IRISH PLANNING INSTITUTE
Institiúid Pleanála Na hÉireann

Planning, Climate Change and Energy in Ireland

Irish Planning Institute Guide

SPECIAL
SPATIAL PLANNING and ENERGY for COMMUNITIES IN ALL LANDSCAPES

Over the past 3 years, the IPI have been working closely with other European town planning associations to deliver a unique and much needed energy upskilling project to planners and related professions alike. Considering the approaching climate change targets, it is a timely and worthwhile project to ensure environmental considerations for sustainable development are integrated within the planning system at the earliest opportunity and also to bridge the gap between sustainable energy planning and spatial planning as separate processes.

Throughout the course of the project, the IPI and project partners experienced great success in the delivery of their pilot training, the learning from which I'm sure will be carried on for many years to come.

In addition to delivering an energy pilot training programme, the IPI has also produced this essential guide on Planning, Climate Change and Energy in Ireland which assembles some key aspects of the project that highlight the delivery of the training programme, important developments within energy planning and also highlight best practice European case studies.

The IPI is proud to have been involved in such an important project and we will endeavour to continue to work with and seek opportunities for collaboration with our European partner associations in the future.

Deirdre Fallon MIPI
President, Irish Planning Institute

SPECIAL: Building the capacity of Town Planning Associations to plan and deliver sustainable energy solutions

Spatial planning has a key role to play in creating urban environments that support less energy-intense lifestyles and communities. Spatial planning and urban planners have a pivotal role in developing energy strategies and actions plans and the Spatial Planning and Energy in All Landscapes (SPECIAL) project was set up to help bridge the gap between climate change/energy action planning and spatial and urban planning and most importantly, help partner countries meet the EU's challenging energy and climate change target for 2020.

SPECIAL, funded by Intelligent Energy Europe, focused on spatial planning for the deployment of local energy efficiency and renewable energy solutions, led by the Town and Country Planning Association (TCPA) with partner planning associations in Ireland, Sweden, Hungary, Italy, Greece, Germany and Austria.

At the heart of the SPECIAL project was a focus on training and capacity building and the cascading of that knowledge through the professional networks of each partner to reach practising planners at the local level through individual pilot training programmes devised with experts in the field.

Key Objectives

To build the capacity of partner Town Planning Associations (TPAs), or their equivalent, to integrate sustainable energy solutions into spatial planning training, practice and delivery.

To foster the exchange of experience and competence-building among national and regional TPAs, to demonstrate the integration of sustainable energy into spatial planning strategies at local and regional levels.

To stimulate the improved energy related competence of town planners working within local authorities, leading to good practice examples of integrated spatial planning strategies for low-carbon towns and regions.

Special Project Partners

United Kingdom
Town and Country Planning Association (Project Lead)

Ireland
Irish Planning Institute

Germany
German Institute of Urban Affairs

Sweden
Swedish Society for Town and Country Planning

Hungary
Hungary Urban Knowledge Centre

Greece
Organisation for Master Plan and Environmental Protection of Thessaloniki

Italy
National Centre for Town Planning Studies

Austria
Provincial Government of Styria, Department of Spatial Planning Law

Multipliers
SPECIAL Partners work through multipliers in their respective countries. The IPI multipliers are South Dublin County Council, Electricity Supply Board International, Sustainable Energy Authority of Ireland and City of Dublin Energy Management Agency.

Comhairle Contae Átha Cliath Theas
South Dublin County Council

ESB INTERNATIONAL

codema
Dublin's Energy Agency

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

This guide is part of the competence building programme of the project SPECIAL to consolidate the skills and knowledge of planners in local authorities, private consultancies or other institutions. It also captures the experiences and best practices models from SPECIAL partners through case study examples.

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Editor: Hendrik van der Kamp

Co-funded by the Intelligent Energy Europe Programme of the European Union

Planning and Energy: The SPECIAL Project

Hendrik W van der Kamp, Editor

Energy in Communities of All Landscapes) project, funded by Intelligent Energy Europe, is a three year project on integrating spatial planning and energy. With the Town and Country Planning Association as the initiator and lead partner, eight partners in the project, all Town Planning Institutes worked together during three years to improve the competencies of planners in delivering renewable energy at the local level.

The SPECIAL project started in 2013 and will come to a close at the final conference in London in February 2016. During this period the project will have delivered on the key objective to get more planners throughout Europe aware of the potential of spatial planning to reduce the energy demands in particular fossil fuel based energy.

The aim of the project was to demonstrate how effective spatial planning can be not only to increase the efficiencies of energy use and increase the use of renewable energy sources, but also to reduce overall demand for energy. The project was based on three basic principles: it should include professional planners as project partners, it should seek to multiply the benefits of knowledge through a network of partners, and it should celebrate best practice across Europe.

The first principle requires that the project partners should be associations of practicing town planners. This provided the scope to put spatial planning central. By understanding the potential contribution that spatial planning can make, all participants were able to engage effectively from the start.

TCPA was ideally placed as a lead partner for the project not only because of its experience with European projects incl. in the energy field, but also because it embraces spatial planning and the common good principles as its core principles. TCPA found effective and enthusiastic project partners in seven other European countries (Austria, Germany, Greece, Hungary, Ireland, Italy and Sweden) who were equally committed and engaged.

Because the project appeared to be the first of its kind where project partners are explicitly professional associations of spatial planners, the working together with the European Council of Spatial Planners (ECTP-CEU) was also an important feature of the project.

This enabled the project to have even more widespread engagement across Europe than would otherwise be the case. ECTP-CEU was founded in 1985 and forms an umbrella group of professional associations of planners. It currently brings together 30 professional town planning associations and institutes from 27 European countries as well as corresponding members.

The collaboration with ECTP-CEU took two specific forms. First, the 2014 edition of the bi-annual European planning awards invited submissions of planning projects that are based on the specific topic of energy and spatial planning.

The four winners (See Box 2) are all examples where this is the case. Second, and towards the end of the project, a pan-European guide was developed to assist planners and interested parties to adopt the lessons learned into practice.

A second important principle is the idea to 'multiply' the benefits of learning by adopting a wide network of collaborating parties within the respective partner countries. This also was a core element in the project proposal. The embedding of a large number of participants into the project was to deliver on the aim of the project to promote integrated renewable energy strategies and building the capacity of the partner planning associations in the planning and delivery of renewable energy solutions.

By first obtaining the knowledge but then sharing that learning through their professional networks and maximise the dissemination of their train-

ing to others, a multiplier effect can be achieved. The multiplier concept meant that by including specific organisations as multiplier organisations in the project activities, the maximum number of practitioners would be reached with improved knowledge and awareness of methodologies and best practice case studies across Europe.

A strong feature of some of the partner countries is the wide range of types of organisations that participated in this form both from the private and public sectors. Examples of the types of organisations that participated as multiplier organisations include non-governmental organisations, private enterprise organisations (e.g. an electricity network company), local authorities (e.g. Hertfordshire County Council in UK) and universities (e.g. Budapest University of Technology and Economics).

But also bodies with a specific remit to promote the use of renewable energy in their respective countries participated enthusiastically. Examples are the Swedish Energy Agency and the Sustainable Energy Authority of Ireland (SEAI). SEAI provides advice to Government and delivers a range of programmes in order to assist Ireland in the move to decarbonised energy systems.

Also organisations set up by or for local municipalities to advise on energy matters, were multiplier organisations in a number of project partner countries. Training and capacity building are key concepts in the projects. Much time was devoted to developing training packages Expert papers on spatial planning and energy were also written.

The third principle was the idea common to most European projects that we should learn from each other. The best practice approach was achieved by identifying case studies throughout Europe with the help of the local knowledge of the project partners and the organisation of field trips designed to study and assess these case studies. This was done by creating the 'knowledge pool'.

This 'knowledge pool' is part of the competence building programme of the project. The portfolio includes more than 100 articles on several issues related to 'planning' instead of 'energy' categorized into separate modules. Case studies are thus grouped under five categories or 'modules' each emphasising an important aspect of integrating energy into spatial planning.

The case studies show convincingly that many examples are so effective that they should be considered elsewhere. The case studies also demonstrate certain principles. The importance of working with local communities to achieve successful outcomes is a finding commonly found in the case studies.

Integrating the bi-annual planning awards of the ECTP-CEU into the project was very beneficial. The four convincing winning projects (see Box 2) show what can be achieved and that the relationship between spatial planning and energy can and should be applied at every geographical scale. The examples of the Canton of Geneva and Limburg in Belgium showed relevant regional approaches while Fornebu in Norway and Montmelian in France illustrated the benefits of energy planning at urban district level.

The approach to regional planning for energy as adopted by the Canton of Geneva illustrated the essence of the Special project of integrating spatial planning with energy planning. This approach adopted a philosophy which combines planning for energy production and consumption with spatial planning starting by defining the territory in terms of resources and places of production, storage, distribution and consumption. The approach brings town planning and energy planning together in such a way that energy issues are fully integrated into spatial planning projects.

The participants of the project and the multiplier organisations have also benefited from a number of fieldtrips to case studies in different countries. Each of these field trips emphasised innovative approaches and also how certain approaches to energy planning can be quite common in one country and not at all in another.

Above all, the project has demonstrated not only the need to put energy high on the agenda of spatial planning but also the scope for innovate planning policies that benefit not only the energy agenda but also other issues that cities must face. Examples of this include the need to deal with unattractive brownfield lands (where energy use can change a site from a negative to a positive image), the need to address the heat island effects in cities (where district heating systems can also be used for cooling purposes) and the contribution of green and blue networks in cities (where energy benefits can combine with improved biodiversity).

These principles developed through the SPECIAL project were finally incorporated in a pan-European guide which has been developed in partnership with the ECTP-CEU and will be launched at the final meeting of the project in London. This practical guide is another concrete and lasting output from the project. This guide provides a practical guidance on how to improve a reduction in energy use through spatial planning policies.

The format of the document is based on identification of ten themes where planning can make a real contribution. See Box 1. Each of the themes is described in a brief and accessible format and illustrated with three objectives. These are followed by practical recommendations.
The recommendations are aimed at

planners but also the informed lay person who has basic knowledge of the issues. For each of the ten themes the guide includes a reference to one or two real case studies from the Special project.

These case studies have been selected in order to illustrate the recommendations. While the description of each case study is brief, as each case study is included in the knowledge pool, a link to the relevant website resource is also provided.

The ten themes represent the important concepts where planners can recommend policies to reduce the need for energy or make its use more efficient. It is important to recognise that these policies can be at different spatial scales ranging from the micro (e.g. urban design solutions) to the macro (e.g. regional strategies).

Most of the recommendations will be relevant across Europe but, as the Special project has clearly shown, local conditions are different and may make certain solutions more or less suitable depending on the context. This context can be cultural, demographic or political in nature but in particular the physical and natural conditions in a local area may make some recommendations much more relevant than others depending on the local circumstances.

What is interesting is that while most of these are topics that are well known to planners and form part of the general 'toolbox' (e.g. masterplanning) others are new and suggest the need to approach energy in a different way in the future.

An example of this is the theme of 'energy production'. Under this theme it is suggested that providing the right amount of land at the right location for the production of (renewable) energy should be a core concept in every planning document equal to, say the need for employment and housing.

Examples of recommendations under this heading therefore include using land uses where possible as energy generating facilities and including the provision of waste to energy plants in municipal plans as part of an integrated, ecological system for the management of waste, energy and local resources.

By adopting such recommendations, city regions can become more resilient and efficient by adopting widespread use of rooftops for solar energy, public open spaces for solar energy facilities and agricultural grazing land for solar parks and improving the scope for a circular economy.

The resilience of city regions that can be potentially achieved to address other challenges that cities face (e.g. flood risk, biodiversity loss, waste) by focusing on an energy perspective, are compelling and have been developed in the guide.

BOX 1: Energy and Spatial Planning in Ten Themes

1. Masterplanning presents a strategic large-scale opportunity to comprehensively plan for new development or for the regeneration of part of a city. In relation to sustainable energy, masterplanning is a useful tool to allow full integration of climate change mitigation and adaptation objectives into the development of an area.
2. Urban Structure defined by the form and design of urban areas has a significant influence on both energy demand per capita and the way that energy is used. Planning has a fundamental role to play in creating and supporting spatially appropriate energy solutions based on an understanding of settlement areas, land uses and the built environment.
3. While the term 'zoning' has become unpopular, it is important to retain the function of spatial planning to identify Preferred Sites; optimal locations for different categories of land use. This can help to reduce conflicts and maximise synergies.
4. Minimising energy needs for Mobility; the energy demand arising from transport is based not only on reduction of the need for travel, but also reduction of the energy requirements per km travelled.
5. Green & Blue infrastructure affects microclimatic conditions in towns and cities considerably, as well as delivering major social and economic benefits. Urban planning should address heat island effects by providing open and green spaces to promote urban cooling.
6. To maximise the renewable energy potential of an area requires a focus on Energy Production to achieve the integrated approach offered by spatial planning.
7. Spatial planning is crucial to achieve District Heating solutions because of the need to link demand and supply of heat to existing and future development.
8. Spatial Planning can define and enforce Zero Carbon standards for both municipal and non-municipal buildings.
9. Brownfield: Increasingly spatial planning is used to find new uses for areas that have become redundant and that may not be suitable without remedial action for all uses (e.g. contaminated soil).
10. It is essential to achieve Community based energy production schemes. As community involvement and participative democracy are core concepts in spatial planning, it is important to integrate community participation in all energy policy proposals.

Hendrik W van der Kamp FIPI is Head of the School of Spatial Planning in Dublin Institute of Technology and a former president of the European Council of Town Planners. He acted as Planning Director to the IPI's work on the SPECIAL project.

BOX 2: The Four Winners of the ECTP-CEU Planning Awards

1. Geneva Regional Approach: In order to bring together energy and urban planning, the Canton of Geneva has developed territorial energy planning tools in order to make sure that spatial planning for the region fully integrates the energy dimension.
2. Montmelian Solar Urban Expansion: an urban expansion project of 20 hectares which is based on maximising scope for using solar energy as the main source of energy.
3. Fornebu – Norway: A brownfield (former airport) urban regeneration project which has used a range of renewable energy sources as well as maximum efficiencies through masterplanning and infrastructure design.
4. Limburg – Belgium: A regional strategy for a former coal mining area following a closure of a large industrial plant based on the use of energy supply as once more to be the driving force and foundation of a wider territorial development strategy.

CASE STUDY 1

Solar Atlas of Berlin, Germany

In brief what does it show:

An online atlas of potential solar energy yield was created for the city of Berlin by measuring parameters such as roof area and slope, taking into account shadowing from vertical objects such as chimneys and masts. The atlas is freely accessible to home and business owners and it is aimed that this tool will create more demand for photovoltaic and solar thermal panels.

Process/How?

Initial calculations for Berlin have suggested that about 2/3 of the entire energy consumption of households and small businesses could be generated on its roofs. Software has been developed by key project stakeholders to automatically create building attributes such as ridge and eaves height, roof slope and orientation, to create an atlas of potential solar energy yield for Berlin.

The method was first implemented in two pilot areas with a total area of 19km^2 in Berlin, around Friedrichstraße and a residential area in Lichterfelde. Approximately 14,300 roofs were evaluated for solar suitability. A potential yield of about 100 gigawatt hours of solar power per year was measured, which could be produced using an aggregated roof area of 0.8km^2. This corresponds to roughly 1% of Berlin's total power consumption. Preliminary estimates for the entire city of Berlin suggest that about 67% of private power consumption in Berlin could be generated on its roofs. Calculations for solar thermal use were also carried out. Implementation of the Berlin solar map as a Web-GIS project has three main objectives: to display the location of existing solar installations in the city (photovoltaic, thermal and energy concepts), to visualise the potential solar industry in Berlin as points-of-interest, and to highlight rooftops suitable for solar panel installation.

Form of sustainable energy:

Solar and PV, energy mapping

Key Lessons?

Planners and urban designers should be engaged as available software can assist in generating models of the existing and future built environment and the opportunities for developing south facing facades / roof environments. Access to data and data protection issues need to be addressed in order to attempt solar mapping. There is a need to engage property and homeowners very early in the process to stimulate support for such solar mapping projects.

Further Information:

http://energyatlas.energie.tu-berlin.de/

Planning for Sustainable Energy

John McCann

There is a growing consensus among world leaders on the urgent need to take action on greenhouse gas (GHG) emissions in order to avert catastrophic effects of climate change. Recently, in announcing his Climate Change Plan, President Barack Obama said "We're the first generation to feel the impact of climate change. We're the last generation that can do something about it," "We only get one home. We only get one planet. There's no plan B".

Globally, commitments to address climate change were first made under the1992 United Nations Framework Convention on Climate Change (UNFCCC) which led to the 1997 Kyoto Protocol to reduce GHG emissions based on the principle of common but differentiated responsibilities. The 2nd commitment period of the treaty is coming to an end and a UN climate summit in November 2015 in Paris will finalise future commitments and implementation.

The EU 20-20-20 policy vision to address climate change requires, by 2020, an EU wide 20% reduction in GHG emissions, 20% average use of renewable energy (RE) and 20% improvement in energy efficiency. If we are to maintain global warming within a safe limit of 2˚C, reductions in GHG emissions must be accelerated. The EU 2030 Framework for Climate and Energy has defined further EU wide targets of a 40% cut in GHG emissions compared to 1990 levels, a minimum 27% share of RE consumption and minimum 27% energy savings compared with the business -as-usual scenario.

No individual member state targets for renewable energy have been defined and it is anticipated that the target will be met from through a rational economic exploitation of EU wide renewable energy resources. Key policies to deliver these 2030 targets will be a reformed EU emissions trading scheme (ETS), new indicators for competitiveness and security of energy system, e.g. price differences, diversification of supply, and interconnection capacity and a new governance system based on national plans for competitive, secure, and sustainable energy.

Ireland's National Renewable Energy Action Plan (NREAP) and National Energy Efficiency Action Plan (NEEAP)

set out how, by 2020, we will achieve our individually binding national targets, of 16% contribution of RE and 20% reduction of energy demand. Achieving these agreed targets will require significant investment to redress the effects of inappropriate prior development and to put in place RE infrastructure.

Ireland is in the process of developing the policies that will contribute to achieving the more ambitious 2030 EU targets. The government published the Climate Action and Low Carbon Development Bill in January 2015. After open public consultation, an Energy White Paper is in the final stages of preparation. In 2014 the Government also published an Offshore Renewable Energy Development Plan for the development of Ireland's extensive offshore RE resources, including offshore wind, wave and tidal energy, recognising that these offer rich potential over the coming decades.

Spatial planning has a fundamental influence on future energy use through both ensuring that future planned development, of all kinds, anticipates transition to the most efficient energy technologies, infrastructure and modes of use and through facilitating sustainable development of the renewable energy sector.

Spatial planning may "lock in" future energy use for 50 to 100 years, as it inherently defines the range of energy use choices within the development pathway it prescribes. To keep Ireland on a long term trajectory towards decarbonising its energy use, the energy-use and emissions impacts of spatial plans must be subject to continuous assessment and optimisation.

SEAI has developed tools to assist spatial planners in defining the spatial energy landscape of the future. One such spatial planning tool is the SEAI methodology for Local Authority Renewable Energy Strategies (LARES).

Local authorities are required to adopt wind energy strategies in response to the statutory requirement to identify land for windfarm development. SEAI convened a steering group to oversee the preparation a methodology and template to act as a guide for local authorities in preparing more holistic Renewable Energy Strategies (RES).

The LARES methodology aims to facilitate consistency of approach in the preparation of RES, and to assist local authorities in developing robust, co-ordinated and sustainable strategies in accordance with national and European obligations. The methodology also aims to address common issues encountered with RE resources, technologies and projects.

The methodology defines the actions in the key steps to deliver a LARES, these are:

- The Preliminary Phase, which clarifies the local need for a LARES and identifies whether Strategic Environmental Assessment or Appropriate Assessment are required;
- Step 1: The Policy Review, identifying all renewable energy and other relevant policies
- Step 2: Identify the Renewable Energy Resources and their potential for exploitation
- Step 3: Review the Constraints and Facilitators that might affect exploitation
- Step 4: Develop the Local Renewable Energy Policy

The methodology provides an outline LARES structure and detailed guidance for planning authority staff on the execution of each of the steps to complete a LARES. It also details the primary sources of information and data, relevant stakeholder organisations and land use interactions for renewable energy developments. The timing and scope of public consultation at key stages in the development of a LARES is also highlighted.

Under its Sustainable Energy Communities programme SEAI has also funded several local authorities and communities to develop their local Sustainable Energy Action Plans (SEAP's), which were initiated under the Covenant of Mayors. It is recognised that, in order to embed SEAP energy targets in spatial plans, additional tools will be required.

After funding the development of South Dublin County Council's SEAP in 2013, SEAI provided a grant to the Council in 2014 to carry out energy demand mapping to inform its LARES and to provide a basis for incorporating the SEAP within the County Development Plan. The City of Dublin Energy Management Agency (CODEMA) assisted in developing the methods to be applied to energy mapping and have since applied these to energy mapping for Dublin City Council and are carrying out similar exercises for Fingal and Dun Laoghaire Rathdown Councils.

Spatial energy planning at the regional, county and local level will underpin the delivery of challenging medium- and long-term national policies and targets for GHG emissions, energy efficiency and renewable energy. SEAI has fostered the development of tools to facilitate spatially based energy analyses and has recently revamped its online Geographical Information System (GIS) to facilitate planners who engage with spatial energy strategies and plans.

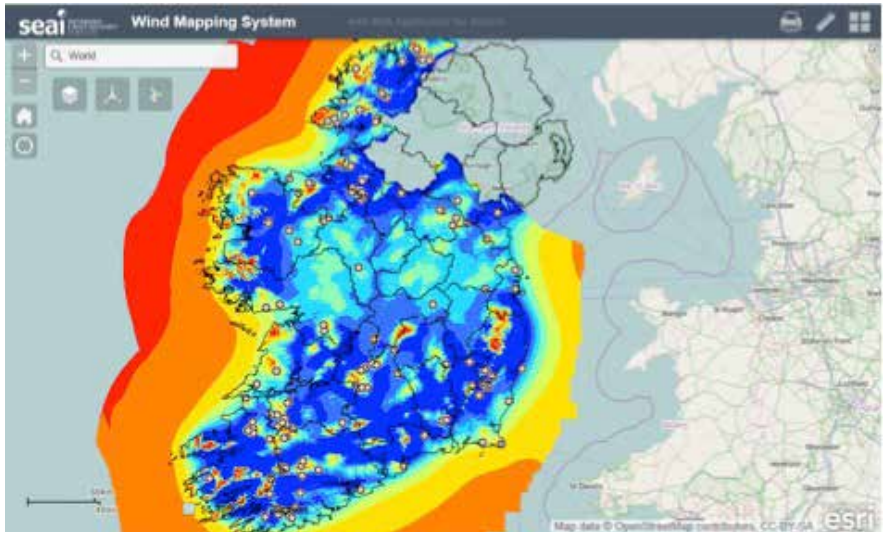
The new online SEAI Energy GIS allows the SEAI renewable energy resource atlas datasets to be utilised within the user GIS environment. The resource atlases will in future be sup-

plemented with new energy demand and efficiency datasets and tools. SEAI has recently contracted for national heat demand mapping and, when completed, this spatial energy dataset will be available for use by local authority planners.

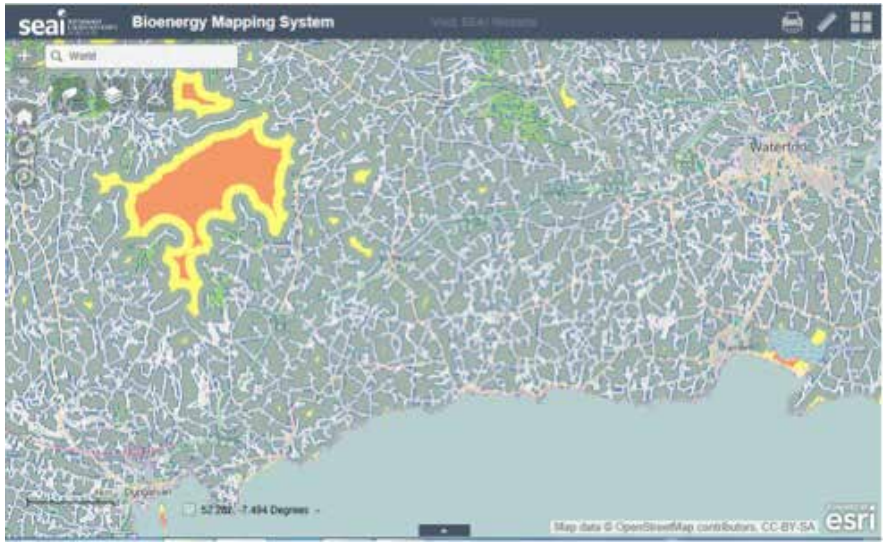
Spatial planning for energy and emissions reduction has a key role to play in reducing GHG emissions to avoid severe climate change impacts. Regional, county and local energy and emissions reduction plans must cascade national objectives to the local level. Robust energy and emissions impact analyses during the development of spatial plans are required to avoid long term "lock-in" of energy use inefficiencies and high GHG emissions levels.

Retrospective action to address the effects of such "lock-in" may be slow to implement, be too late to avert climate change or be prohibitively expensive. Plan A must get it right first time.

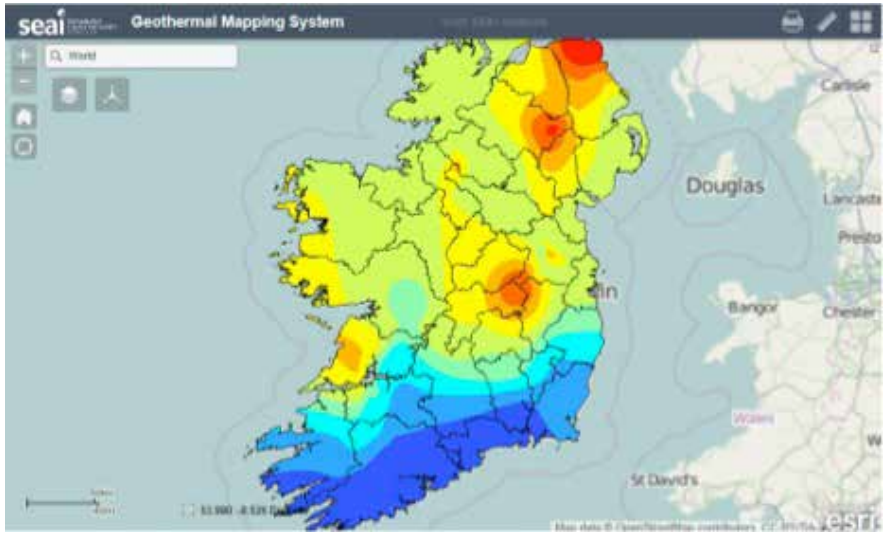
John McCann is Programme Manager with Sustainable Energy Authority of Ireland



SEAI Online Wind Atlas

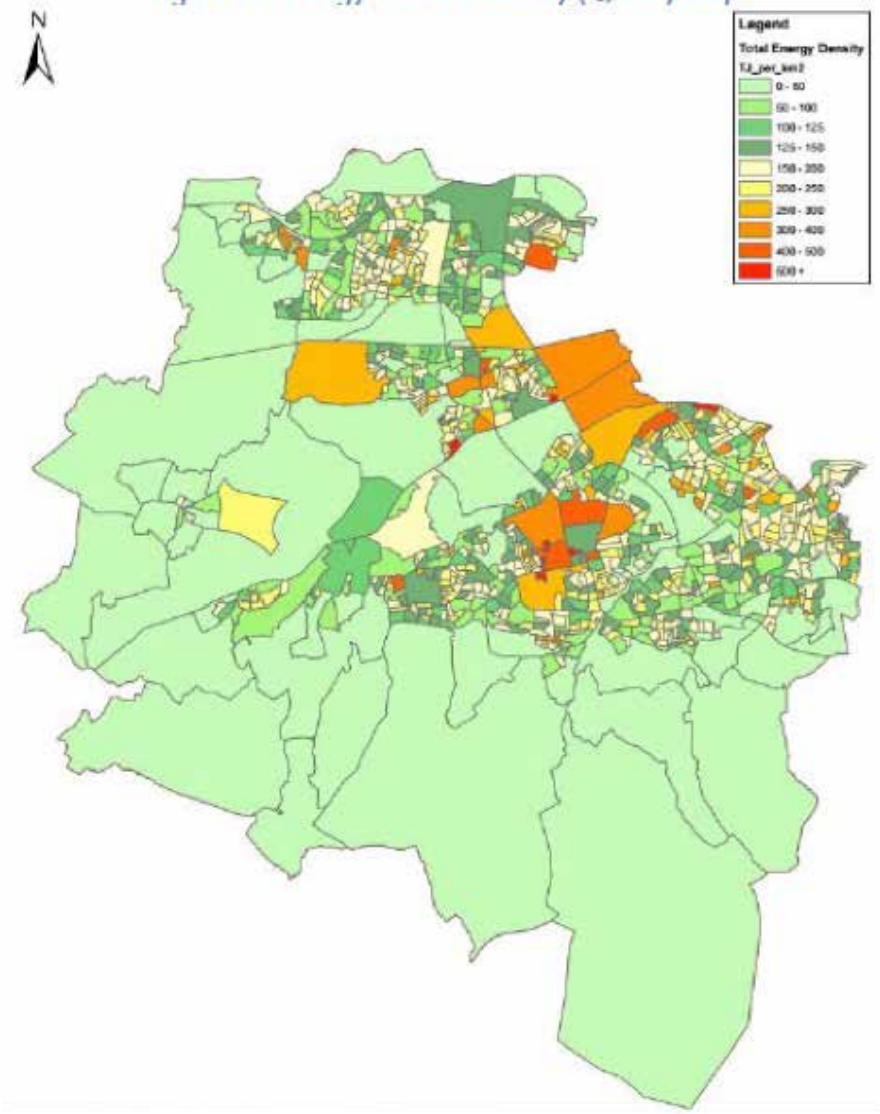


SEAI Online Bioenergy GIS



SEAI Online Deep Geothermal GIS

Figure 10: Energy Demand Density (TJ/km²) Map



SEAI Online Deep Geothermal GIS

CASE STUDY 2

Energy Masterplan for Vauxhall Nine Elms Battersea Opportunity Area, London, UK

In brief what does it show:

Regeneration of a 195 hectare brownfield site on the south bank of the River Thames, creating a new residential neighbourhood, a significant new business district and a new centre for arts and culture in London.

Process/How?

- When complete, the Nine Elms scheme will offer London 16,000 new homes, 25,000 new jobs, education, green spaces and high profile visitor attractions.
- Up to 3kms of the Thames riverside will be opened up to the public, creating a new stretch of London's South Bank and connections to the River Thames. Vauxhall is being dramatically remodelled to create an attractive and pedestrian friendly environment with new and improved public spaces and better links to the river. A cluster of tall buildings will also take shape here creating a new addition to the central London skyline.
- A whole new town centre will be built around a redeveloped Battersea Power Station, New Covent Garden Market will be revitalised and a new US Embassy is planned to open in 2017. New infrastructure will include two new London Underground (tube) stations and the creation of a new linear park sweeping right through the district from east to west.

Form of sustainable energy:

- District heating, combined heat and power, solar, waste heat
- An Energy Masterplan was prepared in conjunction with the Nine Elms Opportunity Area Planning Framework, exploring a range of energy efficiency and renewable energy alternatives for the emerging district. Energy opportunities are linked to phased delivery of development.

Key Lessons?

- Development of a cross-local authority Planning Framework between Lambeth and Wandsworth Councils and the Greater London Authority
- The Nine Elms Vauxhall Partnership was created in 2010 to coordinate and drive forward the transformation of this entire

district of central London. Planners from both Lambeth and Wandsworth Councils formed part of the partnership.

- Current planning policy ensures that permitted developments must be future proofed to connect to a district heating scheme i.e. safeguarding pipe network routes up to the boundaries of adjoining sites.
- Future planning policy will be integral in securing routes for the network and connection to Pimlico District Heat Undertaking, as well as the any future local Energy Centres.
- Engagement with stakeholders including the local community, energy providers, developers and landowners.

Further Information:

http://www.nineelmslondon.com

Battersea Power Station (Source: www.nineelmslondon.com)

Advancing Evidence Based Energy Policy in Ireland
A Spatial Energy Demand Analysis of South Dublin County

Anthony McNamara

Foreword

To combat the effects of climate change, to reverse the dependency on imported fossil fuels and to reduce energy costs across all sectors, South Dublin County aims to respond in a way that prioritises and unlocks local low carbon and renewable energy opportunities, in partnership with all stakeholders, to 2022 and beyond.

Since its establishment in 1994, South Dublin County Council has a proven track record in pioneering activities in sustainable development and promoting the growth of sustainable communities. The Council acknowledges that strengthening climate change mitigation, reducing energy consumption and finding alternative, non-polluting and renewable sources for energy provision across sectors, are a priority in order to respond to EU and national energy targets to 2020 and beyond.

It is clear that continued growth across South Dublin County will require a reliable, robust and efficient energy system to power homes, business and transport needs, over the lifetime of the next County Development Plan and beyond. The county aspires to becoming as carbon neutral as possible and make every effort to increase energy efficiency and unlock renewable energy opportunities. As such, there is a recognised need to build on previous County Development Plan energy policies, focusing on evidence based and spatially appropriate policies, objectives and implementation measures.

In 2015, South Dublin County Council prepared a countywide Spatial Energy Demand Analysis (SEDA), in partnership with the City of Dublin Energy Management Agency (CODEMA). The energy profile for the commercial, residential and municipal sectors, collated under the EU Covenant of Mayors and Sustainable Energy Action Plan (SEAP) methodologies, has been refined to generate county scale tabulations and maps representing a range of energy information, including energy demand, heat density and costs, across sectors. The outputs and recommendations of the South Dublin SEDA have informed the review of the current County Development Plan and the

preparation of South Dublin County Council Draft Development Plan 2016-2022. By carrying out a SEDA the Council aims to facilitate an enhanced spatial understanding of energy needs, and energy efficiency and renewable energy responses, which vary across sectors, settlement areas, land uses and the built environment.

The South Dublin Spatial Energy Demand Analysis is available to view/download at the following link: http://www.southdublindevplan.ie/stage-2

Introduction

The Intelligent Energy Europe (IEE) supported SPECIAL (Spatial Planning and Energy for Communities In All Landscapes) project is a dynamic partnership of eight Town Planning Associations from across Europe. It focuses on spatial planning, local energy efficiency and the deployment of renewable energy solutions.

The SPECIAL project aims to bridge the gap between energy action planning and spatial and urban planning by developing the capacity of Town Planning Associations in the planning and delivery of renewable energy solutions.

This Paper highlights the role of Sustainable Energy Action Plan (SEAP) methodologies in advancing evidence based energy policies at local authority/municipality level, aiding the development of a local authority wide Spatial Energy Demand Analysis, with the ultimate aim of strengthening links between energy and spatial planning, through County Development Plans, Strategic Development Zones and other local plans and strategies.

Who is this paper for?

This paper is designed to highlight the experiences of South Dublin County Council in developing evidence based climate change mitigation policies for County Development Plans and other local plans and strategies, including energy efficiency and renewable energy opportunities. The paper is aimed primarily at local authority planners and related professional staff, County Councillors and private sector practitioners. The paper will also be useful for architects, energy engineers, renewable energy providers, developers and all stakeholders interested in addressing the energy and climate change challenge at the local level.

The Opportunity to integrate energy and spatial planning

The energy targets set out in EU legislation have been translated into the National Renewable Energy Action Plan (NREAP) 2010 and the National Energy Efficiency Action Plan (NEEAP) 2013-2020 (updated in 2014). Ireland plans to achieve the EU 2020 targets under the NREAP by delivering approximately 40% of energy consumption from renewable sources in the electricity sector, 12% in the heat sector and 10% in the transport sector. The NEEAP sets out the Government commitment to deliver a 20% reduction in energy demand (over average 2001-2005 levels) across the whole economy through a range of energy efficiency measures. The Government believes that the public sector should lead by example and has assigned an energy demand reduction target of 33% to the public sector.

In consideration of energy targets to 2020 and beyond, planners and local authorities are best positioned to aid the transition to a low carbon society, by integrating climate change mitigation and energy into spatial planning tools and strategies. Energy and climate change mitigation issues should be recognised and included as an additional thematic layer in the plan making process.

Therefore, there is a need for planners, local authority staff and decision makers to develop robust, evidence based policy relating to energy and climate change mitigation, including energy efficiency in existing and new building stock and advancing renewable energy opportunities at the local level.

Key objectives of advancing evidence based energy policy at the local level are:

- To develop a closer link between European and National energy policy and spatial planning for energy and climate change mitigation;
- To base energy planning policies and objectives on a robust spatial understanding of the existing and future energy profiles across sectors at a local authority scale;
- To promote the generation and supply of low carbon and renewable energy alternatives, having regard to the opportunities offered by the settlement hierarchy of a local authority/municipality area, the variety of land uses present and the built environment;
- To educate local authorities, public and private sector organisations and energy stakeholders on energy responses that are most relevant at the local level;
- To stimulate the development of a regional methodology for spatial energy demand analysis, energy mapping and energy planning policy development;
- To encourage greater local authority involvement and leadership in the roll out of energy efficiency and low carbon and renewable energy projects in partnership with other stakeholders; and
- To inform and support the Covenant of Mayors initiative and advance Sustainable Energy Action Plan (SEAP) methodologies in Europe.

In Ireland, there is significant experience to date in planning for renewable energy alternatives and a broad range

of experience exists across the planning profession. A number of local authorities have prepared Local Authority Renewable Energy Strategies (LARES), Wind Energy Strategies and Sustainable Energy Action Plans (SEAP), informed by methodologies set out in the Methodology for Local Authority Renewable Energy Strategies, Sustainable Energy Authority of Ireland (SEAI), (2013), Wind Energy Development Guidelines for Planning Authorities, Department of Environmental Heritage and Local Government, (2006) and How to develop a Sustainable Energy Action Plan – Guidebook, Covenant of Mayors – Publications Office of the European Union, (2010).

Within this context of up-skilling planners, other local authority staff and decision makers, it is increasingly recognised that urban and peri-urban local authorities require an evidence based response that captures a spatial understanding of the existing energy profile across sectors and land uses which can be used as a baseline to understand and consider the future energy scenario to 2020 and beyond.

This has been the case for South Dublin County and the South Dublin Sustainable Energy Action Plan has been used as the starting point, to further the integration of spatial planning and energy, thereby informing the policies and objectives of the South Dublin County Council Draft Development Plan 2016-2022.

In making County Development Plans, local authorities are required to include a Core Strategy, demonstrating that Development Plans are consistent with the National Spatial Strategy and Regional Planning Guidelines. The Core Strategy must also include a settlement hierarchy and evidence based population and housing targets across settlements.

Core Strategies can also demonstrate an analysis of zoned land availability and requirements to ensure that there is sufficient amounts of zoned lands to cater for growth in the local authority area. In this regard there is an opportunity to take account of and spatially represent the existing energy profile of a local authority area and also forecast future energy requirements across settlement and growth areas.

Developing a spatial understanding of existing and future energy demand across sectors allows the necessary policy decisions regarding the integration of energy efficiency and renewable energy technologies into the built environment and the landscape, to be made in a robust, informed and evidence based manner.

Once a spatial characterisation of energy issues has been articulated at a County Development Plan level, local area plans and other locally based plans and strategies provide a further opportunity to provide more detail on measures and mechanisms to support climate change mitigation at the local level.

An integrated approach to spatial planning and energy allows planners, local authority staff and other stakeholders to make more informed policy decisions relating to energy efficiency and renewable energy alternatives, whilst also generating an increased evidence base to inform further project feasibility and implementation, and also foster greater public acceptance of energy infrastructure projects.

Energy Planning in South Dublin County

To advance a 'bottom up' evidence based policy response to address 2020 EU and national energy targets, South Dublin County Council signed up to the Covenant of Mayors in 2012. The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources within their jurisdiction areas. By their commitment, Covenant signatories aim to meet and exceed the European Union 20% CO_2 reduction objective by 2020 and agree to approving a local authority wide Sustainable Energy Action Plan within one year of signing up to the Covenant. Further information on the Covenant of Mayors is available at www.covenantofmayors.eu.

The South Dublin SEAP 2013 analysed the county's energy consumption and carbon dioxide (CO_2) emissions at a sectoral level. Using 2006 as a baseline year the South Dublin SEAP sets out how South Dublin County could reduce consumption and CO_2 emissions, in line with 2020 energy targets, through a range of energy actions across sectors. The SEAP was approved by the elected members of South Dublin County Council in May 2013 and was verified by the EU Covenant of Mayors – Joint Research Centre in April 2014.

To frame and develop robust policies in the South Dublin County Council Draft Development Plan 2016-2022, the Council sought to advance the South Dublin SEAP data and methodologies spatially, to further inform energy policy decisions in the County Development Plan.

This approach to energy policy development and integration with Sustainable Energy Action Plans is supported by the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022. The EU Covenant of Mayors also calls for local authorities to progress SEAP methodologies and to provide greater integration with spatial planning and related actions at the local level.

As a result, the energy data for the commercial, residential and municipal sectors, collated under the EU Covenant of Mayors and Sustainable Energy Action Plan (SEAP) 2013 methodologies, has been further progressed and refined to generate County scale tabulations and maps representing a range of energy information, including energy demand,

heat density and costs across sectors. A range of data sources have been used to undertake this study, including Central Statistics Office (CSO), Valuation Office, SEAI, Building Energy Rating (BER) datasets and energy data relating to South Dublin County Council owned buildings, facilities and operations. A summary of the estimated annual South Dublin County energy profile, using 2014 as the baseline year, is shown in Table 1.

The SEDA has used the County Development Plan Core Strategy projections to generate strategic assumptions on the energy profile of South Dublin County into the future.

The SEDA has calculated that even though new homes in the County will be built to higher Building Energy Ratings (BER) standards reflecting changes in national Building Regulations, this sector still has the potential to generate an additional 0.4 TWh by 2022 under the lifetime of the next County Development Plan.

By reviewing past job/population ratio splits for the County and using Core Strategy population projections to 2022, it is estimated that the commercial sector could generate an additional 0.5 TWh of energy demand by 2022.

Using the Outputs of the South Dublin Spatial Energy Demand Analysis

The CSO Small Areas have been used as the geographical boundaries to spatially represent the County's energy profile across the commercial, residential and municipal sectors.

This has resulted in a detailed level of analysis which can be refined for further studies and planning strategies stemming from the County Development Plan and other local initiatives. Figure 1 shows a sample of CSO Small Area breakdown in South Dublin County.

The South Dublin SEDA reveals that there is potential for the development of both decentralised, local district heating networks and also a range of on-site/in-house low carbon and renewable energy alternatives to address the energy needs of the various sectors operating in South Dublin County, in particular commercial and industrial uses. The SEDA analysis of the residential sector reveals a diverse energy profile spanning homes built over the past one hundred years, in both urban and rural environments.

Sector	2014 Energy Demand	Estimated Costs
Residential	1.94 TWh	€161 million
Commercial	1.73 TWh	€174 million
Municipal	0.01 TWh	€2 million
Total	3.68 TWh	€337 million

Table 1: 2014 South Dublin County Energy Profile and Estimated Costs
Source: South Dublin Spatial Energy Demand Analysis, April 2015

Low Carbon District Heating networks

In order to identify areas which are suited to local district heating schemes, energy information can be analysed in terms of heat density, which is the amount of thermal energy used within a defined area and is an indicator for the economic viability of district heating schemes.

This is an accepted methodology used in other European countries, including Denmark and Sweden. The viability of district heating schemes is increased when buildings are closer together (due to shorter pipelines and reduced heat losses) and where anchor loads (i.e. twenty four hour loads) demonstrating high levels of energy use, are present.

District heating schemes can be based on a variety of technologies and renewable energy sources, such as combined heat and power (CHP), biomass energy, geothermal or energy from waste.

The diverse mix of land uses and the built environment in South Dublin County offers potential for the development of local low carbon district heating networks. The South Dublin SEDA has analysed the energy profiles

Figure 1: Example of CSO Small Area Breakdown in South Dublin County

of the commercial, residential and municipal sectors and has identified Areas of Potential, measured in tera-joules (TJ) per square kilometre (KM2).

Areas with a heat density above 250 TJ/km^2 are identified as the areas of best potential for initial development in South Dublin County. These areas are shown on Figure 2; six of these areas are located in Tallaght (the County town of South Dublin County). Many of the top ten Areas of Potential in South Dublin County are located within the same Electoral Division (ED) and as such could be grouped with other adjoining/nearby sites of high heat density.

Figure 2: Example of CSO Small Area Breakdown in South Dublin County

Once such Areas of Potential have been identified using the heat density methodology, an approach to County Development Plan policy and Development Management standards facilitating the development of district heating projects, should ensure that all new developments above a certain threshold, within or directly adjoining such Areas of Potential, should undertake an Energy Analysis.

This Analysis should be submitted with the planning application to the Planning Authority and should be related to the uses and quantum of floorspace associated with a proposal for development. It is considered that an appropriate threshold for such proposals, could include large scale residential, commercial or mixed use developments (100+ dwellings at a density of 50 dwellings per hectare (dph) or more and non-residential development of 10,000 sq. metres or above). The Energy Analysis should also include proposals for the delivery of a low carbon district heating system on site, including technology details and a timescale for delivery linked to the energy demand, energy load mix, layout and phasing of the proposed development.

It is considered that in cases where the Energy Analysis concludes that the delivery of a district heating scheme has been fully explored and is not feasible on a particular site, details of future proofing of the building fabric and safeguarding of pipes network routes up to the boundaries of adjoining sites should be submitted with the planning application. This will facilitate future connection to local district heating systems on neighbouring sites and in the area.

Energy Demand and Clusters of High Energy Users

Figure 3 shows total energy demand (both heating and electricity) in each CSO Small Area across South Dublin County. This map shows areas coloured in darkest red have the highest energy demand in the county. To compare this analysis, Figure 4 shows clusters of high energy users across the county. From a comparison of both maps it is clear that areas with high total energy demand have a high number of commercial/municipal energy users and some users with very high energy demand per building.

These areas include premises in Tallaght town centre, Ballymount Industrial Estate and Grange Castle Business Park. In areas demonstrating clusters of high energy users, but not demonstrating heat densities sufficient for a low carbon district heating project, the South Dublin Spatial Energy Demand Analysis identified that there are a range of alternatives for on site / building level alternatives.

A range of County Development Plan policies and Development Management standards can be considered in this regard including waste heat utilisation, solar energy, biomass

energy, or a mix of these and other technologies, which offer potential for commercial and municipal premises demonstrating high energy demands.

Shallow geothermal also offers potential in these areas. With regard to electricity, for buildings with daytime electrical demand and high cost of electricity per kilowatt hour, solar energy including seasonal storage technologies, can be a cost-effective way to reduce electricity demand and costs. For larger applications, Combined Heat and Power (CHP) units can supply both electricity and heating requirements.

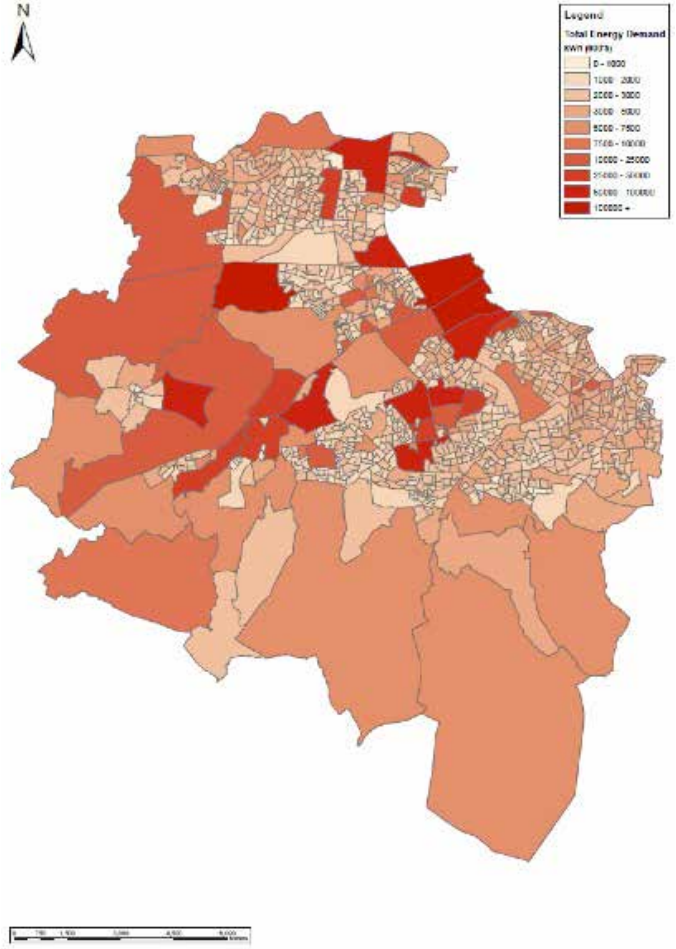


Figure 3 – Total Energy Demand (MWh) Map

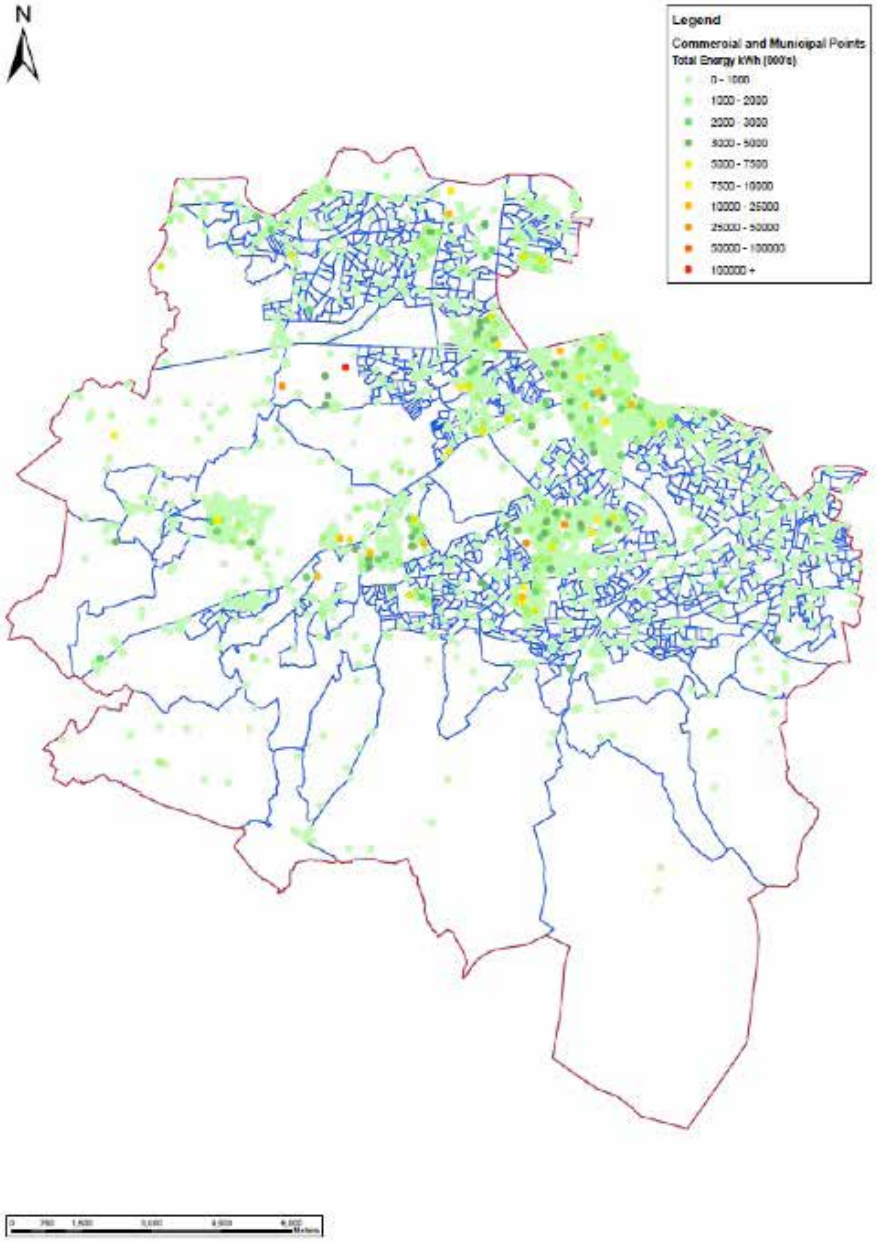


Figure 4 – Energy Use (MWh) and Location of Each Commercial and Municipal Building

Analysis of South Dublin County Dwelling Stock

The energy performance of existing buildings is one of the foremost considerations in responding to the energy challenge in at local authority level. Increased efforts in this area, in particular the upgrading and refurbishment of existing buildings can make a significant contribution in reducing energy demands and costs.

In order to ascertain priorities in addressing the energy performance of existing residential stock, there is a need to compile and map the energy profile of the residential sector, with particular regard to identifying areas of older housing stock and buildings with a low BER.

The South Dublin SEDA has profiled the residential sector in detail; this has been due to the detailed data sources available, in particular Census 2011 and SEAI BER data. Figure 5 shows the distribution of Building Energy Ratings in South Dublin County, according to the period of dwelling construction.

The analysis of the residential sector indicates that approximately 56% of BERs are D1 or lower. Furthermore, 66% of all semi-detached housing is rated D1 or lower, 46% of terraced dwellings and 60% of detached dwellings are rated D1 or lower. Terraced housing and apartments make up the majority of A and B BERs, with the majority of A and B rated homes built from 2006 onwards. The lower F and G rated dwellings are dominated by buildings constructed in the period 1919 – 1970. This analysis assists in the identification of homes that could be at risk of fuel poverty.

The South Dublin SEDA has also characterised and mapped residential energy costs for the residential sector. The range of residential sector energy costs across CSO Small Areas are shown in Figure 6. Small Areas with high numbers of dwellings which use more expensive energy fuels such as home heating oil, will have higher energy costs than others.

Also, areas with high levels of electrical heating and older housing with low insulation levels will also have higher than normal energy costs.

The design, construction and operation of new buildings, has a significant role to play in reducing energy demand and increasing energy efficiency into the future. The integration of energy issues into the life cycle of all new residential and non-residential buildings, from the neighbourhood, street and individual building scale, can result in significant savings at the local level.

The energy efficiency and renewable energy requirements for the construction of new residential and non-residential buildings are primarily addressed in the current Building Regulations Part L (2008 and 2011).

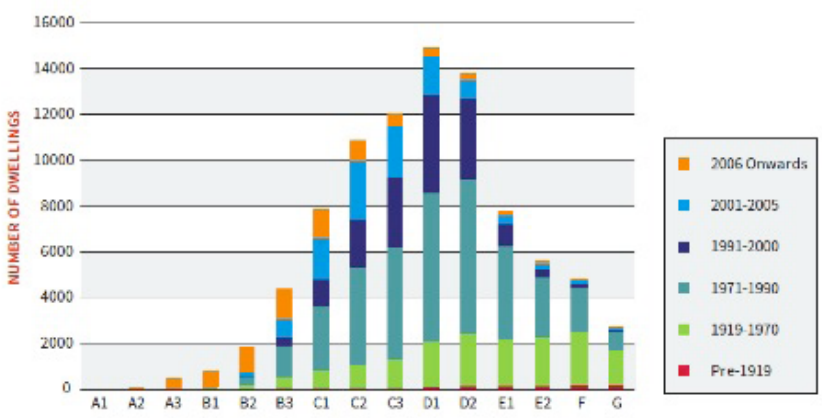


Figure 5: South Dublin Building Energy Rating (BER) Distribution by Year Built

With regard to residential dwellings, all new homes constructed in South Dublin County currently must reach an energy performance equating to an A3 BER standard and there are specific requirements with regard to thermal performance, overall energy use and CO_2 emissions.

The regulations also prescribe that a reasonable proportion of the energy consumption to meet the energy performance of a dwelling is provided by renewable energy sources.

There is a recognised need for planners to become up-skilled in the requirements of the Building Regulations Part L (2008 and 2011) and to include policies and objectives in County Development Plans and other plans and strategies, which confirm the requirements of the Building Regulations.

Furthermore, County Development Plan policies and objectives should support incremental changes to the Building Regulations Part L and other national guidelines that may occur by 2020, without duplicating or introducing specific requirements with relation to energy efficiency and renewable energy technologies that would conflict with, or impede the implementation of the Building Regulations on site.

In this regard County Development Plan policies should continue to support national guidance, including for example, Towards near Zero Energy Buildings (nZEB) in Ireland - Planning for 2020 and Beyond, Department of Environment Community and Local Government (2012).

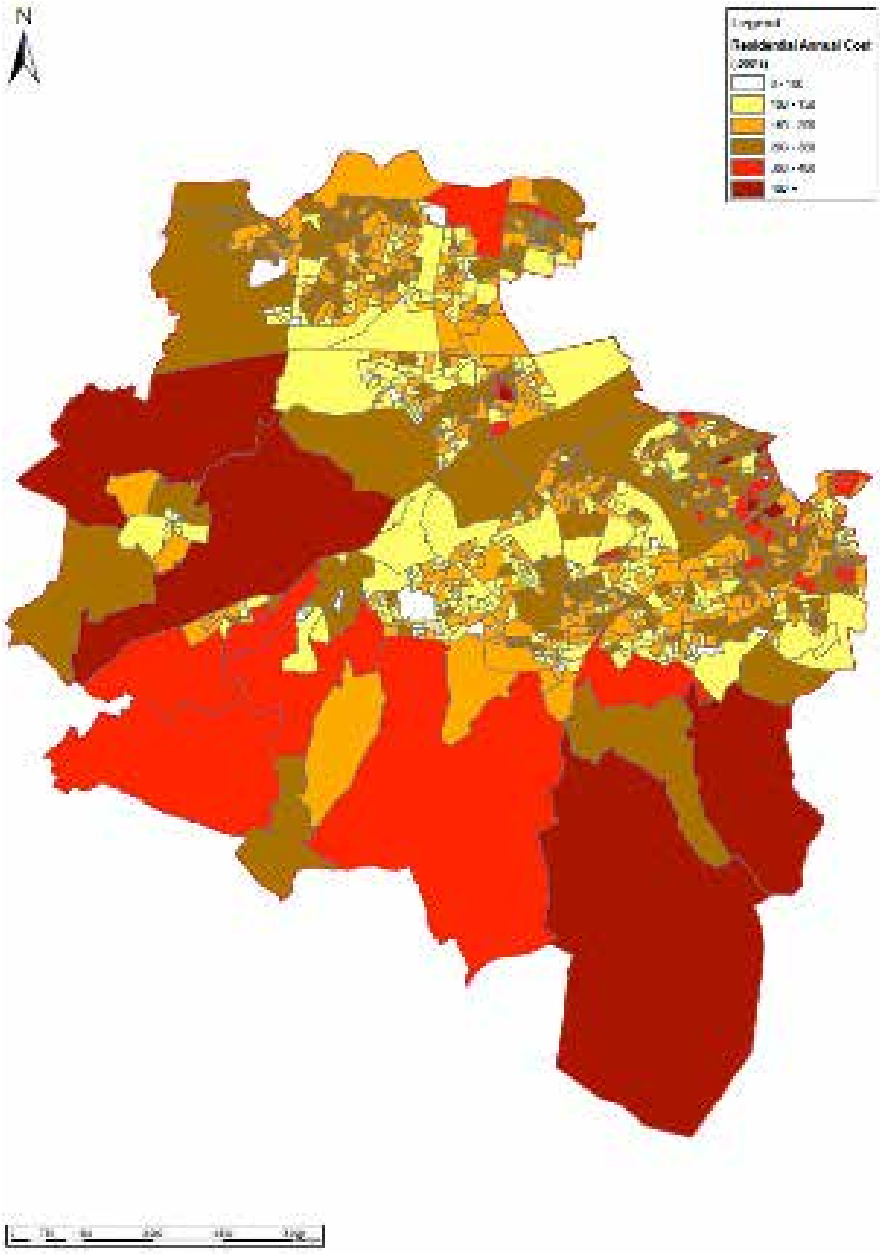


Figure 6 – Estimated Annual Energy Costs for Residential Energy Use per Small Area

Conclusions

The South Dublin Spatial Energy Demand Analysis represents a visualisation of energy character areas across South Dublin County and acts as a robust starting point to inform the energy policies and objectives of the next County Development Plan, Strategic Development Zones (SDZ) and other local plans and strategies. By collating and profiling assumed and actual energy data across sectors, a range of energy maps have been created, in particular heat density, energy demand and costs across sectors.

In response to this spatial analysis, the SEDA highlights energy efficiency and renewable energy alternatives that should be further explored in County Development Plan policies, objectives and Development Management standards, in the context of the location of the County (within the Dublin Region) and the variety of the sectors, built environment and land uses present. Basing the SEDA on the foundations of the Sustainable Energy Action Plan methodology, strengthens the capacity building and commitment of local authority staff and can increase local political support to the energy and climate change mitigation agenda (in particular by signing up to the Covenant of Mayors).

The South Dublin SEDA is the first of its kind to be prepared by a local authority in Ireland and marks a significant step in integrating spatial planning and planning for energy alternatives. The SEDA has also facilitated a 'bottom-up' approach to responding to challenging EU and national energy targets to 2020 and beyond.

By utilising and advancing the Sustainable Energy Action Plan and Covenant of Mayors methodologies, it also points towards the development of a regional methodology and spatial approach to energy profiling and broadening the local canvas for planning for renewable energy, across local authority boundaries.

By compiling a detailed local energy analysis, the SEDA facilitates the opportunity for further local level analysis in South Dublin County, including the development of renewable resource mapping i.e. solar roof space analysis and mapping of waste heat sources. Detailed case studies could be carried out to ascertain the technical and economic feasibility of a range of measures in consideration of EU and National policy, technology advances, whilst also fostering increased local and community ownership of energy projects in South Dublin County.

Anthony McNamara MIPI is an executive planner with South Dublin County Council.

CASE STUDY 3

The Territorial Energy Concept, Geneva, Switzerland

In brief what does it show:

Geneva is the westernmost state of Switzerland and has a population of over 480,000. It is an economically vibrant region that has experienced population growth and urban sprawl in recent years.

Today Geneva has an ambitious growth agenda of developing 50,000 new homes by 2030 to address current housing shortages and to rebalance urban growth and development. In planning for future growth the State or Canton of Geneva has acknowledged that in response to the challenges of climate change, there is a need for greater integration between spatial planning and planning for renewable energy alternatives to fossil fuels.

Process/How?

The commitment to a more holistic approach to development in the Canton of Geneva has resulted in the adoption of a Cantoral Act (on regional policy) in 1987 and updated in 2010, making energy a public policy priority. As such, since 2013, town planning, housing and energy issues are grouped together under the Town Planning, Housing and Energy Department.

Geneva has also developed a 'Territorial Energy Concept' for each of the Canton's spatial planning procedures, to:

- Identify key stakeholders and their respective roles;
- Co-ordinate their activities, taking their interests and constraints into account; and
- Offer energy supply strategies that best promote local resources.

The Territorial Energy Concept is being used across the state to test the approach taken in several large scale projects and to provide learning on the value of closer collaboration between Planners, Energy Experts and other stakeholders. One such project is the GeniLac project, which aims to use water from Lake Geneva to provide a district-wide thermal heating and cooling network.

Form of sustainable energy:

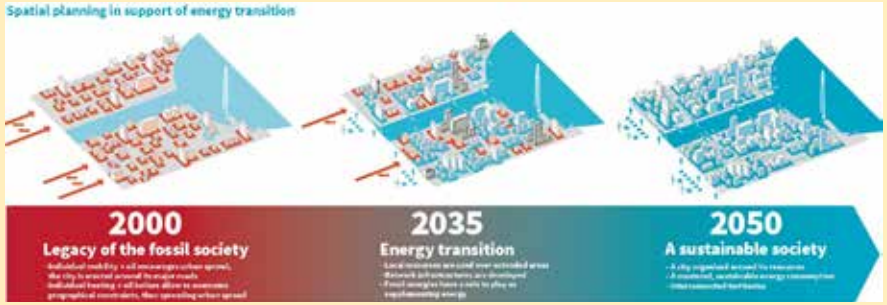
Hydro-thermal district heating, industrial waste heat, geothermal energy

Key Lessons?

- Inter-disciplinary approach to integrating spatial planning, housing and sustainable energy as a corporate and political priority, through the establishment of a dedicated Town Planning, Housing and Energy Department.
- The Canton of Geneva's plan for 2030 integrates energy policy and spatial planning, demonstrating high level political support and commitment.
- Through the Territorial Energy Concept, the Canton of Geneva has a clear procedure for identifying and co-ordinating stakeholder participation.

Further Information:

www.special-eu.org/ectp-awards



Territorial Energy Concept (Source: www.special-eu.org/ectp-awards)

The Modular Approach to Up-Skilling in the SPECIAL Project

Clíodhna Scanlon

Integrating aspects of climate and environmental protection, especially renewable energy and energy efficiency, has become an important element in the day-to-day work of any professional planner. It is crucial that planners and related professionals responsible for the development of the communities we live in, have a firm understanding of energy and spatial planning.

In Ireland, energy and spatial planning skills amongst planners is predominantly focused on rural, renewable projects such as wind energy at a local level rather than on the potential for urban renewable projects and the wider regional and national contexts.

SPECIAL aims to up-skill practicing planners, related professionals and energy sector stakeholders and increase competence building amongst town planning associations, in the integration of sustainable energy aspects into spatial planning functions and operations.

The Irish Planning Institute (IPI) is a partner in a pan-European project titled "Spatial Planning & Energy for Communities in all Landscapes" (SPECIAL). Founded in 1975 the IPI is the all-island professional body representing c. 650 professional planners engaged in physical, spatial and environmental planning in Ireland. Members work in central government, private practice, agencies, third level institutes, planning authorities in the Republic of Ireland and Northern Ireland and overseas.

To achieve the aims of this project, the IPI developed a seven module SPECIAL pilot training programme open to members and other related professionals which was launched in February 2015.

The programme draws on established best practice from across Europe, derived from the SPECIAL project partnership and from the expertise of our multiplier organisations - the Sustainable Energy Authority of Ireland (SEAI) , City of Dublin Energy Management Agency (CODEMA) , ESB International (ESBI) and South Dublin County Council and other speakers.

Programme Development

The training concept was devised following intensive engagement with IPI members and multipliers on the scope, content and format of the capacity building required through a SWOT analysis of their organisation and also drawing from an analysis of members' training needs in order to determine the most appropriate formats of training for our target audience.

Multiplier SWOT Analysis: As part of the programme development, each of our multiplier organisations were asked to complete a SWOT analysis of their organisations in terms of training.

This allowed the project team to identify how the SPECIAL project could improve the competence of the multiplier in spatial planning and sustainable energy solutions, identify gaps in existing knowledge and training, identify which modules and sub-modules are most relevant and build on existing training courses/ techniques and competencies.

Some gaps were identified in knowledge of planning and energy policy and how they interact with each other and also where the opportunities for intervention exist. As the multiplier organisations have, in one way or another, played an important role in energy policy development in Ireland, realistic training and case studies could be developed.

They also demonstrated existing supports in place for those involved in planning and energy which enabled this transfer of knowledge and skills at the dissemination stage.

IPI Training Needs Analysis: An assessment of members' training needs was conducted by the IPI in 2013 to highlight and inform future training programmes and events at a strategic level. In order to frame the context for this analysis, the following sectors were involved: Local Government, Members and Private Practice and Agencies. A series of questions required participants to give details of preferred areas of training, type and timings of training delivery and constraints of delivery, all of which were integrated into the pilot training programme.

This training concept then formed the basis and framework for planning each of the seven pilot modules to cover all aspects of the response to climate change. However, each module was developed individually with the respective multiplier organisation, therefore making it possible to consider the individual knowledge, needs and wishes of each multiplier organisation and local authority.

Short half day training sessions were the preferred method of delivery based on the results of our training needs analysis. The modules were delivered by expert speakers, including several speakers from our multiplier organisations, who provided in

depth presentations on their subject using practical examples from their field of expertise. Each training session was then followed by a facilitated structured workshop for participants to engage with the key note speakers and draw out learning or a detailed question and answer session where participants could ask questions on various issues and how to apply them in their daily working routine.

Target Audience

The target audience for training identified organisations ranging from national, regional and municipal government as well as private corporations and planning consultancies. The aim was to maximise the total audience which is directly accessible during the initial dissemination phase and possible future delivery.

Executive officers and administrative staff working within national, regional and local levels were also targeted during the training phase. Such positions are also essential components in the planning system in terms of the duties and responsibilities they hold, affording the opportunity to educate and raise awareness of the wider planning system while showcasing the manner in which spatial planning intersects and enhances the realisation of energy policy and infrastructure in a sustainable manner.

Delivery of Pilot Training

Seven competence building and training module pilots were planned and organised in cooperation with the multiplier organisations with the aim of reaching between 30 and 50 planning professionals for each module. The following modules were delivered:

- **Module 1:** An Introduction to Planning & Role of the Energy Planner – Directly derived from a need identified by multipliers' reflections on their own organisations, this module introduced architects, engineers and related energy stakeholders to the main functions of the Irish planning system and included an interactive exercise that explored the planning application system in more detail.

  The workshop aimed to explore the overlap between spatial planning and energy planning, including challenges in strengthening links between the two systems, and identify areas where greater integration is needed, including the role of the Energy Planner. The workshop included a group exercise exploring a planning application for a mixed use development with energy components and was delivered by ESBI with a presentation and workshop by Dr. Hugh Ellis, Head of Policy at the Town & Country Planning Association.

- **Module 2:** The Meeting Point: Energy Planning & Regulation – This module explored the evolution and implementation of national statutory building regulations regarding the conservation of fuel and energy. Feedback from multipliers had indicated that planners in Ireland could benefit from up-skilling in this area, with particular regard to construction projects and issues emerging from meeting the requirements of the building regulations on the ground. Led by experts in the building industry and local authority sectors, this workshop explored the evolution of the building regulations in Ireland with regard to energy, explored the practical meaning of the regulations, relating to the construction of developments that have gone through the planning application system.

- **Module 3:** The Departure Point: Mobilising a Response to the Energy Challenge – This discussed Ireland's response to climate change through legislation with a representative of the Department of the Environment, Community and Local Government who presented on Ireland's propose climate change legislation. The legal aspects of climate change legislation from a practicing solicitor was also discussed along with planning the national grid delivered by Eirgird.

  The aim of this module explored the departure point for addressing the energy challenge and to set the scene for strengthening links between spatial planning and energy in Ireland. Various aspects of the current energy debate in Ireland, including approaches to national policy and how to integrate legislation into local policy and the status quo of energy infrastructure provision in Ireland were addressed.

- **Module 4:** The Journey: Developing Evidence Based Policy - This module explored methodologies for developing an evidence based response to energy policy development, including Local Authority Renewable Energy Strategies (LARES) delivered by multiplier organisation SEAI.

  Spatially linked Sustainable Energy Action Plans (SEAPs), and in particular, energy demand characterisation and mapping opportunities and relationship with spatial planning growth assumptions was also presented by multiplier organisations CODEMA and SDCC. Prof Ulf Ranhagen from the Swedish SPECIAL partner also discussed the Swedish Perspective.

- **Module 5:** The Destination: Implementing Renewable Energy Alternatives - Participants gained an appreciation of sustainable energy infrastructure in operation in an urban context with a walking tour of the new Dublin Institute of Technology Grangegorman campus, a vibrant new city quarter

with a diverse mix of uses over phased development on St. Brendan's Hospital grounds in Dublin city centre.

The aim of this module was to explore issues surrounding the planning process and implementation of energy projects in more detail, using the example of DIT's Grangegorman Campus as an urban example. By developing spatially linked energy policies and strategies, a clearer picture can develop as to which energy opportunities are most appropriate on the local scale, as measures will vary across sectors, land uses and building types.

- **Module 6:** Historic Built Environment, Conservation and Energy - Focused on integrating current energy standards and strategies into the retrofitting of our historic building stock and how we can learn from best practice examples (using examples from Dublin's heritage building stock). Retrofitting historic buildings with renewable energy solutions can prove difficult to achieve under current development standards and regulations.

  It is therefore important that planners, conservationists and energy professionals come together to find integrated and innovative solutions. Speakers included the president of the Royal Institute of the Architects of Ireland.

Module 7: Energy & Masterplanning, Applying the Swedish Experience - Masterplanning is becoming increasingly important as a tool to further integrate sustainable energy and spatial planning. There is a recognised need for Planners and related local authority professionals and decision makers to engage with a wide variety of energy issues and stakeholders. The ultimate aim of up-skilling in this area is the addition of climate change adaptation and mitigation, as a robust and evidence based 'thematic layer' in the masterplanning and plan making process. This module focused on this particular area, drawing on the Swedish "Sustainable Municipality" experience delivered by Professor Ulf Ranhagen.

Conclusion

As a pilot training programme introducing energy and spatial planning principles and practices to planners and related professions, the approach was successful.

By analysing detailed feedback forms completed by participants after each module, it was ascertained that all SPECIAL pilot training modules resulted in a significant increase in the level of knowledge of aspects of climate protection and the integration of sustainable energy practices and principles within spatial planning.

The success of the programme delivery can be attributed to the modular type, short training sessions which focused on individual and related energy and spatial planning topics. However, at a national and regional level, there still remains a gap between spatial planning policies and energy policies.

It is a time of change within the Irish planning system at present and with the introduction of new planning legislation, Building on Recovery: Infrastructure and Capital Investment 2016 – 2021, a National Planning Framework and Regional Spatial and Economic Strategies, now is the time to align evidence based energy policies and spatial planning.

One thing is clear, continuity of this crucial training and upskilling programme for planners and related professionals is essential to ensure environmental targets are achieved on a national, regional and local level.

Clíodhna Scanlon MIPI is Planning Projects Officer with the Irish Planning Institute.

CASE STUDY 4

District Heating Manual for London, UK

In brief what does it show:

With energy at the heart of the transformation of cities to sustainable, resilient low-carbon communities, the delivery of new energy infrastructure will be critical to securing a reliable and resilient energy future. It is in this context that the Mayor of London and Greater London Authority produced this District Heating Manual for London. The DH Manual is intended to provide guidance to the development and delivery of district heating networks in London.

Process/How?

The DH Manual covers the following aspects of developing a district heating network;

- Guidance on the relevant planning policy and typical requirements of local planning authorities;
- The design principles and technical concepts for the physical infrastructure focusing on interfaces between heat production plants and network, network and consumer installations;
- Guidance on contract structures and management to help inform developers and project sponsors of appropriate options and the key issues to be considered when establishing delivery vehicles and determining procurement strategies; and
- Guidance on the build-up of tariff structures and associated charges that can reasonably be
- Incorporated as part of a project's revenue streams.

Form of sustainable energy:

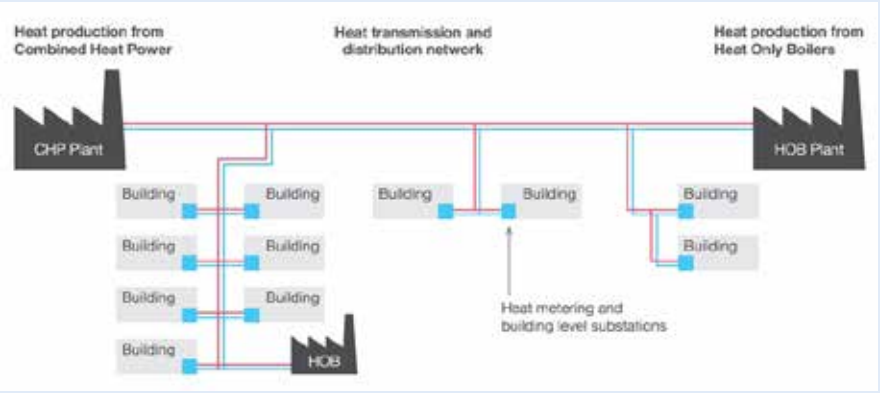
District heating, Energy Master Plans to support local energy opportunities

Key Lessons?

- The Manual advocates that all major development seek to achieve demanding carbon reduction targets through the application of an Energy Hierarchy.
- Planning policy documents which support the development of climate change mitigation measures should be followed up by the preparation of local Energy Master Plans (EMP).
- Where an Energy Master Plan (or similar study) identifies the feasibility of an area-wide heat network but no firm plans exist as to who will build the network or by when, the development should 'future-proof' a connection assuming it has a single plant room producing hot water for space heating and domestic hot water. Future-proofing involves providing 'tees' and isolation valves in the hot water headers to facilitate the connection of an interfacing heat exchanger at a later date.
- Provision should be made in the building fabric to facilitate future district heating connections.
- External buried pipework routes should be safeguarded to a nearby road way or similar location where connection to the main district heating network would be made.
- These matters could be addressed by way of the Development Management (planning permission) process.

Further Information:

http://www.londonheatmap.org.uk



District Energy Network Overview (Source: www.londonheatmap.org.uk)

Spatial Planning and Energy at the 11th Biennial of European Towns and Town Planners

Seán O'Leary

SPECIAL partner the Irish Planning Institute (IPI) hosted the ECTP-CEU's 11th Biennial of European Towns and Town Planners in sites across Dublin in October 2015. The ECTP-CEU (European Council of Spatial Planners - Conseil Européen des Urbanistes) is the umbrella organisation for spatial planning institutes in Europe. The Biennial was supported by the TCPA and SPECIAL and the topic of "energy and spatial planning" formed a key pillar of the programme. SPECIAL is also working with the ECTP-CEU to produce a "Pan-European Guide on the Integration of Spatial Planning and Energy" at the end of the project. The Biennial local organising committee was chaired by Brendan Allen from ESB International, an IPI multiplier organisation.

The key characteristic of the Biennial is that it is by and for practicing planning professionals across Europe and the 11th iteration brought together over 45 expert speakers and projects addressing delegates from 25 countries on the overall theme "Making Cities Work - Technology in Planning Practice".

In her welcome address IPI president Mary Hughes noted that it was timely that the Biennial was taking place in Dublin as according to the European Commission, Ireland has returned to being the fastest-growing economy in Europe with the associated pressures of supporting growth while reducing greenhouse gas emissions.

For Hughes technology and practical examples were key to meeting this challenge with "the diverse programme of themes and events at the Biennial showcasing practical and relevant plans, initiatives and projects for creating the smart, innovative and sustainable cities and regions of tomorrow."

In the opening keynote Colette Maloney, Head of Unit Smart Cities and Sustainability unit at the European Commission's Directorate-General for Communications Networks, Content and Technology, spoke on "Europe's Smart City Agenda". For the Commission the smart city concept goes beyond the use of ICT for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities, and more efficient ways to light and heat buildings. And it also encompasses a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population.

In a keynote address on the opening day Dublin City Council Chief Executive Owen Keegan discussed his vision for a "smarter" Dublin with technology (such as switching to LED lights) allowing for greater energy efficiency and more effective public transport.

During the energy and spatial planning stream, Diane Smith of SPECIAL lead partner the TCPA gave an overview of ways to improve the integration of spatial planning and sustainable energy supply and distribution. The presentation, based on the work of SPECIAL, compared planning approaches from different countries, identified the role of planning associations in improving competencies of planners at the municipal level, set out key points of intervention and demonstrated good practice such as the Hamburg Energy Hill.

IPI member Anthony McNamara of South Dublin County Council, which is working with the IPI on the delivery of SPECIAL, spoke on "Advancing Evidence Based Energy Policy: Developing a Spatial Energy Demand Analysis (SEDA) in South Dublin County". In Ireland, energy planning is primarily focused at national level and there is little integration with spatial planning, particularly at local authority level. There is a recognised need to build on county development plan energy policies, focusing on more evidence based and spatially appropriate policies and objectives. South Dublin County Council has undertaken a countywide Spatial Energy Demand Analysis to facilitate an enhanced spatial understanding of energy needs, and energy efficiency and renewable energy responses, which vary across sectors, settlement areas and the built environment.

The energy profile for the commercial, residential and municipal sectors, collated under the EU Covenant of Mayors and SEAP methodologies, has been progressed to generate county scale tabulations and maps representing a range of energy information, including energy demand, heat density and costs across sectors.

For example, heat density is the amount of thermal energy used within a defined area and is a recognised EU wide methodology and indicator for the economic viability of district heating schemes. McNamara concluded that SEDA provides an opportunity for local authorities to progress from "support" and "promote" type policies in development plans to more meaningful policies in standalone energy chapters.

Ruth Kerrigan of IES (Integrated Environmental Solutions) discussed the "Generation of Content for

Baseline City Energy Model Using Dynamic Simulation Modelling Tools". This presentation discussed the characterisation of a city with respect to its buildings, their typology and use and described the procedure to create a library of prototypical building templates which can be used to generate content for these buildings within the city. The procedure includes a new simulation tool which pulls together various design options as a result of user questions, to form the prototypical building templates and simulate the typical energy/carbon use that this building would present.

Using this procedure a baseline city model can be generated, using simulated content only. This provides city authorities and planners with a baseline energy model to aid them with respect to decisions to be made within the city regarding, investment, incentive schemes, target areas, intervention options etc.

IPI member Terry Prendergast and Paul Horan discussed "The Planning and Delivery of an Energy Efficient Urban Regeneration Project at Grangegorman". The Grangegorman development is a flagship sustainable urban regeneration project in Dublin's inner city. The development will regenerate a 29 hectare brownfield site, formerly used as a psychiatric institution, into a new education/health campus for the Dublin Institute of Technology and the Health Services Executive. The development will include c.380,000m2 of education, health, research, science and technology, student accommodation, amenity and recreational development. The presentation focused on planning for and delivering a large scale low energy urban regeneration development. Key themes included urban form and building design, energy supply, adaptive reuse of protected structures and transport planning. The planning and energy aspects of the Grangegorman project have also been explored as part of the IPI's capacity building programme under SPECIAL through site visits and presentations.

In a keynote address the Biennial also heard from architect James Mary O'Connor, principal-in-chief at Moore Ruble Yudell architects, who completed the Grangegorman masterplan. Biennial delegates had the opportunity to visit the site over the course of the event as a number of parallel workshops were held there.

Christine Schwaberger of SPECIAL partner the Department of Spatial Planning Law in the Provincial Government of Styria, focused on Austria's implementation of energy planning issues and how spatial planning law and climate change issues are already aligning in Styria.

In additional to the SPECIAL partners who attended, particularly welcome were a number of young planners participating in the Biennial as part of an ECTP-CEU initiative and members of the London Irish Town Planners Network. A group of young planners from University College Cork presented on the role of public bike sharing schemes in retrofitting urban environments for modal shifts. The past decade or so has seen the number of people cycling rise 68.5% in Dublin City. The number of Irish people cycling to work, college and school has risen from 58,960 to 61,177, the first increases since the 1980s. Despite uncertainty on whether bike share users are replacing car or public transport journeys and consequently the level of CO_2 emissions avoided, they are clearly a component of making more liveable and healthy cities.

In the Biennial host city of Dublin the "dublinbikes" scheme is a Dublin City Council planning department project and has seen the implementation of one of the world's most successful city bike share schemes with planning ideally placed to lead a multidisciplinary team changing infrastructure, sustainable transportation and the public realm in the city.

IPI member David Moore of Fehily Timoney & Company, a global management, engineering and environmental consultancy, presented on "promoting digital technologies for integrated planning and design of green energy infrastructure". This presentation focused on the supply side of green energy provision and examined how data management using digital spatial technology plays a central role in iterative design process involved in provision of large scale wind energy. The presentation discussed the particular design challenges associated with large scale wind energy provision where protection of, amongst other things, habitats, cultural heritage, landscape and quality of the residential environment, are balanced against economic and engineering constraints. As a result wind farm design becomes a dynamic and iterative process, where collaboration between environmental specialists, spatial planners, engineers, landholders, utility providers, statutory agencies and the developers is needed.

The presentation discussed how spatial data management embraces the life cycle of data from its capture, to analysis, utilisation and storage and can extend the role of digital technology from an exclusively technical input to one which helps promote wider acceptance of large scale energy projects. This concept, encapsulated in the ideas associated with Geodesign, takes the use of digital technology beyond the traditional uses of geographic information systems toward fully a collaborative experience that includes the public and other sectional interests into the design, planning and decision making processes.

Pedro Ardila presented on "Fornebu, A Green, Town Built on National and International Expertise". Fornebu was a winner in the ECTP-CEU's 10th European Urban and Regional Planning Awards held in association with SPECIAL in 2014. The new town of Fornebu in Norway demonstrates

exceptional innovation and creativity with close interaction between the environment, architecture and people. The development of Fornebu is characterised by its high environmental ambitions. The work of planning the new town started in 1994 and a final master plan was adopted in 1999. The final master plan catered for 6,300 new homes, around 20,000m2 of office spaces, extensive recreational grounds, large bird sanctuaries and areas for shopping, services and social infrastructure (schools, health-care sites, youth clubs, etc.).

Several environmental projects and activities in the plan includes themes such transportation, energy supply, consumption and climate changes, building materials and waste, mass management, natural and cultural conservation and pollution and noise. Fornebu has functioned as a laboratory for modern green thinking.

The Biennial, which will take place again in 2017, remains a unique opportunity to bring planning and other built environment practitioners together to address the key challenges of tomorrow and energy is clearly at the heart of these.

Seán O'Leary MIPI is Executive Director of the Irish Planning Institute.

Ardnacrusha Hydroelectric Power Station

CASE STUDY 5

The Stockholm Royal Seaport - Eco City District, Stockholm, Sweden

In brief what does it show:

Stockholm is growing rapidly and 140,000 new homes are planned by 2030. Stockholm Royal Seaport is the largest urban development area in Sweden with 12,000 new homes and 35,000 workplaces to be delivered by 2030. In 2010 Stockholm City Council decided that Stockholm Royal Seaport district is to be a sustainable urban district and an international model for sustainable urban planning.

Process/How?

- One of the environmental goals of Stockholm Royal Seaport is, by 2030, to have a city district that operates with significantly reduced greenhouse gas emissions (less than 1.5 tonne per person per year by 2020) resulting in a gradual minimised dependency on fossil fuels.
- Buildings and facilities are designed to limit the energy use to a minimum and must not use more than 55 kWh/m^2/year (national standards = 90).This is achieved by way of planning permits for development (i.e. planning permissions can stipulate the energy demand to be achieved by new developments in the district). As far as possible the energy used should be based on renewable sources. The surfaces (roofs and facades) of the building should be used to generate energy, aiming at producing as much energy locally as possible and reduce CO_2.

  The long-term goal is to construct plus-energy buildings. Smart energy grids are also to be developed to manage variations in consumption and production and enable residents to use energy efficiently and adapt user-patterns to sustainable production.
- Furthermore, a methodology has been developed, the Green Space Index (GSI) that enables the planners and developers to design green structures, both for public open spaces and each development plot, that strengthens the biodiversity, increases storm water retention and encourages social interaction. GSI can change the urban landscape into greener neighbourhoods and more accessible roof tops.

Form of sustainable energy:

- District heating, combined heat and power, solar and PV, energy efficiency, smart grids

Key Lessons?

- Stockholm Royal Seaport is a sustainable urban district, characterised by dense, multi-functional and resource-efficient development, an urban environment with an integrated green structure and proximity to the surrounding nature.
- Stockholm Royal Seaport is a model of sustainable urban planning and plays a key role as a source of knowledge and inspiration in international collaboration, exports of green technology and expertise in sustainable urban development.
- Stockholm Royal Seaport is to be an urban district with sustainable lifestyles where "doing the right thing is easy," and where people living and working in the area develop their knowledge and ability to live and act sustainably.
- Stockholm Royal Seaport is to contribute to innovation, development and the marketing of Swedish green technology, expertise in sustainable urban development and the development of sustainable businesses with sustainable products and services.

Further Information:

http://www.stockholmroyalseaport.com/en

Aerial of Stockholm Royal Seaport (Source: www.stockholmroyalseaport.com)

The Sustainable Municipality Planning Approach
4 big and 20 small steps towards sustainable and energy smart cities and societies

Professor Ulf Ranhagen and Mats Johan Lundström

Introduction

The Sustainable Municipality Planning Approach (SMPA) is a process oriented planning concept developed within the Swedish Energy Agency's R&D programme Sustainable Municipality (2003-2012). It involves ideas and methodology from various schools of thought and practical planning experiences, combining collaborative, communicative, rational and strategic planning ideas and approaches.

The main purpose is to promote inclusive cross-sectoral planning processes that integrate the energy perspective in spatial planning – or vice versa: the spatial perspective in energy strategies – and support sustainable spatial development in general.

The approach is primarily adapted to planning at a strategic level (the comprehensive plan or detailed comprehensive plan). The emphasis is on capitalising on informal opportunities – in addition to – or within the framework of - the necessary formalities required in planning. Thus it aims at going beyond the formalities in the work and analyses and in the creative development of proposals focusing on sustainability issues and, in particular, energy for heating/cooling/electricity and transport.

4 big leaps and 20 small steps

Our experiences from almost ten years of research and development work are recorded in the publication "4 big leaps and 20 small steps - Conceptual guidelines on sustainable spatial planning" (Swedish Energy Agency, 2011). The four main steps (or leaps) are:

1. Organise and formulate the planning work.
2. Integrate sustainability issues in the comprehensive plan.
3. Integrate energy issues for heating, cooling, electricity and transport.
4. Develop a strategy (action plan) for implementation and follow-up.

Figure 1: 4 big leaps and 20 small steps

The full "ladder" of the 4 big steps and 20 small leaps is presented in figure 1. Please note that it's an approach, not a recipe or one-size-fits-all. The main steps 2 and 3 can successfully be done simultaneously.

However, starting with the broad sustainability work is a good way to introduce planners and other urban professionals to this way of thinking and working before starting to work with the more "hard core" energy issues.

Leap1: Organise and formulate the planning work

Organisation and process design is key for a successful planning process and – not at least – implementation in order to fulfil our desired goals and visions. Hence, we stress the importance of giving these issues the time, efforts and considerations needed in order to develop our society in a sustainable direction. Although it may initially take more time and resources, it is often a good investment that will pay off later on in the development projects.

Cross-sectoral partnerships are a success factor in spatial planning. Communicative planning research clearly shows the benefits of inclusive and interactive planning processes where planners and other planning related professions cooperate, as well with politicians, civil society - citizens and local industry.

Among many things, it fosters mutual trust and understanding and open minds, builds social and institutional capital, boosts mutual learning and understanding etc. Cross-sectoral and inclusive working methods in early dialogues give a plan or a strategy a stronger legitimacy and leads to greater commitment among the actors. Thus, this enhances the prerequisites for efficient implementation.

Workshops constitute a favourable work format with a deliberate interplay between the communication of knowledge and own applications or exercises. The aim is to find informal, creative, development-oriented and enjoyable work methods. The approach can also be applied by switching between highlighting issues in a specific municipal department and cross-sectoral groups, respectively. It has proved advantageous to engage an external workshop facilitator who is not directly involved in – or who has own interests in – the municipality's internal work, to avoid deadlocks and to ensure that the process flows smoothly.

Another key element in our planning philosophy is to avoid a linear approach and promote a cyclic/iterative and flex-

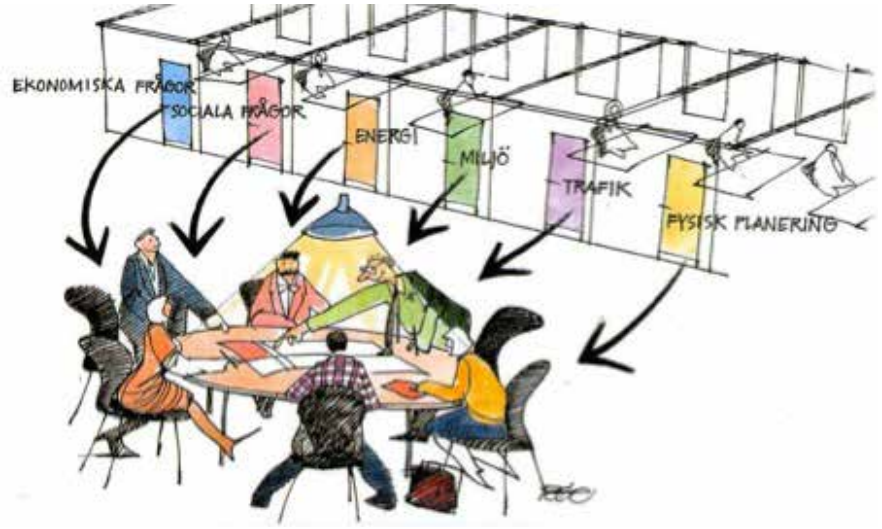


Figure 2: Close cross-sectoral cooperation among different departments of the municipality is key. Illustration: PeGe Hillinge, Sweco Architects.

ible planning process. It is not necessary for each component in a step to be completed prior to commencing the next step.

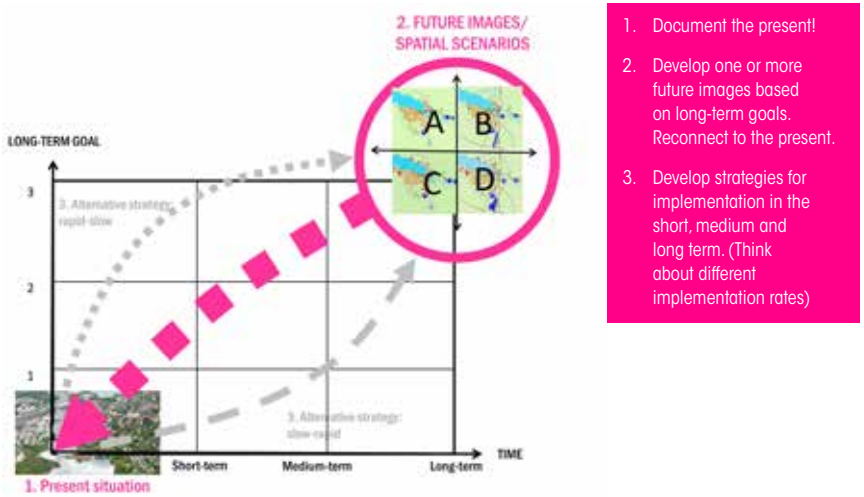
Naturally, a logical, step-by-step process is advantageous to a certain degree. However, advantages exist in working through several stages concurrently to gain a compiled, if somewhat rough, basis for discussion of the main features in the planning. The systematic procedure may be seen as an allowing framework for creative and dynamic activities performed by the stakeholders.

Leap 2: Integrate sustainability issues into comprehensive planning

Multiple concepts of sustainable development have been launched with more or less extensive claims of representing the truth. To avoid unnecessary conflicts and misunderstandings later on in the project, we strongly advise to work on a joint definition or overall concept for sustainable urban development early in the planning process – a local interpretations of sustainability that is relevant for the actual planning assignment. Inspiration can be gained from overall, research-based definitions. We emphasise the importance of balancing the ecological, sociocultural and economic aspects of sustainable development and working with these based on a spatial perspective keeping humanity in focus. Thus a broad participation from various sectors and departments is necessary.

Understanding the current state of the project area and its surroundings is fundamental. The spatial planning for an entire region, a municipality, or a city district depends on the interaction between factors in the world at large and the actual site (external and internal factors). An external conditions analysis is needed to document key economic, social, ecological and spatial driving forces and trends to demonstrate both opportunities and threats. In addition, describing and analysing a given planning area (internal conditions analysis) is a fundamental element in all planning from various sustainability aspects, whether it pertains to the municipality as a whole, a city district or one or more blocks. The internal conditions analysis is a way of strengthening understanding how spatial conditions interact with and influence ecological, economical and socio-cultural conditions, particularly energy issues for transport and heating.

The simple but broad and well-known SWOT-analysis tool (Strengths, Weaknesses, Opportunities and Threats) can contribute to generating commitment to discussing the strengths and weaknesses of a location where planning is in progress, and the threats and opportunities in the surroundings. It is a good tool to identify a number of issues that are most important to deal with in the current planning project. Our experience is that this methodology may be strengthened by applying it on both



1. Document the present!
2. Develop one or more future images based on long-term goals. Reconnect to the present.
3. Develop strategies for implementation in the short, medium and long term. (Think about different implementation rates)

Figure 3: Back-casting is a method that is usable for preparing visionary future images (spatial scenarios). In this case an explorative scenario working with four future images using a scenario matrix.

institutional and spatial issues and by using maps to identify spatial qualities and deficiencies.

However, planning on a comprehensive level needs to be strategic and focus on a limited number of key issues. The key issues will supplement vision, goals and targets and may be linked to these in the work process of developing alternative proposals and solutions.

The sustainability and climate challenges calls for a long-term perspective in spatial planning. Instead of making projections of the future based on historical and present trends (forecasting), work should be initiated according to the back-casting method with a sketching of future images displaying how solutions to a social problem may appear in the long term (Figure 3). Vision, goals and key issues constitute the starting point for developing future images. After deciding on the future images, possible alternative routes from the present to the future may be sketched. In stringent applications, back-casting is connected to visionary future images but in the Sustainable Municipality Planning Approach back-casting is combined with scenario planning. A scenario is a possible future situation that depends on various external changes.

Although evaluation is only one part of the planning, it is such a central activity that it permeates all parts of the planning process. It is recommended that the process concerning impact assessments – here, pertaining not only to the environmental perspective – is run in parallel with the decision process. Since impact assessments

may become overly extensive written accounts supplemented with calculations, a need has arisen to graphically illustrate and summarise assessments primarily with respect to comparison and ranking of alternatives. In the Sustainable Municipality Planning Approach, we use three different evaluation tools: effect profiles (ranking), value roses (spider charts) and multi-criteria analysis (MCA). Each tool has its pros and cons, depending on the needs and frameworks of the current planning project.

In all cases, it is necessary to place major emphasis on the aspects, indicators or criteria selected. Regardless of the tool used, the choice of aspects as well as the evaluation process should be made by a broad group involving representatives from various departments and sectors of the municipality (or external experts).

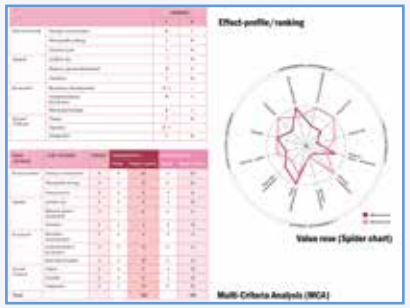


Figure 4: Three evaluation tools used on the same project:

The effect-profile/ranking is a simpler form of evaluation whereby two or more alternatives are compared with each other based on a number of established criteria. For each sub-criterion, the proposal that is best, second best and third best, etc., will be ranked. In this example, only two alternatives are evaluated: A or B is best (1) or worse (2). For some criteria, it may be difficult to recognise any differences (business development and equality, in this example). The table does not show how much better or worse one alternative is compared with the other.

The value rose (spider chart) visualises strong and weak sides in various alternatives. Here, the degree to which one alternative is better or worse than the other is shown connected to various criteria. The further out on the axis, the higher the value. The scale may be graded or ungraded.

The **multi-criteria analysis (MCA)** facilitates advanced evaluation and comparison of various alternatives. The principal sub-criteria receive higher points than other criteria. The weight is multiplied by the points for each alternative = weighted points. The total of the weighted points shows the total points for each alternative, in this case 130 points for Alternative A and 154 points for Alternative B. In this instance, the MCA results indicate that Alternative B is preferable to Alternative A. The results can also be visualised graphically in a value rose.

LEAP 3: Integrate energy issues for heating and transport

When an initial round of planning has been implemented according to leap 2, this will serve as an excellent basis for an additional round of planning to address energy issues in greater detail. Initially, this means mapping and analysing the spatial implications of the energy and transportation systems.

A sustainable energy potential analysis is a tool for a rough analysis of the current energy situation in the area to indicate the current status and the desired and probable development. Broad participation is recommended here as well.

When there is an adequate picture of current planning conditions, it will be time to commence work on future changes and improvements. We use the following approach: minimise energy needs, maximise the proportion of renewable energy, and discuss how lifestyle factors affect energy use as well as how these three perspectives may be combined.

In this leap, work will advance using the future images prepared in the first round of planning. As the starting point of this work, three energy scenarios for heating/cooling/electricity and transport that are different in principle are formulated. The scenarios can be viewed either as streamlined scenarios or peripheral/extreme scenarios to clarify the reach of possible alternatives and the differences that may exist between them.

The conceptual energy scenarios are then to be developed and visualized in alternative, spatial future images (sketched plan proposals). It is very important that the work is conducted in cooperation among planners and transport, energy and environmental experts, but also in broad cooperation with community associations and citizens. Expert support is also of importance to finding the correct focus for the future images.

Similar to the general development of future images (leap 2), it is important to evaluate and compare these based on a number of criteria (indicators), using the evaluation tools presented in leap 2.

For the evaluation of the energy future images, we (together with energy and transport experts) have developed supplementary quantitative evaluation tools based on the Microsoft Excel software: EnScen and TranScen. These can be used to model, calculate and compare energy consumption and carbon-dioxide emissions for the alternative future images.

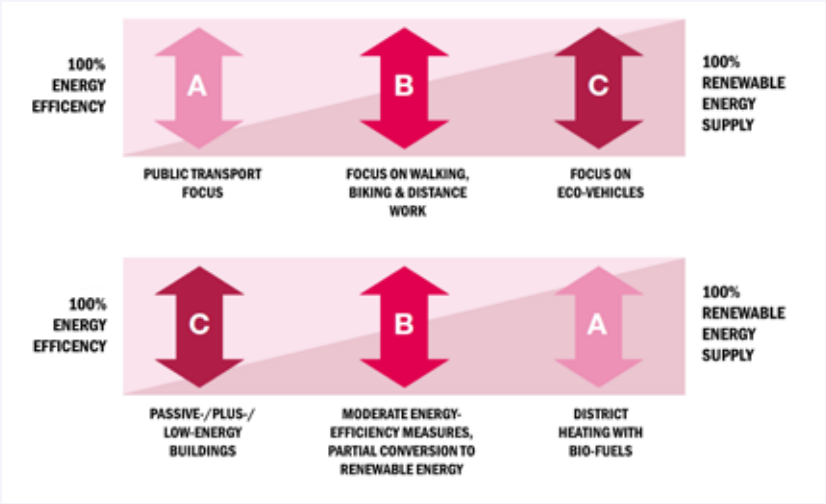


Figure 5

Figure 5: Three alternative scenarios for transport (top) and heating/cooling/electricity in buildings (bottom) that are integrated in spatial future images (sketched plan proposals) and evaluated. Afterwards, there is the possibility to combine portions of the various scenarios into a processed proposal from which to continue work.

Alternative A entails focusing on major investments in public transport and focusing on the supply of renewable energy for buildings; Alternative B entails investments in improving conditions for pedestrians and cyclists and distance work, as well as moderate investments in both energy-efficiency enhancements and the supply of renewable energy; Alternative C entails major investments in eco-cars and energy-efficiency enhancements in building developments.

Leap 4. Formulate an implementation and monitoring strategy

When a proposed plan is being developed, it is important to concentrate not only on making the proposal itself sustainable and energy smart but also to consider the potential to implement the entire proposal or parts thereof.

Various types of control measures are required to be able to implement the sustainability objectives – political, social, economic, institutional (organisational) and legal. Certain control measures are sharp and formal instruments, such as legislation and limit values for energy consumption. Others are softer and informal and more difficult to quantify, such as education, information and forms of cooperation. Thus, there are various "hard" and "soft" control measures to be used in sustainable spatial development processes.

In the Sustainable Municipality Planning Approach, we encourage municipalities to work in broad and cross-sector workshops (using the tool structured brainstorming) to document and develop ideas on various control measures (soft and hard) with respect to politics, policies, programmes, plans (advisory and binding), agreements and financial incentives.

We also want to promote what we call a "PBA+ Approach" (PBA+). Municipalities cannot use legislation to force property owners to make changes in the existing property portfolio. The Swedish Planning and Building Act (the PBA) is quite week when it comes to regulating energy smart developments, but its procedural requirements on citizen consultation can be utilised as an arena for participation, influence and information. And since consultation is required – why don't use this opportunity to do work more aggressively on energy and other sustainability issues?!

This "PBA+ Approach" entails that in addition to hardware –physical structure and technical solutions – software is included, such as the expertise, attitudes, choices and behaviour of people with respect to energy consumption and climate impact.

Using this planning philosophy, the municipality's expert resources, in addition to the urban planners, will gain a more active role as support resource for the property owners and the general public– energy advisors, procurement experts, teachers, property experts etc.

The starting point for developing arenas for good discussions is that they must be used to capitalise on and create innovations when working with sustainable city and district development in cooperation with all the players concerned. In contemporary planning physical arenas need to be supplemented with arenas on digital and social media in order to attract wider targets groups.

The discussion about the needs and benefits of developing and applying various systems and tools to monitor qualities in city districts and cities that are both measurable and difficult to measure has intensified.

Monitoring models can be developed in dialogue-based workshops focusing on reasons, relevant indicators and organisation of monitoring models.

Final comments

Have fun! Develop a fantastic dialogue and creative communication that will lead to sustainable and energy-efficient plans and societies.

Professor Ulf Ranhagen and techn.lic Mats Johan Lundström. The Swedish Society for Town & Country Planning, the Department of Urban Planning and Environment, KTH Royal Institute of Technology, Stockholm.

CASE STUDY 6

Renewable Wilhelmsburg, Hamburg, Germany

In brief what does it show:

Redevelopment of the Hamburg district of Wilhemsburg, which is Europe's largest river island and comprises an area of 35km^2. Wilhemsburg is a former industrial area, characterised by docklands, industrial developments and green spaces. In 2004 policymakers in Hamburg came up with the "Leap across the Elbe" approach for developing this southern district of the city.

The area had an existing population of over 50,000 people and under the International Building Exhibition IBA Hamburg, it is expected that in excess of 5,000 new homes will be delivered by 2020. The master plan for this emerging city district. envisages a colourful mixture of housing, offices, retail, and service establishments such as hotels and leisure facilities. At its core is the closer dovetailing of water, green spaces, trees, and sustainable transport facilities.

Process/How?

The Renewable Wilhelmsburg Climate Protection Concept sets out a combined approach to sustainable energy across the district, under the overarching ambition of supplying the Elbe islands with 100% renewable energy. A range of measures have been implemented, including local renewable energy production, energy efficiency standards for both new buildings and retrofitting existing buildings, and combined heat and power plants.

Form of sustainable energy:

District heating, combined heat and power, solar, energy efficiency, energy storage, energy clusters.

Among the many projects that have been delivered are two initiatives that have helped transform sites associated with World War II into international symbols of climate change action. These are the Georgswerder Energy Hill and the Energy Bunker.

The Georgswerder Energy Hill is a former landfill site which for decades was used as a dumping ground for rubble and domestic waste following the Second World War and was later used for toxic industrial waste. Today, the Energy Hill is an iconic visitor attraction and important local renewable energy source, supplying approximately 4,000 households with electricity using wind and solar generation (which is Hamburg's largest photovoltaic system). Landfill-generated gas is also being utilised as a source of energy.

As part of the IBA Hamburg a former

air-raid bunker, built in 1943, has been renovated and converted into a renewable energy power plant and heat reservoir.

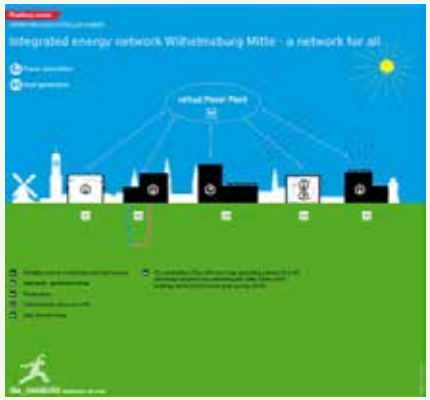
The Energy Bunker provides enough heat for approximately 3,000 homes and electricity for in excess of 1,000 homes through a bio-methane combined heat and power unit, a solar thermal roof installation, and waste heat from a nearby industrial plant.

Key Lessons?

- The International Building Exhibition IBA Hamburg model has been transformative in pointing Wihelmsburg on a pathway towards 100% renewable energy generation.
- As a former industrial area, Wilhelmsburg offers many transferable lessons for towns and cities across Europe on the re-use of former industrial sites and buildings for both renewable energy opportunities and community facilities.
- Masterplanning at a city district scale enables the co-ordinated delivery of multiple projects, ensuring that environmental, social and economic benefits are maximised.
- The projects promoted and delivered through the Renewable Wilhelmsburg Climate Protection Concept are not only innovative in terms of smart technologies and regeneration but also provide symbolic landmarks for climate action.
- A key focus of the initiative was to ensure a high level of stakeholder engagement including politicians, planners, architects, engineers, local business and the general public.

Further Information:

http://www.iba-hamburg.de



Wilhelmsburg, Hamburg (source: www.iba-hamburg.de)

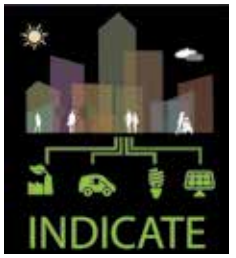
INDICATE
Indicator-based Interactive Decision Support and Information Exchange Platform for Smart Cities

Tom Grey

Introduction

INDICATE is a smart city research project funded by the EU 7th Framework Programme (FP7) as part of the Specific Targeted Research Projects (STREP) funding scheme. The overall aim of the project is to create a prototype interactive cloud-based decision support tool to inform the urban planning and design process as part of a transition towards sustainable and smart cities.

The tool will enable critical stakeholders, such as local authority decision makers, urban planners, architects, or urban design teams, to assess the energy related interactions between buildings, energy distribution grids, renewable technologies, and Information and Communication Technologies (ICT).



The analysis of these interactions will help identify opportunities for optimising infrastructure, installing technology, and providing cost effective utility services.

The INDICATE project commenced in October 2013 and is due to be completed in September 2016, at which point a working prototype tool will be available.

Project Partners

The project partners comprise a mix of large companies, SMEs, universities, and local authorities drawn from Ireland, the UK, Italy, and Switzerland. The Irish partners consist of Future Analytics Consulting, Trinity College Dublin, Dundalk Institute of Technology (DKIT) and Louth County Council, while Integrated Environmental Solutions (IES) are Scottish based, but have an office and large presence in Ireland. Italian partners include D'Appolonia S.p.A. and Ente Ospedaliera Ospedali Galliera (Galliera Hospital), who are a large hospital based in the centre of Genoa city, and finally, Esri R&D Centre Zurich, who are based in Switzerland.

Expertise within the consortium includes: dynamic simulation model-

ling; GIS development; 3D urban cad modelling; demand side management; sustainable urban indicators; business model development for energy in cities; and the integration of energy efficiency solutions & technologies at an urban scale.

Background: The need for Integrated Urban Planning and Design Solutions

In what has been referred to as 'The Century of the City'[1] there are many converging factors influencing the debate around urban energy consumption and efficiency. Currently the world's population is in excess of 7 billion, with a low forecast of 8 billion by 2050, a median of 9.2 billion, and a high forecast of 10.5 billion.[2]. It is estimated that over seventy percent of this population will live in cities by 2050[3] which equates to 6.4 billion urban dwellers. This will have a significant impact on the daily functioning of all urban systems including energy generation and distribution, public transport, waste management, sanitation, water supply, housing, and other urban infrastructures. All compounded by rising energy costs, energy supply security, concern about peak oil[4-6], and of course increased greenhouse gas emissions.

While it can be argued that compact cities, due to density, public transport efficiency, and proximity to services, represent a more energy-efficient settlement model than dispersed settlements[7], there is no doubt that cities consume a significant portion of global energy. According to some estimates, cities consume approximately 80% of all commercial energy produced[8] and account for 75% of global green house gas emissions, all this, despite only taking up 2% of the Earth's land mass. This is driven by the combustion of fossil fuels consumed in an array of urban residential, industrial, and transport processes[9].

Over the past few decades there has been a wide range of responses to this urban crisis with a growing consensus around the potential for more compact, walkable urban form designed around public transport nodes[7, 10-14]. Whether settlement patterns are compact, dispersed, or clustered around transport nodes, there are myriad energy issues that must be addressed in the urban context in order to achieve sustainable urban environments.

These energy issues should be considered alongside the burgeoning field of 'smart cities', and 'smart technologies' with respect to improving the efficiency and effectiveness of urban systems[15].The smart city involves the integration of ICT into a strategic approach to sustainability, citizen well-being, and economic development. In this regard smart technologies can be used as innovative and efficient approaches applied to 'intelligent buildings', 'smart grids' including electrical vehicles, smarter water systems, public safety , and other key urban issues[16].

In this context, the 'internet of things' [17, 18] is emerging as a key factor due to its role in connecting objects across various scales; from everyday devices, to industrial equipment, vehicles, building technology, and infrastructures. Alder[19] argues that these devices can be used to collect and analyse data and thus enable "a shift from reactive to proactive systems; from delayed problem management to automatic sense-and-respond capabilities."

The INDICATE concept

The proposed INDICATE tool seeks to support urban planning and design decision making in an age of increasing demands and complexity. The tool will provide dynamic assessment of the interactions between buildings, energy distribution grids, renewable technologies, and ICT to provide recommendations regarding: suitable technologies to; optimum building retrofit; highlight infrastructure that requires improvement to enable local energy balancing; and identify utility services that offer the best financial return. To understand how the decisions made will affect the overall urban environment, a set of sustainable urban indicators are being developed to measure effects from any changes made to buildings, infrastructure, or energy related technology. The resulting tool will support a holistic approach to the city and allow decision makers, planners and urban designers to:

- **PLAN** using an energy-based decision support tool that utilises dynamic simulation & takes into account buildings & occupants, the urban environment & energy distribution grids.

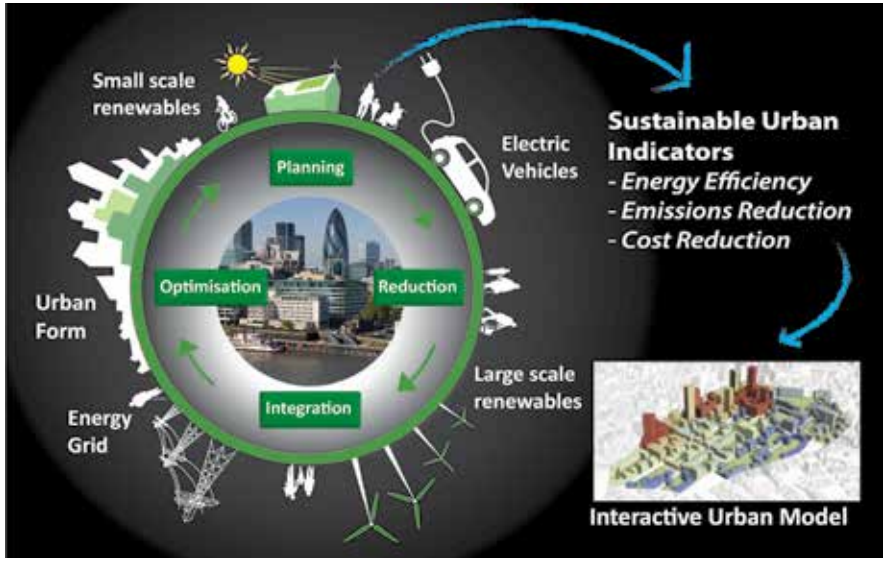


Figure 1: INDICATE Concept

- **REDUCE** energy consumption & CO_2 emissions by indicating the impact of energy conservation measures via dynamic simulation modelling.
- **INTEGRATE** new technologies & services to manage supply & demand via dynamic simulation modelling, GIS & 3D urban modelling.
- **OPTIMISE** existing systems to enable local balancing through demand response & tariff analysis, via dynamic simulation modelling of the interactions between buildings & their occupants, installed systems & energy distribution grids in the urban environment.

The INDICATE tool has been designed to operate any stage of development; it can be used in a city where the buildings and their urban environment are at an early stage of development or redevelopment, or to optimise existing smart grid infrastructure or efficient technologies where they have already been installed.

To enable this level of analysis, the INDICATE tool will bring together a number of components including: simulation software developed in this project, the IES <Virtual Environment>, 3D urban CAD tools, the Esri 'CityEngine' software, and a suite of energy related sustainable urban indicators; to create a Virtual City Model (VCM) ready for simulation. The VCM is fed with real urban data and processes this through the components outlined to assess the impact of any proposed changes to technologies, individual buildings, or larger changes at a district level. (For a more detailed discussion of these issues please see Melia et al 2015 [20])

INDICATE demonstration sites

A key part of this research is the inclusion of demonstration sites where real-world urban planning and design projects are underway. These sites provide a testing ground to interact with stakeholders, to investigate data availability and reliability, to develop locally appropriate indicators, and to 'road test' the prototype tool with actual planning and design problems.

It was also important to select demonstration sites that could test various aspects of the tool in terms of masterplanning, the integration of new renewable technologies in an urban area, or the optimisation of existing energy systems in a city. To demonstrate each of these aspects of the tool, three test sites were chosen; two in Dundalk, Ireland and one in Genoa, Italy.

The masterplanning features of the tool are being examined in the context of Dundalk's Sustainable Energy Zone (SEZ), which was initially created in 2005 as part of Sustainable Energy Authority of Ireland's (SEAI) Sustainable Energy Community (SEC) programme[21]. Data collected from the site will be processed by the tool

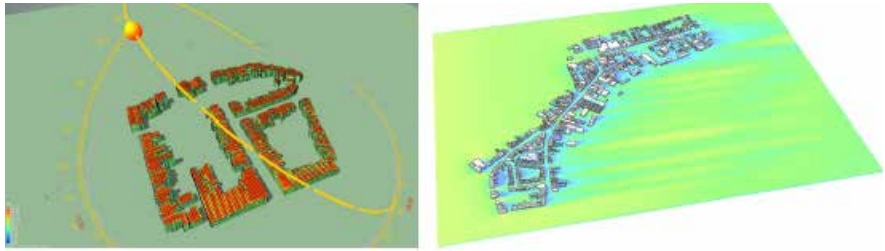


Figure 2: Solar and wind analysis on parts of Dundalk Town

to test the energy masterplanning capabilities.

The Galliera Hospital is located in the centre of Genoa and is composed of a range building spread across the site, totalling 110,000m^2 of Gross Floor Area. The hospital is undergoing major redevelopment with the aim of minimizing energy consumption in line with the Green Guide for Health Care[22]. Metered data from the site, along with the Building Information Modelling (BIM) model that is being prepared for this redevelopment, are being used with INDICATE to examine the performance of the tool in terms of sustainable technology integration in the context of a redevelopment project.

Figure 3: Aerial view of Galliera Hospital Site showing new hospital buildings in the centre of the site

Dundalk is also being used to test how INDICATE handles optimisation of existing systems. In this case the demonstration site focuses the DKIT campus, the Great Northern Haven scheme (16 age-friendly smart apartments), a community youth centre, ten local authority houses, and a post primary education school. These buildings all contain renewable energy and smart technology, and the INDICATE tool will use onsite data to analyse the interactions between these buildings and technology to test how the tool performs with regard to providing decision support around optimising these existing systems.

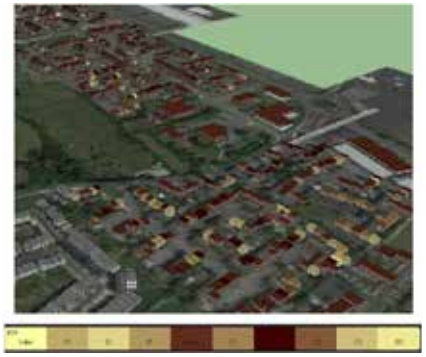


Figure 4: Building Energy Rating mapping of buildings in the Muirhevnamor area in Dundalk (Map data: Google)

Conclusion

The INDICATE project is now entering its last phase and current work includes development of the user interface and the iterative process of expert and end-user usability testing of the prototype tool.

While the tool is still in development, the early prototypes are showing great promise.

When finished, It is hoped that INDICATE can contribute to the creation of more sustainable and energy efficient communities, and help support Irish and European efforts to reduce energy consumption and increase efficiency.

To achieve the ambitious targets set by the EU to reduce greenhouse gas emissions by a minimum of 20%, to increase renewable energy production to 20% of consumption or more, and to achieve an overall energy savings of at least 20%, integrated and holistic planning and urban design approaches must be adopted as a matter of urgency.

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For more information about this project please see www.indicate-smartcities.eu/, or email tom.grey@tcc.ie or aidan.melia@iesve.com (Aidan is the Project Manager with IES).

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CASE STUDY 7

EU Covenant of Mayors Programme and Sustainable Energy Action Plans

In brief what does it show:

The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources within their territories. By their commitment, Covenant signatories aim to meet and exceed the European Union 20% CO_2 reduction objective by 2020. A Sustainable Energy Action Plan is a document that shows how a local authority / municipality aims to reach EU and national 2020 energy targets, through a range of cross-sectoral energy actions, which can include spatial planning and energy integration.

By signing up to the Covenant of Mayors an authority is committed to submitting a SEAP to the Covenant for formal verification within one year of being approved by the elected members / politicians of the authority. Once the SEAP has been approved by the Covenant of Mayors office, the authority is committed to submitting regular updates on SEAP action implementation and CO_2 reduction progress, to the Covenant.

Process/How?

A SEAP covers the entire geographical area of a local authority and uses the results of a Baseline Emissions Inventory (BEI) to identify the best areas of action and opportunity for reaching the local authority's CO_2 reduction target. The SEAP should include actions concerning both the public and private sector; local authorities are expected to take an exemplar role concerning its own building, functions, fleet and operations, thereby demonstrating civic leadership in addressing the energy challenge at a local level.

In addition, the SEAP should cover areas where local authorities can influence energy consumption in the long term, with particular regard to interaction with land use planning and energy projections. Once prepared, a SEAP is approved by the elected members / politicians of the local authority. Screening for Strategic Environmental Appraisal (SEA) and Appropriate Assessment (AA) may also need to be carried out, as part of the SEAP development process.

To implement and achieve the objectives of the SEAP, the participation and involvement of local stakeholders, residents and community groups, business interests and chambers of commerce, educational and institutional facilities and the general public, is essential. The SEAP must describe how these groups have been involved in its development, and how they will be involved in implementation and monitoring (where appropriate).SEAP actions cannot be implemented without financial resources. The SEAP should; therefore, identify the key financing resources that will be used to finance the actions. For example, regional, national and European financial funding sources and opportunities should be highlighted for actions across sectors. Areas for public / private partnerships could also be identified.

Following SEAP approval by a local authority, continuous monitoring is needed to identify progress in action area, impacts on energy consumption and CO_2 emissions to allow for consistency in the SEAP implementation process. Regular monitoring following SEAP approval facilitates a continuous improvement cycle.

Form of sustainable energy:

A SEAP should include a range of energy actions across energy efficiency and renewable energy opportunities, for both the public and private sectors.

Key Lessons?

- In most local authorities energy issues are addressed in different ways across a number of departments including Architects, Engineers, Planners etc. For the purposes of SEAP development it is recommended that the team be comprised of a range of local authority staff from different backgrounds and across departments.
- The support of local politicians / elected members is crucial to the success of a local authority's SEAP.
- Community and stakeholder engagement is an important element of the SEAP development process, with particular regard to the effective implementation of SEAP actions across sectors. Local authorities can act as effective 'energy brokers', bringing energy suppliers of goods and services together with the general public to facilitate effective dialogue between both parties.
- It is strongly recommended that the SEAP should be prepared in-house by local authority staff, with additional technical support provided by a local energy agency or other expert advisors. In this way local authority staff can be up-skilled in developing evidence based approaches to energy policy and planning, that can be developed further and integrated into other work areas i.e. energy demand and opportunity mapping to inform policy in County Development Plans, Strategic Development Zones and Local Area Plans.

Further Information:

http://www.covenantofmayors.eu

Extract from South Dublin Mayor's Speech at the Parliamentary Reception held in the House of Commons for the SPECIAL Project in February 2016

South Dublin County Council has worked in this area for over five years, and has learned first-hand from the Town and Country Planning Association and other European project partners, the value of planning for climate change mitigation and the benefits of local authority staff and local politicians working in partnership to achieve these efforts.

As a direct result of participating in the EU Leadership for Energy Action and Planning project, the Council signed up to the Covenant of Mayors in 2012. Furthermore, my colleagues on the Council, adopted the County's first Sustainable Energy Action Plan in April 2013.

It is the aim of the Council to 'make our County the best possible place in which to live, work and do business'. Reducing dependency on fossil fuels and reducing energy costs is very important in this regard. As such the Planning Department sought to advance the integration of energy and spatial planning, following the adoption of the Sustainable Energy Action Plan and to directly inform the preparation of our new County Development Plan.

Following collaboration with other Council departments, County Councillors and other energy stakeholders, a countywide Spatial Energy Demand mapping analysis was undertaken in 2015.

This process resulted in the production of a variety of energy maps, including the mapping of areas showing potential for kick-start district heating projects. South Dublin County Council was the first local authority in Ireland to carry out and endorse such an approach to planning for sustainable energy, and I am pleased to say that other local authorities in the Dublin Region, are following in our footsteps in this area.

I wish to commend the work of the Irish Planning Institute in sharing knowledge and best practice from across the EU, through the delivery of a range of workshops and other events throughout the course of the project. I particularly welcome the publication of the Pan-European Guide on Spatial Planning and Energy, an important output of the SPECIAL project.

Resources such as this are welcomed as we progress efforts to address a range of challenging energy targets to 2030 and beyond, particularly at the local level.

In conclusion, I wish to offer my sincere thanks to the Town and Country Planning Association, with whom we have worked in close partnership for over five years, and I look forward to exploring further opportunities between our two organisations in the future.

Councillor Sarah Holland
Mayor of South Dublin County

Heat Planning at a Local Level in Ireland Using GIS Energy Mapping

Donna Gartland

Introduction

When planning to positively influence the use of energy at a local or regional level, in terms of increasing the use of local sustainable low/carbon resources, the first step is to try to fully understand the energy landscape of that area. This means analysing what kind of energy is used, and where and when it is used, in order to find the most appropriate locally available resources to meet that demand. This type of energy planning practice is well established in some EU countries such as Germany, Sweden and Denmark, but is a relatively new concept in Ireland, as traditionally energy planning is carried out from a national, top-down perspective rather than from a local bottom-up approach. This lack of autonomy makes it very difficult for any municipality to fully address energy issues within their regions, and has led to local authorities lacking the in-house skills to incorporate energy planning into their normal planning procedures [1] [2]. Spatial planners in Ireland do not have the knowledge of energy systems required to carry out energy planning

Without bottom-up energy planning, the unique energy solutions and synergies available only at a local level are often over-looked [3]. For example, an area with a large local industry which produces waste heat, could potentially supply many nearby premises with low cost heat, therefore increasing the industry's own efficiency and reducing fuel, operation and maintenance costs for the surrounding buildings.

The move away from fossil fuel based energy production to renewable energy technologies means energy production is now an area-dependent resource [4], i.e., space is required for wind turbines, solar parks, bio-crops, etc. Using GIS to identify areas suitable for local renewable energy supply, such as suitable roof-top areas or brown-field sites for solar, can begin to build an evidence-based picture of the renewable production possible within a local area.

Heating in particular is a sector which is by its nature a local level energy issue. Heat is produced locally, within each individual building, and the fuel used differs from area to area depending on locally available fuels. The emissions produced from heating are produced locally, unlike electricity, which is often produced a long distance away from where it is finally used. Also, unlike the electricity sector, it is difficult to integrate renewables into the heating sector as it involves changing thousands upon thousands of conventional heating systems.

Heating accounts for 50% of the total EU energy demand and 45% of this heat is used in the residential sector. Almost half of all boilers installed in EU buildings were installed pre-1992 and have efficiencies below 60% [5]. The amount of heat produced from industrial processes, including power stations, and wasted in the atmosphere or into water is estimated to be enough to cover the EU's entire heating needs in the residential and tertiary building sector [6].

In Ireland, national level strategies to decarbonise the heating sector have so far not achieved anywhere near the levels of renewable penetration needed, and with only 4 years left to 2020, Ireland is only just over half way towards meeting its obligatory EU 20-20-20 renewable heating targets. Ireland's share of renewables in the heating sector is the fourth lowest in the EU [5]. Effective energy planning at a local level is one way to have a large impact on the way heating is provided in Irish buildings.

Methodology

A unique methodology was developed by Dublin's energy agency Codema, in order to analyse local level energy demand from a bottom-up approach. For the first time in Ireland, local level energy demand was mapped and the first Spatial Energy Demand Analysis (SEDA) developed for two municipal areas of Dublin [7] [8].

Learning from Danish Experience

The basis for such analyses comes from the Danish experience of energy planning practices. Local area energy planning has been carried out by all municipalities since it was made obligatory in the 1970s in Denmark, following the oil crisis.

The Danish therefore have a long history of planning for heat use in their regions, and have developed best practice methods to identify the most socio-economically beneficial energy solutions. District heating (DH) solutions have been implemented and widely used in Denmark due to the socio-economic benefits it brings to the local population. Over 60% of all heat installations are connected to a DH system, and most of these systems use industrial heat that would normally go to waste, therefore lowering the heating costs for consumers.

When analysing which areas are economically feasible for DH in Denmark, a heat atlas is created. This GIS technique allows areas to be identified which have a high heat demand density (i.e. a large demand for heat within a small area) and which have potential low cost heat resources, such as industrial waste heat or potential for a shared combined heat and power (CHP) system. The reason heat demand density is important is the closer the demands are, the shorter

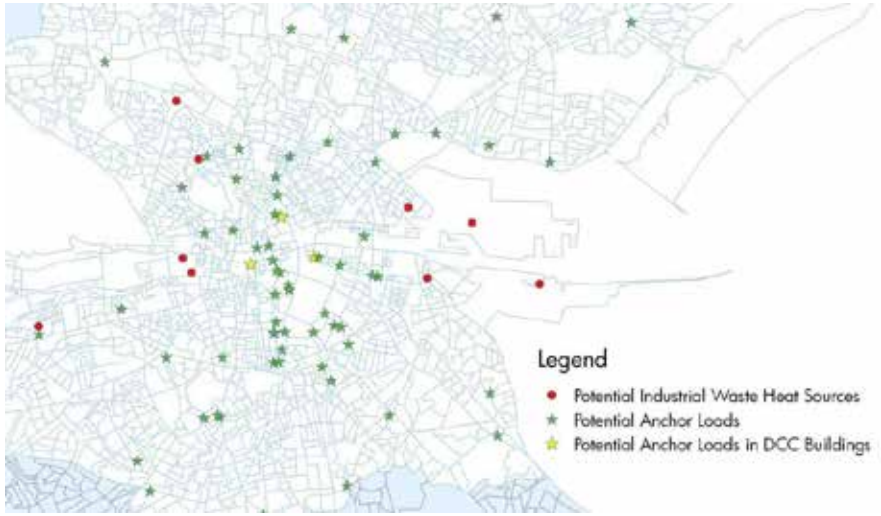

Figure 1. Waste Heat and Anchor Load Locations in Dublin City [8]

the pipelines required to connect all customers, and therefore lower upfront investment costs and heat losses.

In Danish energy planning, a threshold of 150TJ/km^2 is used, with any areas above this classified as cheaper to install DH than installing separated boilers in each building. DH can bring many benefits asides from low-cost heat, such as long-term stable heating costs, better comfort, lower operation and maintenance costs, less space used for boilers and water storage in buildings, no carbon monoxide risks in the home, no local emissions and potential to lower fuel poverty levels. Anchor loads can help to make a DH system feasible, and are classified as those with steady 24-hour high heat demands and reliable customers, such as public sector buildings.

Heat Resources

If there is a locally available heat resource in areas of high heat demand, the heat can be provided at a much lower cost to customers than through individual gas or oil systems. For example, a traditional electrical power plant will have an efficiency of around 40%; the majority of the 60% losses are in the form of heat. If this heat can be utilised through a nearby DH network, it can supply nearby demands. There are also excess heat activities in industrial sectors such as chemical and petrochemical, food and beverage, iron and steel, metal and minerals, and paper and printing. For example, a large concrete industry supplies most of the heat to the town of Aalborg in north-western Denmark. In Dublin, there are 4 power stations situated very close to the city centre, along with other industries using CHPs with excess waste heat, large bakeries, concrete works, etc., which could all potentially feed in low cost heat to a DH network in Dublin.

In areas where the heat demand density is low and there are no low cost waste heat facilities in the area, the next best solution is to use heat pump systems powered by renewable electricity, which can be produced locally or supplied through the grid. Heat pumps have a high coefficient of performance (COP), and typically produce 3 units of heat for every unit of electricity applied. There are ground source, air source and water source heat pump varieties; the best one to use is dependent on the on-site resources and space available.

Data sources

In order to spatially represent local energy demand, the energy use of all buildings needs to be mapped. There is no metered energy data publicly available for every building in Ireland, and so a methodology based on the best available data was developed. Information on each dwelling from the national census gave the attributes of each building which will impact on the energy usage; dwelling type (size and external wall area associated with apartment, detached, semi-detached and terraced) and year of construction (building regulations and typical materials used). These dwellings are broken down spatially into geographical zones called small areas, and give a detailed level of information for mapping.

The Building Energy Rating (BER) database, which holds information on every BER carried out in Ireland, was analysed according to postcodes, dwelling type and construction period, and extrapolated to apply to all dwellings. This gave an energy use figure in kWh broken down into heating energy and electricity, and also shows fuel type used, associated emissions, and importantly, costs per dwelling. Energy benchmarks developed by the Chartered Institute of Building Services Engineers (CIBSE) for each type of commercial building were applied according to floor area to a list of commercial buildings supplied by the valuation office. This data is also broken down into heating and electricity energy use, and associated emissions and costs applied.

The commercial building point coordinates were amalgamated into the overlapping small area polygons used to map dwellings to give total building energy demands per small area. The number of small areas per municipality region varies depending on the concentration of dwellings, with small area polygons designed to outline between 50 and 200 dwellings. Dense urban areas will therefore have a higher number of small area polygons and therefore a higher granularity of detail.

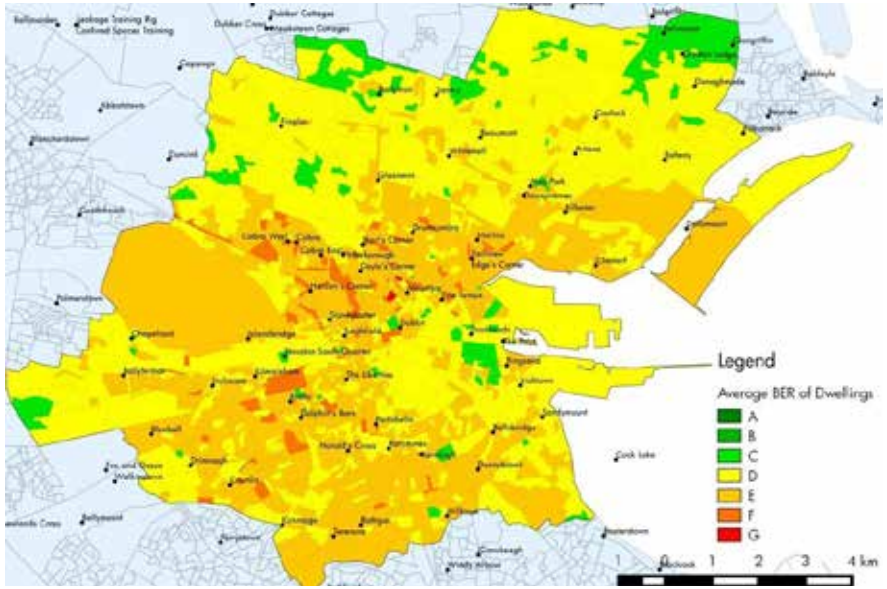

Figure 2. Heat Demand Density in municipal region of Dublin City [8]

Results

DH Potential

Mapping the heat demand density in Dublin City found that over 75% of the city has heat demand densities high enough for feasible DH connection. Some areas, seen in dark red in Figure 2, have very high heat demand densities and should be considered the most suitable areas for DH implementation. These areas are found mostly within a 2.5km zone surrounding the city centre, with most found on the south side of the River Liffey.

The same analysis was carried out for the South Dublin area, and although there is a much lower potential for DH development than in the city due to the peri-urban nature of this area, there are clusters of high heat demand density around the town centres, which have heat densities ranging from 400 to 700 TJ/km^2. These smaller town centres can also be ideal locations, particularly if there are anchor loads and waste heat resources present.

Another aspect of heat supply is the level of energy poverty associated with the costs of adequately heating homes. Those at risk of energy poverty are generally living on welfare benefits or pensions, living in old, inefficient buildings which they cannot afford to upgrade or they are renting. The costs associated with heating homes to an adequate level have been applied to each dwelling, and those dwellings with low incomes and low

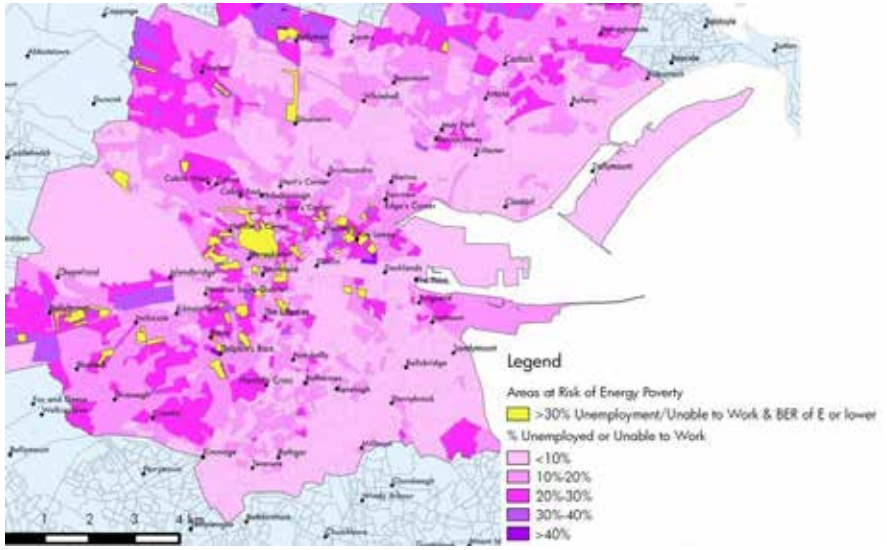

Figure 3. Areas at Risk of Energy Poverty in Dublin City [8]

BERs are mapped. These areas can now be identified by local and national authorities dealing with energy poverty and prioritised for energy upgrades.

When coupled with the DH analysis, these areas could be included in any future DH plans and be supplied with lost cost heat from a DH network. Figure 4 shows how this methodology was applied in Dublin City and highlights the 70 small areas deemed to be at Figure 2. Heat Demand Density in municipal region of Dublin City [8] high risk of energy poverty. These areas contain 5,785 households, many of which have energy bills greater than €2,000 per year.

Due to the level of detail available, it is also possible to map areas according to the average BER. This shows areas which have old inefficient building stock and therefore areas which need to be targeted for energy upgrades to reduce heating demands. Heating accounts for the vast majority of energy use in dwellings, with over 80% of energy used on space and water heating.

In the Dublin City map, the areas worst affected are found around the older parts of the city near the city centre and some of the older suburbs. The BER map also highlights how new building regulations have positively affected the ratings of newer developments, which can be seen in green in the map in Figure 4.

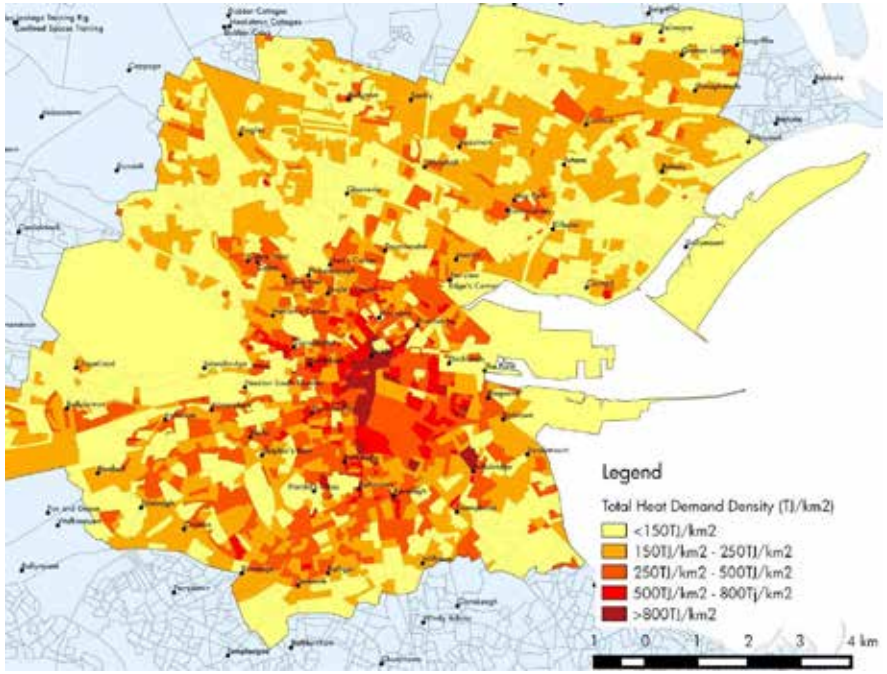

Figure 4. BER map of Dublin City [8]

Conclusions

The development of the GIS based SEDA, and - in particular - the analyses targeting the heating sector, have positively influenced local level energy planning and the same methodology is applicable throughout all municipalities in Ireland.

Already plans are in place to further improve and build upon this methodology and train other municipalities to carry out the same analyses in their own regions. Building upon Danish expertise, the first energy demand maps have been created and implemented from a bottom-up approach. This will allow municipalities to better understand energy use in their area and create evidence based policies to encourage the use of sustainable heating solutions and positively impact the lives of the population.

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CASE STUDY 8

Community Engagement and Energy Retrofit Programmes, Southampton, UK

In brief what does it show:

Southampton City Council launched a city-wide citizen engagement campaign on energy efficiency between 2011 and 2013 to supplement several major retrofit programmes in the city.

The principals were:

- reducing demand for energy,
- lifting vulnerable residents out of fuel poverty and
- helping them to keep warm during winter.

In order to achieve the maximum benefit for residents, and the best thermal performance from the low carbon makeover of residential properties in the city, advice and information was provided to enable residents, through a range of methods, to adapt to the changes in their properties and change how they use their homes.

Process/How?

This project was a joint effort, led by Southampton City Council in partnership with internal stakeholders along with Southern Water and British Gas. This citizen engagement campaign involved 131,854 residents and saved 22,582 tCO2e.

International Way, Weston delivery of £9m worth of structural and energy efficient improvements within four residential tower blocks on International Way, Southampton. This aided residents in using the new energy systems installed in their homes—residents were given the knowledge to save money and reduce their energy usage. Support was gained from senior staff and politicians through high level meetings with both the portfolio Cabinet Member and council wide Low Carbon and Use of Resources Groups.

Existing groups were used to make initial contact with the key stakeholders that helped initiate the individual work streams under this programme. 7,000 individual home visits, 250 people attended a community information day, a YouTube Video was made and information packs distributed.

The expertise and track record of partner organisations, such as The Environment Centre and Groundwork, was crucially important to Southampton City Council in delivering various aspects of the citizen engagement campaign.

Form of sustainable energy:

Retro-fitting and energy efficiency improvements to existing dwellings

Key Lessons?

Use partnerships and collective working to achieve shared goals is beneficial in a climate of economic challenge. Establish personal links with city-wide, sub-regional or regional public sector organisations, energy /utility companies and third sector organisations working in the same environmental sphere.

In Southampton's case the links established over a number of years: through the work in the private sector housing and sustainability team in partnership with The Environment Centre and local strategic energy stakeholders through the Southampton Energy Partnership.

Further Information:

https://www.southampton.gov.uk

CASE STUDY 9

Planning and Energy at 'zero:e park am Hirtenbach', Hannover, Germany

In brief what does it show:

Hannover was one of the first municipalities in Germany to set visionary objectives for climate protection and has a target to achieve a 40% reduction in carbon dioxide emissions 2020. Development commenced in in 2010 to build 330 homes to passive house (Passiv Haus) standards on a 26 hectare site in the south west of the city – the 'zero:e park am Hirtenbach' development. A zero-emission strategy is being applied to the entire site.

Process/How?

The development is a joint venture by the City of Hannover, a housing developer and a not-for-profit company for the development of rural areas. The key principle of the development's approach to energy use is to reduce the heat requirements of dwellings to a minimum, based on energy efficient construction methods, with passive and active (obligatory solar thermal and optional photovoltaic) use of solar energy.

This design approach means that only a small amount of additional energy will have to be supplied, using renewable sources: requirements totalling 1,300 MWh per annum have been identified for the whole zero:e park site, and these are to be covered by generating electricity from a restored hydroelectric power plant. The building plan specifies that all houses will be angled towards the south, and it sets guidelines for the slope of roofs to avoid casting shade on neighbouring dwellings.

Form of sustainable energy:

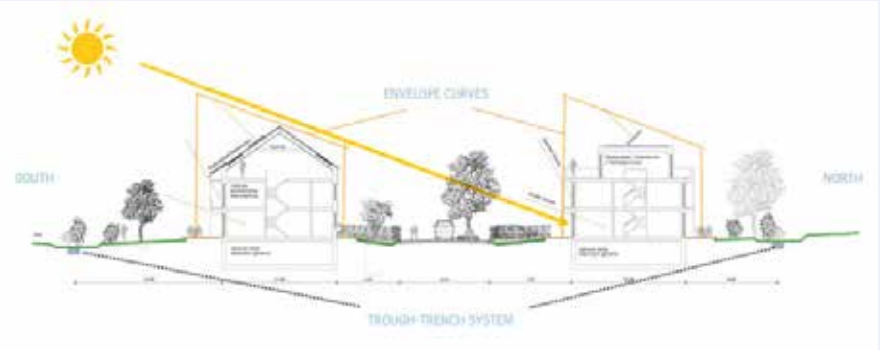
Passive house building standards. District heating, solar and PV, hydro-electricity

Key Lessons?

- With regard to planning policy, the proposal benefited from the support of strong spatial planning structures. The Hannover Region comprises the City of Hannover and 20 other municipalities. Regional planning and regional climate change protection and energy policies are strongly integrated and there is strong co-ordination between the regional planning authority and the municipalities.
- The zoning plan and urban development contract are vital elements in implementing Hannover's climate change objectives. An urban development contract between the three key stakeholders involved in the delivery of the zero:e park development regulates the implementation of passive house architecture and solar energy.
- The success of the project to date is due in large part to the intensive consultation between the project organisers and residents and the Climate Protection Bureau of the City of Hannover.
- Investment in the development is promoted and supported by the 'enercity-fund proKlima' (a regional funding body made up of local energy providers) and by federal building subsidy.

Further Information:

http://www.zero-e-park.de/en/home



Solar Optimised Development (Source: www.zero-e-park.de)

Supported by INTELLIGENT ENERGY EUROPE

CASE STUDY 10

Grangegorman Urban Regeneration the Development of an Education and Health Campus, Dublin, Ireland

In brief what does it show:

Regeneration of a 29 hectare inner city brownfield site for education, health and community use

Process/How?

The Grangegorman development will relocate the Dublin Institute of Technology to a single campus from its existing dispersed sites.

It will continue to develop modern health and community facilities on the site regenerating the local area. Since September 2014, DIT Arts, Media and Social Science students have moved onto the site, occupying existing protected buildings.

A mental health facility has opened with a primary care centre under construction. A new research hub will open in early 2016. The process required the development of a masterplan, high levels of consultation and engagement with stakeholders and flexibility in implementation.

A Sustainable Energy Strategy has been prepared, the aim of which is to reduce energy demand and to optimise the use of renewable energy so that the Grangegorman Urban Quarter may eventually become a Zero Carbon Development. The target aspiration is that at least 30% of energy will be from zero net carbon emissions from energy generated on site on an annual basis, including district heating, combined heat and power and solar energy.

The energy strategy has been developed as a flexible framework which is designed for change over time as and when new and economically competitive technologies become available.

Form of sustainable energy:

District heating, combined heat and power, solar and PV.

Key Lessons?

The following skills/attributes proved to be invaluable in securing the future of a sustainable Grangegorman development

- Development of a Vision i.e. the Grangegorman Masterplan 2008
- Devising a Strategy to implement the Vision i.e. the Grangegorman Planning Scheme 2012
- Developing a Sustainability Strategy with climate change mitigation measures to underpin the development
- Engagement with stakeholders including the local community, local politicians, government department and bodies, transport agencies, the local authority
- Adaptability and the ability to respond to economic crisis and funding cuts

Further Information:

http://www.ggda.ie

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