association. Carbon emissions from the retrofitted dwellings were dramatically reduced through improved air-tightness, increased insulation, avoidance of thermal bridging and provision of mechanical ventilation and heat recovery units.

New low carbon developments can offer opportunities to catalyse more sustainable living in existing neighbourhoods through provision of shared services, renewable energy, district heating systems, green and blue infrastruture, cycling provision, car-pooling etc. When undertaking new-build or infill projects we endeavour to explore and encourage engagement with existing communities as an essential component of building low carbon sustainable communities.

Exploring new typologies of urban blocks in Newham for Peabody Housing

New-build/infill projects as catalyst for wider sustainability initiatives

The Terrace House Retrofit Project

The major project arising from the infrastructure development funded by the Department of Employment and Learning for Northern Ireland and the University of Ulster under the Research Capital Investment Fund objectives was the completion of "Terrace Street" opened by DELNI Minister Dr Stephen Farry MLA on 25 January 2012. "Terrace Street" was devised to allow the development of a refurbishment strategy that can demonstrate to all stakeholders the potential pathways and intended and unintended consequences of retrofitting a challenging housing type. "Terrace Street" consists of two solid wall dwellings originally built in Belfast in 1900. Pre- 1919 solid wall types represent some 14% of Northern Ireland's housing stock and therefore represent the greatest challenge in terms of retrofit.

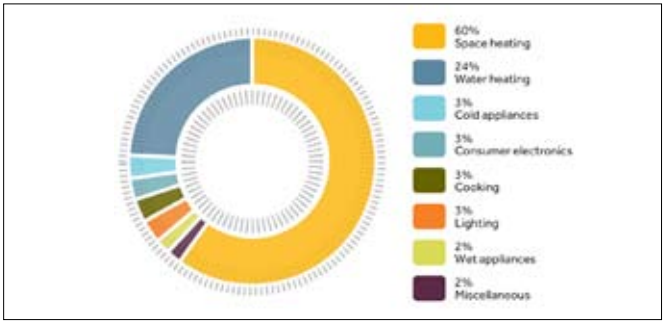


Fig.5 Understanding occupant use patterns is crucial to successful retrofit

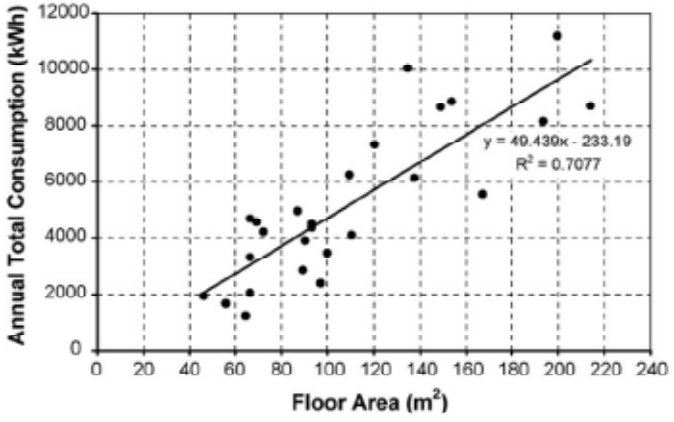


Fig.6 Yohannis et al 2010 - Energy Consumption as function of floor area

The *'Terrace'* at University of Ulster is used to test retrofit possibilities

Thermographic imaging of existing terraces to identify heat loss 'cold spots'

The University of Ulster's Centre for Sustainable Technologies has been at the forefront of developing cost effective new and renewable energy systems appropriate for the domestic retrofit market, such as solar water heaters, advanced glazing systems, heat pumps and energy storage technologies that are promising in terms of challenging the fuel poverty agenda. One example is the SolaCatcher, a low cost passive solar water heater designed specifically for pre-heating domestic hot water.

The Solar Catcher

BUILDINGS: Non-Domestic (Completed Projects)

Non-Domestic Retrofit

The 1.8 million non-domestic buildings in the UK account for around 17% of CO_2 emissions. As the cost of fossil fuels continues to rise and UK legislation and taxation aimed at reducing CO_2 emissions increases, retrofitting and converting existing buildings to new uses makes increasing economic and environmental sense.

The RMI Retro team can help building owners determine the reuse possibilities of existing buildings and weigh up the pros and cons of retrofitting in terms of embodied and operational carbon, energy consumption and energy costs. We can carry out environmental and energy audits and develop cost effective and environmentally responsive retrofit strategies which optimise building functionality and occupant comfort.

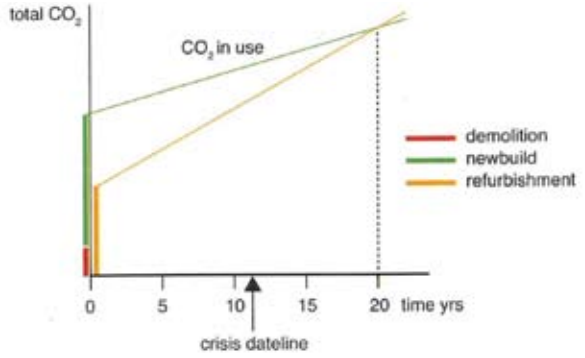


Fig.7 CO_2 Emissions of new-build and retrofit. Source Baker 2009

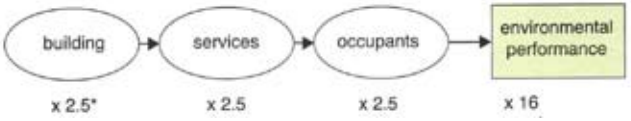


Fig.8 Key Factors in Building Environmental Performance. Source Baker 2009

McMillan Cancer Fund Builidng - £1m retrofit and extension to listed building

Great Patrick Street - £0.9m retrofit and conversion to create offices and gallery

ORS Offices - £0.9m conversion and retrofit to create new solicitors office in Belfast City Centre

Orchard Leisure Centre - £1.5m refurbishment including new biomass boiler and services

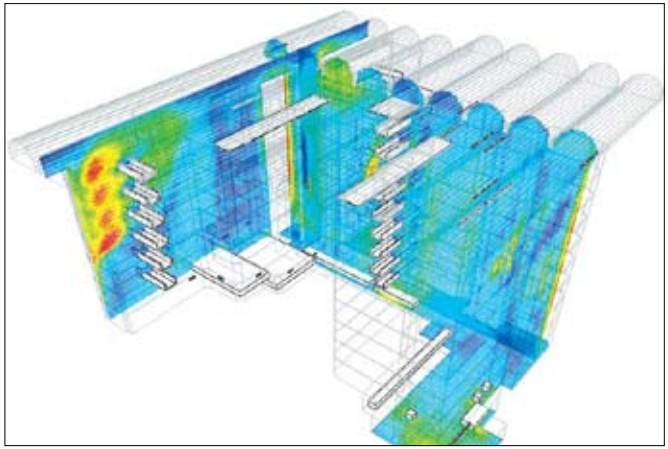
Belfast City Hall - £3m refurbishment including full services renewal to reduce CO_2 emissions

BUILDINGS: Commercial & Office (Work-in-progress)

Innovative Office Retrofit

When considering how to reduce energy consumption and CO_2 emissions in existing non-domestic buildings there is a lack of clear guidance and data to help building owners and design teams formulate appropriate retrofit strategies and prioritise retrofit measures based on cost/benefit analysis. In particular, significantly improving the performance of buildings with low energy and environmental ratings will often involve considerable expenditure, potentially well beyond future savings in energy bills. The challenge is therefore to develop readily useable methods of prioritising and sequencing retrofit measures based on clear cost/benefit analysis and payback periods.

RMI Retro are currently working with Integrated Environmental Solutions (IES)and assisting Belfast City Council in the preparation of proposals for innovative retrofit measures to the Cecil Ward building in Belfast City Centre. The Building is a 7000m2 office building and the aim of the study is to identify the most cost effective means to transform the building from its current EPC 'F' rating to an 'A' rating using IES Dynamic Simulation software.



IES dynamic simulation modelling

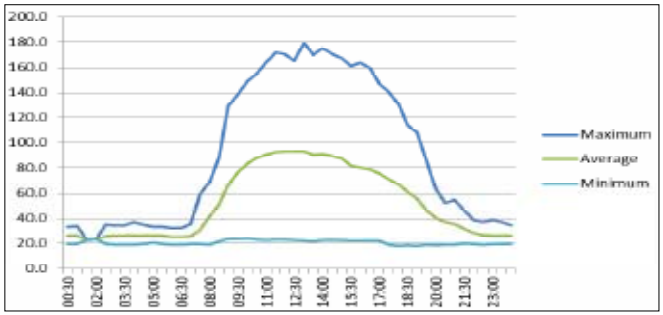


Fig.9 Cecil Ward Building Energy Daily Load Profile

THE RMI RETRO TEAM

RMI Retro aims to combine practice and research and provide a coherent integrated consultancy service across the retrofit and retroplanning agenda. The collaboration brings together skills and expertise able to assist local authorities, registered social landlords and development agencies in designing and delivering retrofit strategies across a range of scales, from one-off buildings up to village, town and city scale decarbonisation and sustainable development strategies. We have a wide network of offices and resources RMI Retro is able to deliver services across the UK and Ireland.

RMI Architects LLP

The RMI Retro Collaboration is led by RMI Architects LLP, an award winning Architectural Practice with offices in Belfast and Glasgow. Founded in 1963 the Practice will mark its 50th anniversary in 2013 and during this time has gained a reputation for high quality, well designed buildings, recognized by numerous RIBA, RIAI and RSUA awards. In recent years new Partner and Sustainability Coordinator Rob Jennings has been developing the Practice's expertise in low carbon, sustainable design and has recently completed an MSc in Advanced Environmental and Energy Studies. Rob leads the RMI Retro collaboration.

RMI are working on projects throughout the Northern Ireland, Scotland and South-East England across the residential, hotel, industrial, conservation, schools and commercial sectors.

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RMI
Robinson McIlwaine Architects LLP

SLR Consulting

SLR is a leading international environmental consultancy with an unrivalled reputation for providing high quality tailored services. With offices in Europe, North America, Australasia, and Africa, SLR is one of a very small number of truly international specialist environmental consultancies. We provide global consultancy advice and support on a wide range of strategic and site-specific issues to a diverse and growing base of business, regulatory and governmental clients. SLR is an environmental consultancy that specialises in the energy, mining & minerals, waste management, planning & development, infrastructure and industrial sectors. We also provide expert sustainability advice and project management support that spans all of these sectors.

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SLR

DESIGN DELIVERY & INNOVATION

RMI Retro is focused on Design, Delivery and Innovation in retrofit and retroplanning and on the challenge of transforming our built environment to meet targets for carbon emissions reductions and creating low carbon sustainable communities. Our strategy is to become a leading Design Consultancy in this emerging sector, able to put together the right combinations of skills and expertise, tailored specifically to project requirements to ensure the delivery of successful outcomes for our clients.

Caldwell Consulting

Caldwell Consulting provide bespoke engineering solutions for building integrated renewable technologies, recently completing the award wining Swiss Centre in London with geo thermal heat pumps, air source heat pumps, CCHP, solar thermal and solar PV serving a combined energy centre operated as an ESCo. We are also registered with the Commissioning Specialists Association (CSA) and can provide Energy modelling to IES level 5. Caldwell Consulting is a leading independent Engineering practice with offices in Belfast, Derry and London.

Caldwell Consulting has operated a Building Services Consultancy for over 45 years and have a dedicated team of environmental specialists i.e. registered BREEAM Assessors for Education, Offices, Bespoke & Industrial, BREEAM AP and Low Carbon Consultants and Energy Assessors.

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Centre for Sustainable Technologies

University of Ulster

The Centre for Sustainable Technologies (CST) at the University of Ulster is the energy research centre of the University of Ulster. Its role is to develop and evaluate new and renewable energy technologies with a focus on cost reduction. A key objective of the centre is in delivering knowledge transfer between academic research and industry. Our research and development activity has real potential to contribute to economic development and competitiveness in Northern Ireland and across the UK. As major suppliers of energy based research in Northern Ireland, CST plays a vital role in producing high quality academic and knowledge based research and development programmes which translate that research into market led innovations.

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RMI retro

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