SPATIAL PLANNING & ENERGY

YOUNG PLANNERS WORKSHOP

Creating our futures
ECTP-CEU
European Council of Spatial Planners
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Final reports – conclusions

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PRESENTATION

PRESENTATION

Hendrik van der Kamp

President of the ECTP-CEU

The aim as well as the effect of the Young Planners Workshop is to bring together members of the profession from different parts of Europe. In addition to the main benefit of addressing a relevant topic in a group project setting, the participants experience in a very direct way the different types of projects that planners get involved in different parts of Europe but also the different approaches and practices that planners in these different countries adopt. In this way the participants experience the relevance and to some extent even the definition of spatial planning as it exists in different parts of Europe. That such practices differ between different parts of Europe is one of the main challenges that is faced by the European Council of Spatial Planners today. What it means to have a profession called 'spatial planning' and what contribution this profession can make for real improvements in our environment, social conditions and our economy, are central challenges in the work of the ECTP-CEU.

This year's topic of linking energy with spatial planning and inviting the participants to address such challenging questions as whether the 'energy neutral city' could ever be a reality, was embraced with great enthusiasm and the initial call for proposals led to a wide range of submissions from many different parts of Europe. It is because of this enthusiastic response that the 2014 event became such a success with as a highlight the one day long plenary presentation of all projects in the head office of the ECTP-CEU in Brussels. This year the workshop was planned two days in advance of the presentation of the European Urban and Regional Planning Awards. This presentation took place in the building of the Committee of the Regions. The event was attended by many of the participants of the young planners workshop who continued their discussions to reach the conclusions that are presented in this e-book. The enthusiasm that was evident at this event also contributed to the success of the awards ceremony. (The day in between was used to good effect in the form of a highly relevant study field trip in Brussels organised by the local member association of ECTP-CEU).

I recommend the e-book to all young planner members of the ECTP-CEU member associations throughout Europe not only to inform themselves of the topic and the treatment by the different national teams, but also in order to encourage young planners to partake in the 2015 Young Planners Workshop event.

The Young Planners Workshop has been the idea of Ignacio Peman, member of the Executive Committee of ECTP-CEU and representative delegate from the Spanish association AETU who again this year organised the activity and was final editor of this e-book that forms the final outcome.

INTRODUCTION

Ignacio Pemán Gavín

ECTP-CEU Young Planners Workshop Chair

1 OBJECTIVES AND CHALLENGES

The present publication contains the findings of the workshop developed between March and May 2014 under the coordination of ECTP-CEU on the topic "Spatial Planning and Energy". The results were presented in Brussels (Belgium) on May 3rd 2014.

This Edition of Young Planners Workshop is a project shared with 10th European Urban and Regional Planning Awards 2013-2014 organized by ECTP-CEU along with the Committee of the Regions and SPECIAL Project co funded by Intelligent Energy Europe Programme of the European Union. In this framework, the ECTP-CEU Young Planners workshop proposed the same topic as the 10th European Urban and regional Planning Awards: planning and energy. This offered to young planners the possibility of working on new solutions for new paradigms of planning and energy.

Recent Directive 2012/27/UE on energy efficiency, recognizing that buildings account for 40% of final energy consumption in the European Union requires Member States long-term strategy aimed at mobilizing investment in the renovation of residential and commercial buildings, to improve the overall energy efficiency of the housing.

In the years to come, States and Municipalities should implement actions for new models of planning and housing specially for housing rehabilitation in order to adapt housing to energy saving requirements by means insulation of buildings, adapting heating and power supply facilities.

But rehabilitation for saving energy will not suffice; the cities challenge is to become an energy that Buildings can change from consuming to producing energy. To address these challenges, urban/spatial planning should be an important tool to promote new requirements of buildings, rehabilitation of neighbourhoods or buildings to improve energy efficiency, sustainable urban mobility, urban design, including urban land uses that allow new forms of urban energy production.

According to these challenges for planning, the Workshop proposed to young planners four possible project topics in order to highlight or give answers to following important questions:
- How planning can help to deliver sustainable energy solutions?
- How spatial planning can promote buildings rehabilitation to adapt it to energy efficiency.
- How spatial planning can promote design of cities -morphology of plots, model of housings- in order to avoid private transport?
- New tools that allow integrated rehabilitation of adapting buildings for energy efficiency: ways of financing, utilities, buildings owners participation in the preparation of plans and project.

Thirteen papers were presented at Brussels analyzing the same general topic urban planning and energy from different perspectives:
a) Measures for saving energy or new alternatives of energy resources
b) Focusing on exiting city or new developments,
c) Scales at regional, city, neighborhoods or Buildings.
d) Social participation nor consequences of. Some of them are good practices already implemented and other are theoretical researches.

2 DIFFERENT SCALES, DIFFERENT PERSPECTIVES, ENRICHING A COMPLEX CHALLENGE

There have been studies that have analyzed the proposed topic Energy ***and Urban Planning*** from different territorial perspectives and scales:

A.- Firstly, some works have focused on the planning from a general perspective, highlighting the lack of implementation at the local level of national energy savings plans. So, thePaper **"Can the planning system assist in promoting the uptake of CHP in residential or commercial developments in Ireland?"** analyzes the general situation in Ireland regarding the importance of Combined Heat and Power for the reduction of CO2 emissions. As the work illustrates, Ireland has *"to reform the planning system on large developments that incorporate energy efficiency measures in their design* including a *binding Energy Plan detailing how the development addresses energy efficiency with regard to the demolition, construction and long-term management"*. "**Sustainable Energy Action Plans (SEAP) and the Climate Plans new tools for local environmental planning"** focuses on the problems to implement European politics at local level, especially in Italy. This work describes the objectives of "The Covenant of Mayors" and the problems experienced in achieving important results. Also, the work tries to explain the causes of this situation and the possible measures needed to achieve effective results. "**Spanish urban planning and energy: challenges for the future"** focused on a new current framework because of new Spanish law for improving energy savings standards at local level. This work also illustrates the lack of experience and competences of Local Administration in implementing new measures and coordinating stakeholders involved.

B. - Secondly, some of work analyzes urban design at city scale, highlighting how the design of cities can influence energy-related solutions. **The Eco-town: A New Vision towards Sustainability** studies the case of Marston Vale former Oxford clay in the centre of three administrative areas, Bedfordshire County Council, Bedford Borough Council, and Mid-Bedfordshire District Council. The project investigates housing environmental control technologies within the context of urban form theories and the Eco-town governmental Green design principles. **"Evolve, not change. Improve not replace"** describes the example of Honselersdijk in the Netherlands where the new *Max Town' concept has been implemented. This work emphasizes three ideas: a) renewable energy technologies can be located closer to the users, b) the importance of food production at different levels: house hold, street, and neighborhood, c) how to avoid excessive space for automobile networks and alternatives for parking solutions.*

C.- Two works analyze general Policy at city scale. Firstly "**Building Technologies in Dublin; Outlining policy and a suggested method of implementation"** reflects on Dublin problems to implement energy efficiency measures, especially for Retrofitting Existing Buildings**.** It starts from the idea that "*Ratifying extensive policy documents is easy while implementing this and affecting real environmental change has proven difficult"*. For the authors the only way is the active participation of Dublin's local communities and to take advantage of the skills of planners in order to carry out these audits. Meanwhile**, "Transforming London into the energy neutral City"** explains the good results in the energy policy of London based on adopting sustainable design principles; prioritizing decentralized energy; using renewable energy. All of this has been possible by improving energy usage through spatial planning in a flexible policy context within a balanced approach at both the local, district and regional scale.

D. - The specific topic of *rehabilitation of existing city* and *saving energy measures* have been analyzed in three other works: "**Energy Efficiency in Historic cities Scale, Scope of energy efficient solutions and Administration"** analyzes the topic from a general historical districts perspective. The study *how values embedded in energy efficiency policies shape the development of urban historic districts* in particular deepens on the European Union policies and its Member States in regard of energy efficiency. **Steps towards Energy Efficiency on Klauzál square (Budapest)** examines the challenges of intervention and proposes possible solutions for a historical district including data-collection desk research on best-practices, interviews with experts, inhabitants and site visits. Finally, **New sustainable strategies of Rome's historic district** aims to give a response to the historic building stock, by comparing two scenarios of possible interventions: energy retrofit with the best available technology and energy retrofit with the best allowed technology

E. – Social perspective has been proposed in some works highlighting the importance of adequate participation of citizens in the solutions affecting energy. "**Energy dependency at the urban scale and its social consequences"**

analyzes the significant impact that higher energy prices have on the domestic life of the citizens in the territorial frame of the Metropolitan area of Madrid. The effects in Madrid are an increase in energy prices and the impact on transport and domestic bills involved in the new social phenomenon called *energy poverty*. "**Public participation in city design"**explores the forms and possibilities of interactive public participation on solutions to the energy concerns, such as interactive web tools and other kinds of presentations of actual projects and communication with a public demonstrating the results of public participation in Šentrupert (Slovenia). Finally, "**Urban planning: the mirror of society"** focuses on the development of a real participated way of planning processes, starting from a local urban organization including society through three steps: informing citizens; involving citizens actively in planning making decisions; and creation of multifunctional spaces which will produce "green" Energy.

3 SOME IDEAS FOR THE FUTURE

The Workshop on spatial planning and energy has highlighted the current situation in different European territories and identifies not only the causes of the issues but also proposing possible solutions. The main analyzed perspectives can be summed up in the following items:

a) Important goals have been achieved in this field but also many challenges still lack solutions.

b) The importance of local/urban Planning for having an integrated approach of both energy and land use;

c) The importance of a new model of cities in which measures for buildings can be integrated along with other measures;

d) The need of new models of cities beyond *smarts cities* in order to introduce different perspectives such us food, public transport, structure of residential and commercial areas;

e) The importance to get energy resources closer of consumption so urban voids should be used for renewable energies;

f) The importance of neighborhood scale for implementation of actions especially to implement saving energy measures in existing cities.

In addition to these challenges, many hindrances must be addressed: Firstly, regarding to shortcomings at urban level the following two challenges has been mentioned: a) The necessity to solve the current gap between European objectives, National Energy Plans and urban planning that could be integrated in a regional planning, and local level actions; and b) The need to solve the current lack of experience at local level by organizing international seminars and European working groups in which good experience and know-how can be shared.

Secondly, in order to implement saving energy measures in existing city, five actions have been highlighted:
a) The importance of neighborhood scale;
b) The necessity of publics funds, especially from EU, for its implementations mainly in historical districts because the lack of inhabitants wealth;
c) The need of other financing alternatives such as the refund payments;
d) The requirement of financing information and citizens participation;
e) The importance of participation through new forms of governance for all affected stakeholders such as owners, builders, utilities, governments and banks.

To conclude, I would like to congratulate all participants for their excellent work, the ECTP-CEU Executive Committee and especially Dominique Lancrenon ex ECTP-President and current Secretary General, for their support to this ECTP-CEU project and Julian Hills.for his continued support in organizing the workshop.

PAPERS

Can the planning system assist in promoting the uptake of CHP in residential or commercial developments in Ireland?

Bernard Dwyer and Gregor Herda

ABSTRACT

With the exception of Greece, Ireland is the lowest user of combined heat and power (CHP) in the EU-15 (CHP Policy Group 2006: ii). This project thus examined how the planning system can strengthen the uptake of CHP in Ireland. The paper first presents an overview of the advantages and disadvantages of cogeneration, the European legislation regulating CHP implementation and a comparative analysis of cogeneration promotion and coverage in Ireland, the United Kingdom, Germany and the Netherlands.

The project examined the language of Irish City Development Plans in promoting CHP and drafted a sample development plan objective following the SMART principle. In addition, further, fiscal and planning policy measures were proposed.

In conclusion, it is found that the role of the planning system in strengthening the uptake of CHP in Ireland has not been fully exhausted and, in conjunction with a suite of complementary fiscal incentives, could help meet Ireland's energy efficiency and renewable energy targets under European agreements.

Keywords: combined heat and power, CHP, energy efficiency, forward planning, Ireland

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1 INTRODUCTION

This paper aims to explore the reasons behind the low uptake of Combined Heat and Power (CHP) energy systems in Ireland as well as the potential role of the planning system in reversing this trend. An initial study of the details of CHP as well as the European legislation in place to promote this technology will be followed by a comparative look at various E.U countries including Ireland. The study will then explore the legislative framework in Ireland and explore the barriers to the uptake of CHP. Finally proposals will be put forward based on the findings of the study.

1.1 WHAT IS COMBINED HEAT AND POWER (CHP)?

In conventional electricity generation much of the input energy is lost to the atmosphere as waste heat. In Ireland over half of the input energy to electricity generation is lost with the other half being transformed into electricity. Combined Heat and Power (CHP) systems channel this lost heat to useful purposes so that usable heat and electricity are generated at the same time. The term cogeneration or cogen is also used to describe this process. Where there is cooling energy created in the same process, the plants are termed trigeneration plants. The efficiency of a CHP plant can typically be 20% to 25% higher than the combined efficiency of heat-only boilers and conventional power stations (SEAI 2013: 5).

This is due largely to the fact that heat and electricity is produced on site, or very nearly on site by means of a district heating system (DH), and consequently the avoidance of transmission losses. To make optimal use of the available heat, CHP systems require a high heat demand which is why they are most often found in hotels, hospitals, industrial processes and commercial buildings with a continuous demand of both heat and power.

It is estimated that for every 1MW of CHP installed, CO_2 emissions are reduced by at least 1,000 tons per annum (Irish Combined Heat and Power Association n.d : 3). In combination with the potential energy cost savings of CHP, the technology is thus well-suited to contribute to meeting Ireland's climate change targets for 2020 and beyond. Traditionally, CHP applications have been broken down into three categories based on their electrical output: large-scale (greater than or equal to 1MWe), small-scale (less than 1MWe) and recently micro-CHP (less than 50kWe). Each of these categories is suitable for specific applications where large differences still exist between plants for individual sites based on their specific heat and power demand. While large-scale CHP plants can be mainly found in the industrial sector as well as large commercial processes such as universities and airports (more than half of the CHP energy produced in Ireland is due to a single aluminium plant in Limerick), small-scale CHP units are found mainly in the commercial sector (hotels, hospitals and leisure centres). In addition, internal and external combustion engines as well the development of micro-turbines in the 1990s has allowed individual homeowners or groups of homes to produce their

own heat and electricity off-grid using a micro-CHP unit, though often at much lower efficiencies.

1.2 FACTORS FOR LOW CHP UPTAKE IN IRELAND

One method of introducing CHP into the residential sector would be to connect the CHP unit to a District Heating (DH) network where heat is distributed through a medium such as hot water to service a larger number of homes. Unfortunately, the penetration of district heating in Ireland has fallen behind that of other European countries as well as the US for a number of reasons. The mild climate has been quoted as contributing to unfavourable economics around large-scale district heating schemes on top of comparatively low residential densities which makes pumping hot water over long distances impractical.

In addition, district heating in Ireland has been associated with one particularly notorious social housing development in Ballymun, Dublin, which was constructed in the 1960s. The tower blocks of Ballymun came to renown as centres for significant social problems and district heating consequently attained a long-lasting reputation as 'poor man's heat' which has been cited as another factor standing in the way of broader public acceptance (Atkins 2002: 13).

Apart from this, the traditionally high rate of home ownership in Ireland and the dispersed settlement patterns have been a limiting factor. Irish home owners are far less likely to accept a prescribed form of heating such as a district scheme. Equally, the lack of high density urban housing has prevented district heating schemes from availing of economies of scale.

However, we find that it may be time to review these long-held assumptions in light of changing economic circumstances and societal values and reassess the feasibility of district heating schemes as well as the regulatory framework that could support them.

2 EUROPEAN LEGISLATION ON COGENERATION

The European Union CHP Directive 2004/8/EC, approved in 2004, was the first piece of EU legislation attempting to promote CHP across the EU's member states. The Directive was transposed into Irish Law with the Energy (Miscellaneous Provisions) Act of 2006.

The Energy Efficiency Directive 2012/27/EU provides the most recent and relevant guidance to Member States with regards to energy efficiency and the promotion of CHP in particular. The Directive repealed the earlier 'CHP Directive' which was regarded as having failed to fully tap the energy saving potential within the European Union.

In the following section some provisions in the Directive relating to cogeneration will be highlighted.

Article 3 requires that each Member State shall set an indicative national energy efficiency target for 2020, based on either primary or final energy consumption, primary or final energy savings, or energy intensity. Ireland has set itself an energy savings target of 20% nationally and 33% in the public sector, both compared to the unadjusted average energy consumption between 2001 and 2005. It can be surmised that the recent economic downturn has already positively contributed to achieving this goal. Ireland envisages CHP to contribute about 6% of all energy savings in the public sector and 7% in the private sector in 2020 (Department of Communications, Energy & Natural Resources, Ireland 2013: 5).

Article 14 (1) requires all Member States to 'carry out and notify to the Commission a comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling'. In the case of Ireland this assessment is still to be undertaken.

Article 14 (3) further requires that states shall 'carry out a cost-benefit analysis covering their territory based on climate conditions, economic feasibility and technical suitability'. This cost-benefit analysis may be part of an SEA of the effects of certain plans and programmes on the environment. Where a potential is identified and benefits exceed the costs, adequate measures shall be taken 'for efficient district heating and cooling infrastructure to be developed and/or to accommodate the development of high-efficiency cogeneration and the use of heating and cooling from waste heat and renewable energy sources'.

The Directive sets out requirements especially for medium- to large-scale CHP with a minimum capacity of 20MW.

A cost-benefit analysis is required for new as well as refurbished thermal electricity generation installations exceeding 20MW of capacity, planned or refurbished industrial installations exceeding 20MW and generating waste heat at a useful temperature, planned district heating and cooling networks as well as refurbished networks where a new energy production installation is planned in order to 'assess the cost and benefits of utilising the waste heat from nearby industrial installations' (Article 14 (5)). It is also considered 'appropriate', however, for Member States to promote cogeneration installations of less than 20MW.

The role of SMEs in providing cogeneration capacity is especially mentioned as well as the need to review administrative procedures to obtain permission to construct cogeneration capacity or associated networks following the 'Think Small First' Principle. This relates also to access to the grid for small-scale and micro-cogeneration which should be facilitated.

The Directive **does not require Member States to avail of spatial planning or development control mechanisms to promote cogeneration** whereas the initial proposal in 2011 included a requirement for Member States 'to adopt national heating and cooling plans to develop the potential for high-efficiency generation and efficient district heating and cooling, and to ensure that spatial planning regulations are in line with these plans' (European Commission 2011: 5).

This could be considered an oversight which fails to exploit the powers of the planning system to encourage a broader uptake of cogeneration in new developments.

For Ireland, a draft of the transposing regulations was meant to be published in March 2014 but was not available at the time of publication. A consultation paper on the transposition is available online (Department of Communications, Energy and Natural Resources 2013).

In addition to the above legislation, the *Energy Performance of Buildings Directive 2010/31/EU* (recast) will have wide-ranging impacts on the extent to which low-carbon technologies such as CHP will be introduced into new builds of all sectors post-2020. Article 9 of the Directive requires that 'Member States shall ensure that by 31 December 2020 all new buildings are nearly zero-energy buildings; and after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings'. This is reflected, for instance, in the Draft Cork City Development Plan which places a greater emphasis on retrofitting and energy efficiency (see section 'CHP Promotion in Irish City Development Plans').

Apart from a building's use of photovoltaics, its fabric and its services, the heating system is a major contributor to a building's energy efficiency. This Directive will thus have foreseeable consequences for the introduction of cogeneration on a large scale across all EU member states.

3 CHP IN IRELAND, THE UK, GERMANY AND THE NETHERLANDS

3.1 CHP COVERAGE AND TARGETS

CHP is employed in a wide variety of sectors with stark distributional differences across various countries in Europe. While CHP in Ireland is primarily employed in the commercial and industrial sector, cogeneration in countries such as Denmark and the Netherlands is also present in residential installations due to, among other factors, a much higher coverage of district heating networks (see section 'Proposals').

It should be noted that the promotion of CHP is a long-term process which in countries such as Denmark, the Netherlands and Germany has been on the government agenda for decades. Equally, it is a process influenced by a variety of micro- as well as macro-economic factors which affect even countries that perform strongly in this regard. The recent COGEN review on the Netherlands, for instance, found a stagnation and partial decline in the Dutch CHP sector due to an unfavourable gas spark spread, a lack of stimulus from the EU Emissions Trading Scheme and the absence of a comprehensive Dutch CHP policy (Williams 2013).

Fig. 1 gives an overview of the current amount of electricity produced from CHP plants in Ireland[1], the United Kingdom[2], Germany[3] and the Netherlands[4]. For a more comprehensive comparison of CHP capacity across the EU-15, see Figure 4 of Appendix II.

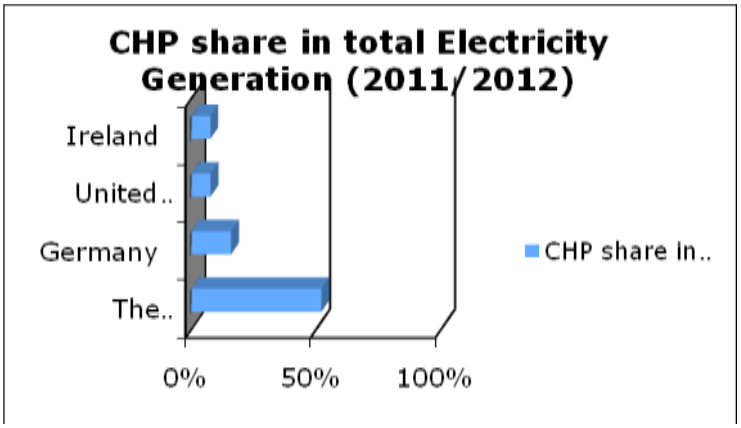
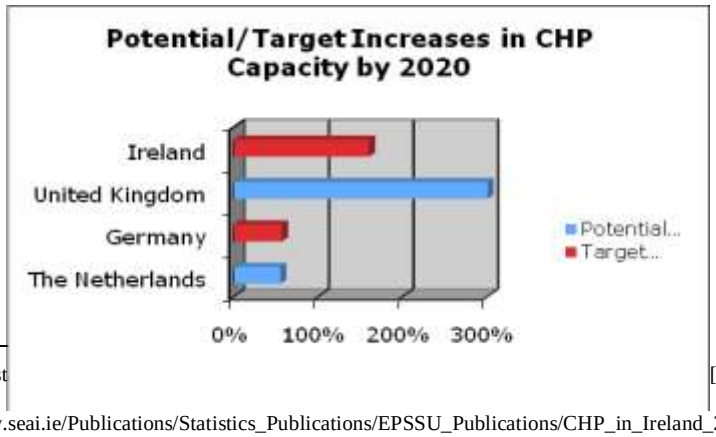


Figure 1 CHP share in Total Electricity Generation

Figure 2 then shows the 2020 target or potential increase in CHP as a percentage of the current capacity envisaged by each country[5,6]. While these numbers should be taken with a grain of salt due to their dependence on a number of uncertain variables, it is clear that both the governments of Ireland and the UK have realised the growth potential of CHP as well as the need to close the gap to some of its European neighbours.



[1] SEAI - Sust [online] available from <http://www.seai.ie/Publications/Statistics_Publications/EPSSU_Publications/CHP_in_Ireland_2013_Report.pdf >

[2] COGEN Europe (2012) *European Cogeneration Review – United Kingdom*. Brussels: COGEN Europe.

[3] Umweltbundesamt (2013) 'Kraft-Wärme-Kopplung' [online] available from < http://www.umweltbundesamt.de/daten/energiebereitstellung-verbrauch/kraft-waerme-kopplung>

[4] COGEN Europe (2013) *European Cogeneration Review – The Netherlands*. Brussels: COGEN Europe.

[5] ECN (2010) *The potential for high-efficiency cogeneration in the Netherlands: Report to the Ministry of Economic Affairs* [online] available from: http://www.code-project.eu/wp-content/uploads/2011/01/NL-Report-on-Potential-English-Version.pdf

[6] Department of Energy and Climate Change, United Kingdom (2012) *The Future of heating: A Strategic Framework for Low Carbon Heat in the UK* [online] available from: http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/heat/4805-future-heating-strategic-framework.pdf

Figure 2 Potential/Target Increases in CHP Capacity by 2020

The cultural, historical, regulatory and climate similarities between Ireland and the United Kingdom lend themselves to a more appropriate comparison for the purposes of this study. Our findings would indicate that the United Kingdom, and Scotland especially, is performing better with regards to incentivisation and overall strategy, and may serve as a suitable benchmark for Ireland's immediate CHP objectives.

3.2 COMMON INSTRUMENTS TOWARDS CHP PROMOTION

	Ireland	United Kingdom[7]	Germany[8]	Netherlands[9]
Regulatory Framework to promote CHP	☑	☑	☑	☑
Tax Relief	☑	☑	☑	☑
Guaranteed Price and Premium	☑	☑	☑	☑
Investment Support/Grants	NONE	☑	☑	☑
Streamlined/Preferential Planning Procedures for CHP	NONE	NONE	NONE	☑

Table 1 Instruments towards CHP Promotion in four European Countries (see Appendix II for a more detailed breakdown)

The gamut of instruments employed by different countries for the promotion of CHP is wide and varied. However, the interplay and impact of different policies can be difficult to ascertain. Most countries rely on a combination of tax relief, investment grants and guaranteed feed-in tariffs which are often linked to a high-efficiency certification according to the standards set out in the European Union Energy Efficiency Directive.

Governments rely greatly on making CHP more economically viable while in the case of the Netherlands even directly utilising market forces to make electricity

[7] COGEN Europe (2012) *European Cogeneration Review – United Kingdom*. Brussels: COGEN Europe.
[8] COGEN Europe (2013) *European Cogeneration Review – Germany*. Brussels: COGEN Europe.
[9] COGEN Europe (2013) *European Cogeneration Review – The Netherlands*. Brussels: COGEN Europe.

providers compete for limited government subsidies. In the four countries examined here, planning regulations and development management seem, so far, to play only a minor role in this respect. While streamlined planning procedures are in place as part of the Green Deal Programme in the Netherlands, which covers CHP applications to some degree, we believe that the potential of the planning system to incentivise cogeneration especially in the commercial and industrial sector has remained largely untapped both in Ireland and abroad.

In the following, we would therefore like to examine to what degree cogeneration is presently promoted through Forward Planning primarily in an urban context. Finally we will suggest ways in which this approach could be improved upon in future iterations of City Development Plans.

4 CHP PROMOTION IN IRISH CITY DEVELOPMENT PLANS

Based on our initial research, the greatest potential for CHP development in Ireland exists within the urban centres. In addition, this is undoubtedly where spatial planning has the greatest role to play in promoting that development. With that in mind, we undertook a review of the current development plans for the 5 major cities in Ireland to identify their objectives with regard to renewable energy and specifically CHP.

Each development plan mentions CHP in some way as part of their renewable energy strategies, however what is lacking from each is a specific, targeted approach.

4.1 LIMERICK CITY DEVELOPMENT PLAN 2010 – 2016

The council refers to their wish to Promote New & Innovative Schemes for Renewable Energy and refer to the Government White Paper on 'Delivering a Sustainable Energy Future for Ireland'. In light of the ambitious targets outlined in this paper for expanding the role of renewable energy, notably the target of 33% of electricity consumption to come from renewable resources by 2020, the City Council intends to pursue measures for renewable energy take-up and promotion.

"The City Council will continue to promote research into, and use of, both geothermal heating systems and CHP systems along with alternative energy efficient and renewable energy technologies. "

This objective is further emphasised in Policy EM.21:

"It is the policy of Limerick City Council to pursue initiatives which promote innovation in the fields of energy conservation and renewable energy resources and research."

The document makes an additional reference to CHP in its Energy Efficiency strategy (Page 164)

"Promotes sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, CHP and CCHP schemes."

4.2 GALWAY CITY 2011 – 2017

The Galway City plan again refers to National Policy, albeit a separate set of guidelines - Building Ireland's Smart Economy – A Framework for Sustainable Economic Renewal (2008). CHP is listed in section 8.4 as a source of renewable energy:

"8.4 Renewable Energy Sources Renewable energy sources include wind, hydro, wave/ocean, solar power, geothermal/CHP and biomass."

This section goes on to refer to the Sustainable *Residential Development in Urban Areas Guidelines for Planning Authorities* (2009) which state that:

"residential developments offer the potential to benefit from renewable energy sources within a district/site. Suitable technologies may include small-scale wind energy plants and combined heat and power schemes."

4.3 DUBLIN CITY DEVELOPMENT PLAN 2011-2017

The main thrust of CHP policy can be found in chapter 17 of the Dublin city plan. District heating and CHP are promoted for larger projects in particular

"17.1.4 Sustainable Site and Building Design Energy Efficiency –

All proposals for development should seek to meet the highest standards of sustainable design and construction with regard to the optimum use of sustainable building design criteria such as passive solar principles and also green building materials (see policies and objectives as detailed in sections 5.2.4.14 to 5.2.4.16). ***For larger schemes, consideration should be given to district heating schemes and Combined Heat and Power (CHP).*** *"*

Chapter 17 also contains additional guidelines on development standards. It outlines the various criteria that the council will use to identify "exemplary standards of environmental sustainable design and building solutions" including CCHP Systems (combined cooling, heating and power).

Dublin City Council, unlike the other city councils have taken the measure of setting themselves a target to report on the following annually:

"Number of CHP units within the private housing and commercial sectors."

The Environment and Engineering department in the council are to take responsibility for this reporting .

4.4 WATERFORD CITY DEVELOPMENT PLAN 2013 – 2019

The Waterford City plan is notably weaker in the language it uses in the promotion of CHP technology. The plan aims to encourage energy efficiency during the construction phase and lifetime of new development including in the choice of heating systems.

4.5 CORK CITY DEVELOPMENT PLAN 2009-2015

Cork City's current development plan runs until 2015 and the draft of the upcoming plan has recently been released for public consultation. While the existing plan has strong references to the promotion of CHP, the new plan on the other hand emphasizes the need to introduce energy efficiency measures and retrofitting and does not mention CHP specifically as part of its strategy.

References to CHP are contained in chapter 17 of the current plan. The council firstly stresses that all new applications will need to "meet the highest standards of sustainable design and construction and conform in full with sustainable energy policies". The document sets out the requirement that new major developments should:

"*Submit an Energy Statement with the planning application addressing how demolition, construction and long-term management of the development will be catered for and how the development:*

*Promotes sustainable waste behavior in new and existing developments, including support for local integrated recycling schemes**, CHP (Combined Heat and Power) and CCHP (Combined Cooling Heat and Power) schemes**;*"

As mentioned above, CHP does not feature specifically in the draft plan for 2015 – 2021, however there is a reference to district heating and its potential use in certain new developments. There is a strong element of pragmatism with regard to the high costs of retrofitting the existing building stock with district heating systems and a recognition of the difficulties in this regard.

"District heating is too costly to retrofit to existing development but holds potential for future mixed use developments that include uses with a constant heat demand (such as hospitals, hotels, etc.) Potential for district heating is currently limited by

lack of a reliable national biomass fuel supply and by a lack of expertise in the area."

5 PROPOSALS

5.1 DELIVERY OF CHP

According to the SEI Guide to CHP in Ireland the cost of retrofitting existing residential units to connect to a district heating system would be in the region of 2500 euro per unit. This is opposed to a cost of 150 euro per unit to connect a new house to a DH scheme (Irish Combined Heat and Power Association n.d.). On that basis we would suggest that district heating be promoted in suitable new residential developments through the planning system thereby allowing for the implementation of CHP to capitalise on economies of scale.

5.2 EVIDENCE-BASED FORWARD PLANNING

Our review of the various city council development plans revealed a variety of approaches and strategies in terms of energy efficiency and heating policy. Most refer to National legislation and targets on reductions in GHG emissions. Dublin, Cork, Limerick and Galway all refer to CHP but the language tends to be weak with objectives to "promote" or "consider" CHP in new schemes. Waterford City Council does not make any reference to CHP.

There also seems to be an issue with regard to the legislation that is being referred to. Chapter 17 of the current Cork City Development plan refers to statutory instrument 666 on Energy performance of buildings. This piece of Irish legislation refers to Directive 2002/91/EC on energy performance of buildings. It seems inappropriate to refer to this as there are much more recent and relevant EU directives (see section 'European Legislation on Cogeneration').

As the economy in Ireland begins to change in a positive direction and with the current push towards more evidence based planning, the respective city development plans will need to provide accurate data and specify achievable targets going forward if they are to effectively influence the uptake of CHP in new development. The use of SMART (Specific, measurable, achievable, realistic and Time based) objectives will be essential in this regard.

Scotland, a country with a comparable population and similar overall population density to Ireland, provides a positive example in this regard. The draft heat generation policy statement published earlier this year by the Scottish government specifies that individual boilers heating individual buildings are the main source of

heat in the country, another similarity to Ireland. The document outlines the need for local development plans to use heat mapping to assess the potential for co-location of developments with a high heat demand with sources of heat supply. Heat mapping is referred to as a valuable tool that can provide planning authorities with the knowledge base to identify opportunities with regard to heat recovery, district heating, renewable heat and low carbon heat. Heat mapping is being used as a tool across the UK (COGEN Europe, 2012). They go on to suggest that heat networks, even if reliant on fossil fuels, should be promoted as long as they can be converted to renewable or low carbon sources of heat in future. In cases where heat networks are not viable the document proposes the use of microgeneration and heat recovery technologies.

The energy and heat demand of developments should become a primary consideration in the development control process with the aim of proactively clustering developments whose energy and heat profiles might complement each other.

Finally, the Irish planning authorities will need to engage with the Sustainable Energy Authority of Ireland to a greater extent in order to establish the evidence base and the impetus for stronger policy on CHP technology going forward. Given the statutory nature of City and County development plans in Ireland, a move away from aspirational language to more strategic and targeted strategies in this regard should help to ensure a greater uptake of the technology.

5.3 FINANCIAL INCENTIVES

While Local Authorities in Ireland do not have jurisdiction over taxation they do administer the charging of commercial rates and development contribution schemes. The use of innovative measures in this regard could also be employed to encourage and stimulate the uptake of new technology such as CHP. Moves are already taking place in this regard. Development contribution schemes are charged on all new developments and are typically calculated based on floor space and other factors. Cork City Council has published a new draft development contribution scheme guidelines document which allows for charges to be waived in certain circumstances including where a development incorporates renewable energy generation with a capacity up to 0.5MW. Micro CHP projects would fall into this category and the opportunity to forego these development charges will undoubtedly be an appealing incentive in new projects. There would appear to be a strong argument to be made for a similar policy to be applied across all the city councils in Ireland.

5.4 PROPOSED DEVELOPMENT PLAN OBJETIVE

The following is an example of how a development plan objective could be re-drafted to assist with the achievement of National targets on Energy efficiency at a local level.

The example given below (SIO90) is an objective from the current Dublin City Development plan. We have re-written this objective as SIO91 using SMART (Specific, Measurab**le,** Achievable, Realistic, Time-based) principles. The new

objective has been put together on the basis that a similar heat mapping survey to that in the UK would be carried out at National level and would identify areas of high heat demand which is essential for the economic viability of new CHP systems (UK Dept. for Energy and Climate Change: n.d). This would then provide the evidence base needed for targeted action at local level.

SIO90 *To require that proposals for large-scale developments (typically 50 units or 5,000m² and above) or as may be determined by the planning authority, should include an* ***Energy Statement*** *to accompany any application, illustrating how the proposal incorporates the above design considerations and how it addresses energy efficiency with regard to the demolition, construction and long-term management of the development.*	**SIO - 91** To require that proposals for large-scale developments in priority areas identified by the National Heat Mapping survey (typically 50 units or 5,000sq.m and above) or as may be determined by the planning authority, should include **a binding Energy Plan** detailing how the development addresses energy efficiency with regard to the demolition, construction and long-term management of the development **SIO - 91(a)** To require that all developments that are to submit an energy plan as per objective SIO - 91 shall include as part of that plan proposals to **incorporate an energy efficient mode of heating** into the development such as CHP, Ground source heat pumps, or efficient gas boilers.

6 CONCLUSION

In this paper we have explored the area of Combined Heat and Power, its potential to assist with the realisation of reduced CO_2 emissions and the factors that have been limiting that potential in Ireland compared to other E.U. countries. The main finding of our research is that planning has the potential to play a bigger role in CHP promotion as part of a wider social and economic framework. In this respect, a holistic approach is needed from all sectors of government targeting the most suitable applications for industrial, commercial and residential CHP.

While CHP applications are becoming increasingly diverse in terms of capacity and their ability to exploit clean, renewable fuels, the underlying technology is very simple and has been in existence for quite some time. In that sense CHP is a low tech method of achieving the ambitious targets that are being set at E.U. and national levels. In many ways, CHP could be utilised as an intermediate technology and a compliment to other measures such as increased energy efficiency and insulation standards as we progress, as a society, towards a carbon free future. We are confident that with a renewed effort and strong political will,

Ireland can play a key role in advancing this technology at a European level. As a small country with a relatively young and still growing population, we have the ability to be flexible and innovative in our approach to future development.

In addition, Ireland's planning system is well established, with over fifty years of knowledge and expertise. The recent economic narrative in Ireland has encouraged reform in the planning system with a greater focus on targeted, deliverable development plan objectives and new measures such as the introduction of an independent planning regulator. This reform has given the profession a renewed focus on sustainability. Evidence of this reform can already be seen. At a local level, Cork City Council proposes to waive development charges from next year on large developments that incorporate energy efficiency measures in their design. Meanwhile at a national level measures such as the National Energy Efficiency Action Plan have outlined specific, sectoral targets to reduce energy usage with CHP included as part of a suite of proposals. We envisage that policy measures such as this will facilitate the inclusion of CHP technologies in large new developments and will have a measurable influence on cutting our emissions.

This logic can also be applied at a wider European level. In light of the most recent IPPC reports the problem of CO_2 emissions appears to be worsening despite the stated objectives of most national governments. At this point it may be prudent to reflect on the approach currently being taken and to perhaps adopt different and more binding policies on a local level in the absence of truly enforceable national targets post-2020. One problem we encountered while carrying out this research is the variety of different measures used to set targets and report on emissions as adopted by individual member states. While there is certainly a need for strong policy on emissions reporting and setting targets, perhaps we are entering a time where a greater urgency is needed on adopting specific measures to address the problem. CHP is one measure that has the potential to tackle what we would see as the "low hanging fruit" of energy consumption in a relatively cost efficient manner.

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8 ANNEXES

8.1 ANNEXE 1 – Data on Combined Heat and Power in Ireland

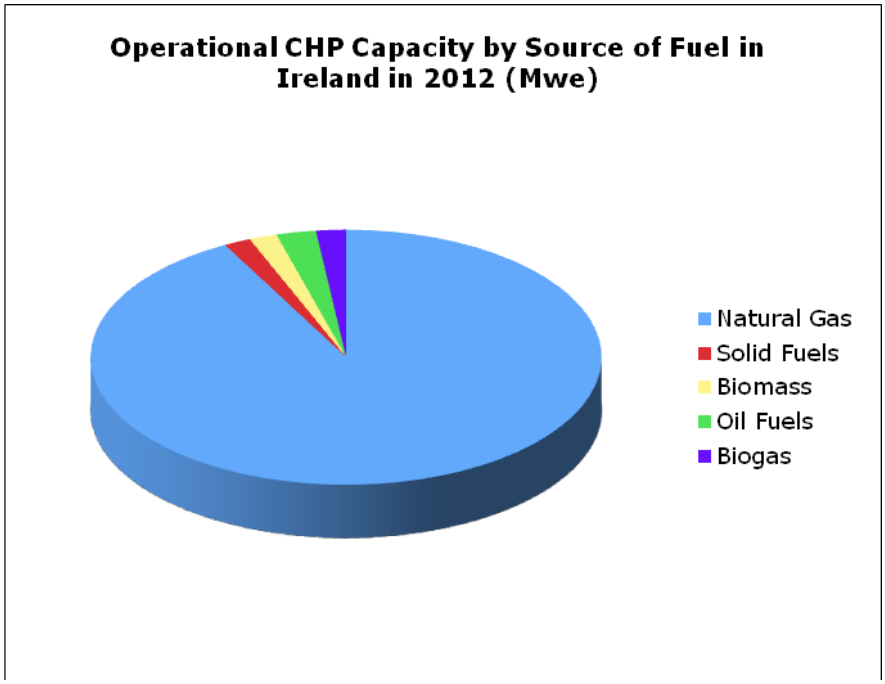


Figure 2 SEAI (2013) Combined Heat and Power in Ireland: 2013 Update

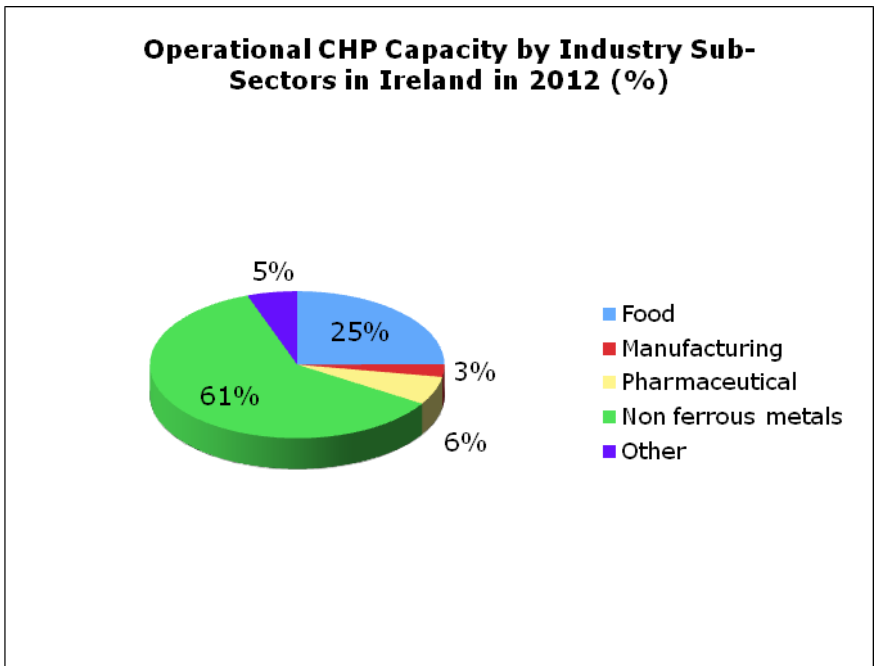


Figure 3 SEAI (2013) Combined Heat and Power in Ireland: 2013 Update

Figure 4 SEAI (2013) Combined Heat and Power in Ireland: 2013 Update

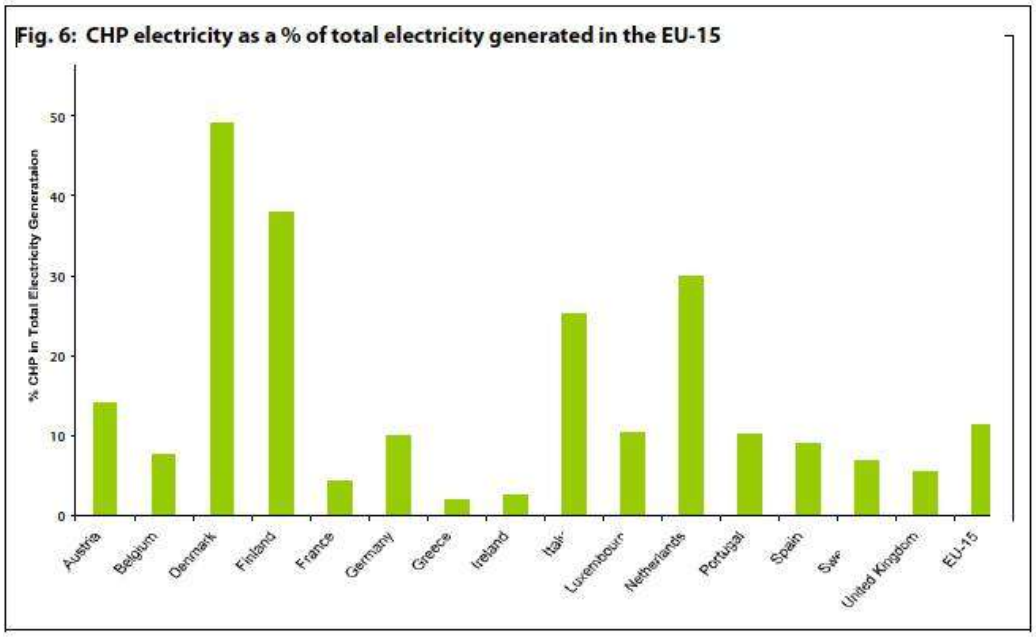


Figure 5 SEAI (2012) Combined Heat and Power in Ireland: 2012 Update

Sustainable Energy Action Plans (SEAP) and the Climate Plans: new tools for local environmental planning

Filippo Magni, Denis Maragno.

ABSTRACT

The climate change debate developed in the last years and especially the evidence provided by the Intergovernmental Panel on Climate Change (IPCC) and European Union reports about increasing temperature, have push the policy-makers and government to deal with climate protection policies.

In particular, the European Commission has promoted the “Covenant of Mayors” in order to endorse the local authorities efforts to implement energy policies about urban systems mitigation and adaptation to climate change. The research presented here concerns the assessment of methods and techniques for the land-use analysis and planning. Methods useful to promote the reduction of greenhouse gas emissions and the appropriate adaptation strategies.

The research aim is to verify in which conditions energy, environmental and urban policies are able to promote the resilient territory development. The research project meets the general objective to implement the "Climate-Energy Package" (GUEE L 140 of 5 June 2009), implementing Directive 2009/28/EC on the promotion of energy from renewable sources. In that way, it provides a transferable methodological support, able to be used at regional level for the development of the Climate and Energy Action Plan. All that is in a close relation to spatial planning tools provided by the Regional Law 11/2004 in the Veneto region. The research specific objective is the definition of a preliminary study for a Local Action Plan for Climate (according to the EU model) in the Province of Rovigo. That preliminary study has the task of programming specific actions to improve efficiency of urban systems (including the development of guidelines for planning technique) promoting the use of renewable energy from a perspective that encourages local development.

Key words: SEAP, Climate Change, Urban Planning, Covenant of Mayors

1 INTRODUCTION

1.1 THE EUROPEAN COMMISSION AND THE COVENANT OF MAYORS

Considering that 75% of the European population lives in urban areas in which over 80% of the produced energy is consumed and that the growth rate for energy consumption is 1.9% per year, it is expected that urban energy consumption increase by double the average European growth rate (IEA, International Energy Agency). These are the conditions that prompted the Parliament and the European Commission to launch the Covenant of Mayors, recognizing that local governments have a strategic role in tackling climate change due to their responsibility in the plans and regulations that can influence adaptation and mitigation and their ability to demonstrate leadership in adopting innovative solutions on these issues (Musco, Fregolent, 2009). The local level, simultaneously considered “part of the problem” and “part of the solution”, consequently becomes the ideal starting point to launch actions and policies for climate protection that allow real transition towards a sustainable energy model that can combine simple energy savings with investments in energy efficiency and the use of renewable energy sources.

The Covenant of Mayors, launched in 2008 by the European Commission after the introduction of the "Climate and Energy" package (package 20-20-20), was introduced to endorse and support the efforts of local authorities in implementing policies in the field of sustainable energy. Within the Italian context the local perspective is therefore almost entirely linked to the initiatives created within this European proposal, in some cases actual enactment of local programs on a voluntary basis or of European projects. In fact, its purpose is not simply to reduce CO_2 emissions, but primarily to promote sustainable development in local communities. Its mechanism is simple: it is the only instrument on a European level that puts the city in direct relationship with Europe - without going through intermediate levels such as states or regions. By signing a voluntary pact with Europe, each municipality is committed to reducing CO_2 emissions by 20% within the year 2020 and in order to reach this objective, the signatories undertake to:

- Prepare an inventory of emissions (BEI-Baseline Emission Inventory)
- Provide, within a year after signing the Covenant, a Sustainable Energy Action Plan (SEAP) approved by the City Council outlining the measures and policies to be developed in order to achieve the required goal
- Publish every two years, after elaborating the SEAP, a report that evaluates the progress in implementing programs and the provisional results
- Promote activities and engage their citizens/stakeholders for the implementation of local energy days
- Spread the message of the Covenant of Mayors, in particular by encouraging other local authorities to join.

The European Commission has also prepared a detailed guideline for the definition of inventories and the elaboration of SAEP in order to standardize some formal aspects and the content of the various plans. With their plans Covenant signatories aim not only to save energy, but also to create stable and skilled jobs, a better environment, and a healthier quality of life, and to increase economic competitiveness and energy independence (Accorigi, 2012). Today, five years after its introduction, the political commitment of the Covenant tallies more than 5000 signatories, more than half of which are in Italy.

2 SUSTAINABLE ENERGY ACTION PLANS

2.1 STRUCTURE AND AREAS OF INTERVENTION

When analyzing the content and composition of a series of Action Plans for Sustainable Energy, you can identify a universal structure which remains nearly constant among all the various strategic choices made, the diverse territorial characteristics, and the different arrangements of the plan document. It should not be omitted that such plans fall within the framework of existing management and planning policies of governments and are generally shared by various areas of expertise. Many of the identified policies, due to their commonality to various areas of expertise, require the involvement of several institutional actors as well as the private sector to be actually finalized.
The strategies included in the action plans therefore propose new policies and actions which, inserted into an existing framework, in some cases start new lines of experimentation and very often become explicit by indicating variations to existing plans or programs: variations in building regulations, variations in traffic plans, variations in energy plans and so on).
The sectors of reference involved in the environmental policies, despite being listed and grouped in different ways by the various administrations, contain macro reference sectors identified in all the plans analyzed:

- Transportation and mobility
- Buildings: residential, commercial, institutional
- Urban planning at a block/neighborhood level
- Local production and energy distribution
- Production sectors: industry, services, agriculture and forestry

As for the structure of the plans (Table 2) a "pattern" in principle is identifiable, one that is common to almost all the cases examined both in terms of the environmental plans and the SEAP. The typical plan opens with a framing strategic document, which identifies the long-term goals after having classified the territorial features, the areas of intervention, and the actors to involve. What follows is an inventory of emissions, which identifies the elements and the areas on which to act in order to mitigate direct emissions, i.e. those relating to intermediate and final consumption of energy produced from fossil fuels. The plans, in fact, often attach tables which report and reconstruct the emissions per

unit of product (fuel or material) relative to the production cycle of a specific fuel also in relation to its origin.

Sections	Contents
Preliminary Strategic document	Identifies long-term goals and provides a framework for planning and involved stakeholders
Baseline Emission Inventory	Accounts emissions and defines the main areas for the mitigation process
Inventory of potential impacts *	Defines impacts and areas directly affected by the Climate Change
Action Plan	Defines the actions and the privileged sectors (public-private)
Tables of actions and measures	A specific table for each action to find: resources, time, and subjects involved
Package of adaptation actions *	Manual with urban and environmental planning solutions at various scales

**Sections in case of plans with specific address to adaptation*

TAB 1: Summary of the structure of the climate plans

Once the areas of intervention have been identified, the Action Plan, thanks to all the elements identified by the IBE, consequently selects actions and measures to be taken in order to reduce CO2 emissions. The technical specifications sheets, which describe every action in detail, are used as a management and verification tool in which the following can be found: the title of the action and/or project, its nature, its duration, the players involved, the reduction targets, the path to be adopted in order to involve citizens, any costs (investment-management), etc. In the event that the action plan, in addition to dealing with mitigation, goes further to address issues of adaptation, an inventory of potential short to medium-long term impact scenarios can be found. This inventory identifies among other things:

- Potentially difficult hydraulic and drainage areas
- Coastal areas at risk of erosion
- Areas at risk of developing urban heat islands

The potential impacts are of course of "forecast" nature (risk measurement) and of locational (areas/groups) nature. The memorandum of adaptation actions is configured primarily as a manual of technical solutions to urban planning and environmental design at various scales depending on the level of action plan (Musco, 2012).

2.2 THE COVENANT OF MAYORS IN FIGURES

Since 2008, the year of initiation of the European Covenant of Mayors, the number of cities, municipalities and local authorities in general involved in the

program has steadily increased, confirming the role that European cities will play in the fight against climate change in the coming decades. At the end of that year, a little more than 200 local European communities joined the Covenant of Mayors, but today there are already over 5000 signatories of which more than 2000 are Italian (more than 50% of the total). Although there are dozens of European cities that are added daily, an indication of the growing awareness of their role in institutional sectors which until recently were considered "independent" from local strategies and actions (Lumicisi, 2010), there are just as many European cities that, not fulfilling the commitments with the EU, are excluded from the European Union initiative. If we compare, for example, the number of signatories in September 2012, which was a total of 4213 local municipalities who signed the pact (Table 2), with the 4230 signatories in March 2013, we note that the trend, albeit little, it is still growing.

Italy	Spain	France	Greece	Portugal	Romania	Germany	Belgium	Sweden	Total
2145	1111	141	97	74	71	64	62	50	4213

Tab.2: European countries with more than 50 member – September 2012

Italy	Spain	France	Greece	Portugal	Belgium	Romania	Germany	Sweden	Total
2115	1252	118	66	62	62	61	57	48	4230

Tab.3: European countries with more than 50 member – March 2013

Italy	Spain	France	Greece	Portugal	Belgium	Romania	Germany	Sweden	Total
2637	1465	114	88	73	69	50	53	48	5092

Tab.4: European countries with more than 50 member – December 2013

The absolute figures indicate an increase of only 17 memberships in 6 months, whereas, by analyzing the relative values in more detail, we find that merely during the period from January to March, there were 79 new members. This fact has a very important value if you place it within a European context, because with every accession, there are about the same number of expulsions from the program. The high number of exclusions demonstrates on one hand how difficult it is for local governments to finalize the agreement with the European Union and on the other hand how joining the Covenant of Mayors for some municipalities may be considered a simple greenwashing operation, implemented by short-sighted local administrators and without a genuine intention to pursue sustainable development attentive to energy and climate issues (Iraldo, Melis, 2012).

2.3 THE ACTION PLANS FOR SUSTAINABLE ENERGY (SEAP) IN EUROPE

At five years after the launch of the Covenant of Mayors, the two countries that have so far given the main contribution in terms of membership are Italy with 2637 signatories and Spain with 1465 member municipalities, which alone added 80% of local authorities to the Covenant. This is not a paradox, but a growing awareness, both at a European and at a local level, that you can come out of the current global crisis by focusing on the development and growth of certain well-

identified sectors in the European industrial landscape, such as the production of energy from renewable sources, energy efficiency, sustainable mobility, etc. (Benedetti L., Racchetti A., A. Rizzi, 2012). If on a national level ideas are not yet completely clear, on a local level the high number of memberships to the Covenant of Mayors is surely an initial indication. With their membership, thousands of local authorities have already made commitments to reduce CO2 emissions. Of the more than 3267 SEAP presented by European local authorities, the European Commission (through the intermediary of its Joint Research Center - JRC), illustrates first and foremost that these SEAP concern territories that amount to more than 80 million people and that, in the face of an emission total of 430 million tons of CO2 (6t CO2 per capita), these cities have committed to cut emissions by 128 million tons, with an average reduction of emissions by 2020 well above the required minimum of 20%.

Some surely interesting elements relate to the fact that the vast majority of SEAP (82%) provides information on costs and investment plans which are around the substantial amount of 40 billion Euros; the industry in which we expect to see the greatest contribution is energy efficiency (in particular, residential/buildings and small to medium enterprises) with approximately 40% of total emissions (Verones S., B. Zanon, 2012). In addition to Italy and Spain, the European countries with more than 50 participating municipalities (Table 3) clearly shows that the countries considered "Mediterranean" (Italy, Spain, France, Greece and Portugal) cover almost the entire number of municipalities that have signed the covenant of Mayors. Therefore it's spontaneous to wonder why the interest is polarized and most of all to wonder why there is such a 'scarce' participation on behalf of northern European countries which are considered to be at the forefront on issues related to sustainability and environmental protection. The reasons for this disparity are many and diverse, and can be summarized in a consolidated and sustainable governance of resources which has become routine in land management policy in northern European countries; while in countries such as Italy, Spain and Greece the interest in sustainability issues has had a different history. In the Mediterranean, this attention has only recently begun to appear, at least on a larger scale; clearly showing how in many regions municipalities have limited skills and therefore an inadequate power to influence energy/climate problems mainly for the following reasons:

- The size of the municipalities are often very modest and there is a shortage of technical personnel
- Integrated planning is almost absent or of very recent introduction.

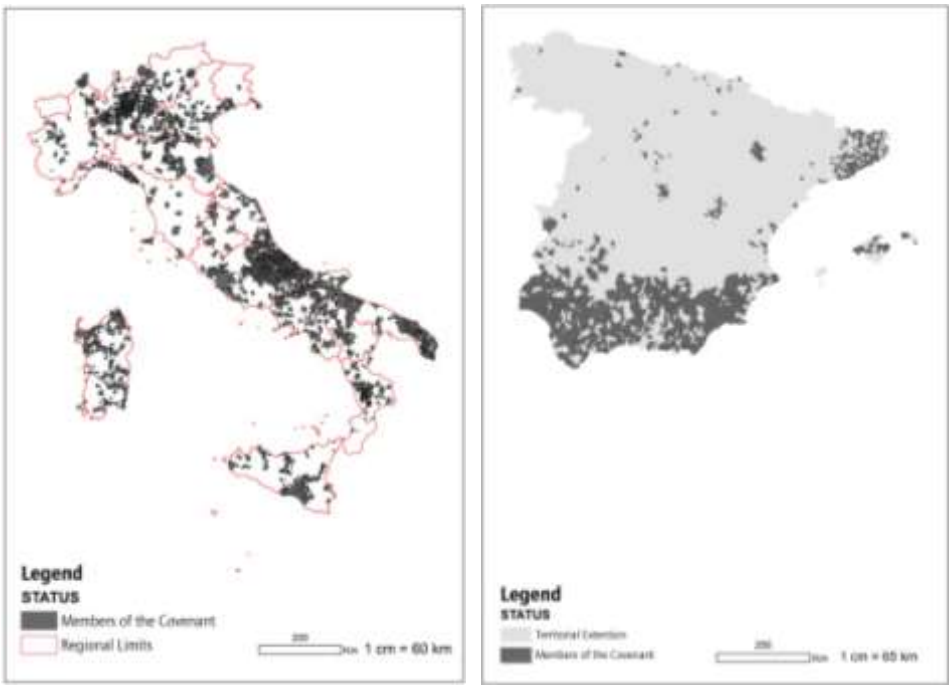
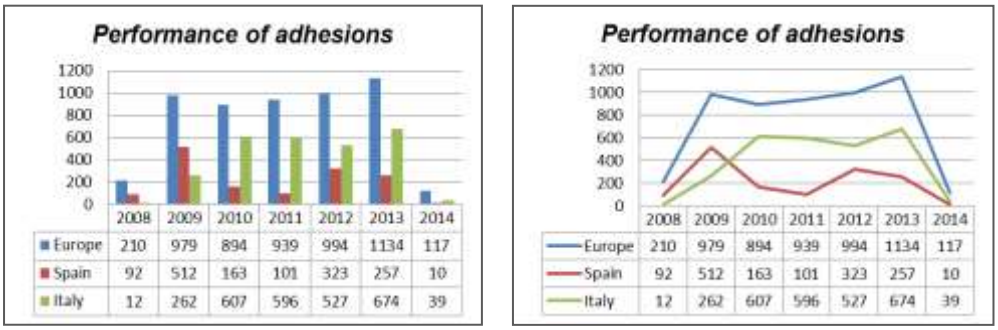


Fig. 1: Mapping of the adherents to the Covenant of Mayors in Italy and Spain (elaborated by Maragno D., Magni F. 2013)

It should be underlined, however, that in the face of severe economic crisis, which is involving more Mediterranean countries and which drives individual municipalities to fear any commitment in terms of investment, most of the local administrations of Mediterranean Europe (3427) see the Covenant of Mayors (and therefore the issues related to energy and climate) as a possible tool for development.



Graphic 2: Performance of adhesions to the Covenant of Mayors in Europe, Italy and Spain (Source: www.Eumayors.eu, Elaborated by Magni F. 2013)

3 NEW TOOLS FOR ENVIRONMENTAL PLANNING AND LOCAL DEVELOPMENT

2.1 ACTION PLANS FOR SUSTAINABLE ENERGY (SEAP) IN ITALY

Conscious that the path taken by local administrators towards a greener Europe is still a long one, the Italian situation allows you to look positively to the future. Of the more than eight thousand Italian municipalities, nearly a quarter (2637) of them has already joined the Covenant of Mayors, and among them, more than 1,300 have already drawn up an Action Plan for Sustainable Energy (SEAP); this means that the interest in local development through energy issues is very strong. Italy has never seen such a territorial mobilization on an issue such as the fight against climate change. It seems a paradox that such mobilization took place in the central years of an international crisis still far from resolution (Lumicisi 2013). This important success is above all due to the coordinated action of AICCRE (Italian section of the Council of European Municipalities and Regions of Europe), the Ministry of Environment and Protection of Land and Sea (Mattm) and the European Commission itself. A fundamental role in the development of the Covenant of Mayors in Italy is carried out by support structures recognized as such directly by the European Commission which identifies two main levels of participation. The first regards the public administrations and the local authorities (Territorial Coordinators) and the second regards associates and networks of local authorities (Covenant supporters). Currently in Italy 101 support structures among public administration are active among 56 public provinces; 7 regions; 6 mountain communities; 14 among unions, consortiums, municipal associations) and 16 associations and networks of local authorities.

TERRITORIAL COORDINATORS		
Regions	Abruzzo, Marche, Piemonte, Toscana, Sardegna, Sicilia, Veneto	7
Provinces	AG, AL, AV, BN, BG, BO, BZ, CE, CT, CH, CS, KR, FC, FE, FG, GE, IS, AQ, SP, LE, LC, LI, LO, MN, MS, MT, ME, MI , MO, MB, NA, NO, PD, PG, PE, PU, PC, PZ, RE, RG, RN, RM, RO, SA, SS, SV, SI, TE, TN, TO, TR, TV, UD, VE, VI, VR.	56
Unions of Municipalities	Antichi Borghi di Vallecamonica, Tre Territori Veronesi, Comuni del Golfo, Comuni della Versilia, Comuni delle Valli, Antigorio Divedro Formazza, Comuni della Gallura, Comuni della Valdichiana Senese	8
Aggregations of Municipalities	Calatino Sud Simeto, EST Veronese	2
Comunità Montane (Mountain Communities)	Monti Azzurri, Valle Sabbia, Valtellina di Morbegno, Valle Brembana, Valle di Cembra, Valle Trompia	6
Associations of municipalities	Autorità di Ambito Sele, Bacino Imbrifero Montano Bormida, Bacino Verona Due del Quadrilatero, Oltrepo Mantovano, Sviluppo del Basso Veronese, Patto Nord Barese Ofantino.	6
Total		**85**

Tab.5: Territorial coordinator of the Covenant of Mayors active in Italy at the 26/12/2013 (Source: www.Eumayors.eu, Elaborated by Magni F. 2013)

SUPPORTERS OF THE COVENANT		
Associations and networks of local authorities	AICCRE, ANCI Emilia Romagna, ANCI IDEALI, Associazione Borghi Autentici d'Italia, Associazione TECLA, Cittaslow International, Climate Alliance Italy, Consorzio CEV, Coordinamento Agende 21 Locali Italiane, COPPEM, Focus Europe, Fondazione Cogeme Onlus, LEGAUTONOMIE, Nebrodi Città Aperta Network, Sweden Emilia Romagna Network, Union of Italian Provinces	16
Total		**16**

Tab.6: Supporters of the Covenant of Mayors active in Italy at the 26/12/2013 (Source: www.Eumayors.eu, Elaborated by Magni F. 2013)

Italy, as a country with the highest number of signatories, is also the country which can boast the highest number of desertions. In fact, considering a time frame of September 2012 to February 2013 as an example, you can see how from a quota of 2145 signatory municipalities, the number decreases to 2089 signatories (56 expulsions in less than 12 months). The figure emerges almost as a contradiction, especially in a period in which, thanks to Europe, municipalities could contribute to a real development that protects the environment and revamps local economies (Frassoni M., 2012). European funding that the local authorities could take advantage of in most cases are unable to be reached and this happens because the municipalities do not have the resources (both human and financial) to present preliminary studies. Yet the funds are available: ten billion in grants allocated by the EU for the mere executive planning of the measures to include in the SEAP. At present, the Covenant of Mayors, as indicated previously, beyond representing the strongest movement in place to involve local government in the fight against climate change, it is also an instrument that allows municipalities to complete projects to reduce emissions thanks to funding bestowed directly subsidized by the European Investment Bank (EIB). Projects which often, in addition to "doing well" for the climate and the environment, may also boost local economies, a factor not to be overlooked in this age of crisis. In Italy, however, the Covenant is not working as well as it could or in some rare cases it fails.

2.2 EXPERIMENTATION IN THE PROVINCE OF ROVIGO

From what has been said so far, the main problems related to the development and propagation of the Covenant of mayors in municipalities in Italy can be summarized in:

- The lack of experience and technical structures capable of supporting the Covenant of Mayors through the implementation of the action plan for sustainable energy (SEAP) at first and secondly with the final draft of the individual measures proposed by SEAP.

- The lack of economic resources both for the preparation of the above mentioned documents and for the execution of the actions proposed for the reduction of CO2 emissions.

Therefore to ensure the success of that process (from the preparation of the SEAP to implementation and its monitoring), it is essential that sufficient support and autonomy are granted by the highest levels of municipal politics. The signing of the Covenant of Mayors by the City Council (or the equivalent decision-making body) already constitutes clear and visible proof of commitment.

The design and implementation of a sustainable energy policy is a long and difficult process, which must be systematically planned and managed with continuity. It requires the collaboration and coordination of various departments of local government, such as environmental protection, territorial planning, economy and social affairs, management of buildings and infrastructure, mobility and transport, budget and finance, procurement, etc. In addition, a clear organizational structure and assigning detailed responsibility are prerequisites for the correct and sustainable implementation of the SEAP. The lack of coordination between different policies, local authority departments and external organizations has created a considerable shortage in energy planning in many local authorities.

Depending on their size and the lack of appropriate technical skills (particularly the mere availability of human resources), the local authority may have resort to support structures or energy agencies, sub-contracting some specific tasks such as the drafting of a basic inventory of emissions (IBE) to external agents. The governments that do not have sufficient resources or the ability to prepare and implement their own SEAP will have to revert to the aid of administrations or organizations able to remedy these deficiencies. Support structures are able to provide strategic advice and technical and financial assistance to local authorities who, while wanting to participate in the Covenant of Mayors, do not have the ability or the resources to meet the requirements. In addition, the support structures closely cooperate with the European Commission and the Office of the Covenant of Mayors for the best implementation possible. Therefore, the support structures are officially recognized by the Commission as essential allies for the dissemination of the message of the Pact and to increase its effectiveness. There are two types of support structures:

- National and regional public bodies, regions, districts, provinces, agglomerations
- Networks or associations of regional and local authorities

2.3 THE STUDY CASE: A PUBLIC-PRIVATE NETWORK TO SUPPORT THE COVENANT OF MAYORS

The province of Rovigo, active member of the Association of National Local Agenda 21 coordinated in Italy that has shared the objectives of the Charter and activities of cities and Regions of Italy for the climate, in consistency with the principles of sustainable development, for several years has launched a political process aimed at promoting tools for integration between environment, economic development and social context. Following the European Conference "Climate Protection and Renewable Energy: Medium and Small Communities facing the challenge held in Rovigo in 2008, it joined, as a privileged actor, the Climate Road Map for the implementation of the Kyoto Protocol by Local European

administrations. The province also promotes, at a European level, the subscription to Rovigo Outreach, documents in which small and medium-sized local authorities commit to the construction of policies for climate protection at the local level.

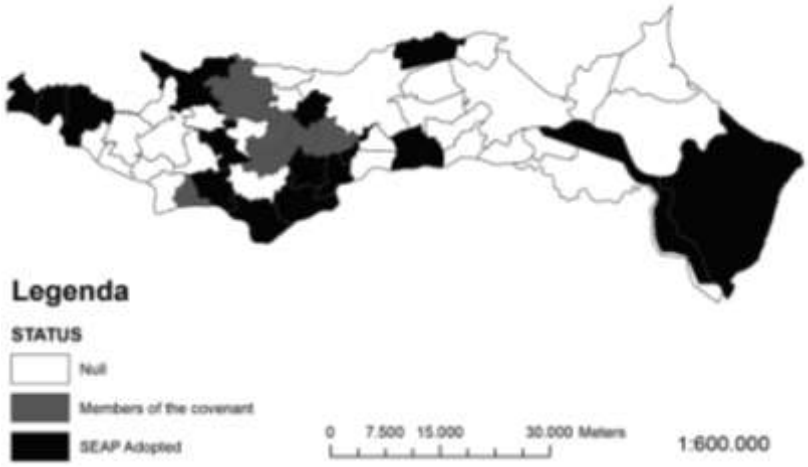


Fig.2: State of the art of the covenant of Mayors in the Rovigo province

To continue, in accordance with its function as assistant and within the local action for implementing policies for the protection of the climate and the reduction of climate-changing emissions, the province also has a role of support structure for the European Commission for the Covenant of Mayors, on the basis of the partnership agreement signed in 2010. The commitment made by the province with Europe is:

- To increase awareness about concepts and the value of the Pact within municipalities;
- Scientific and administrative assistance in regards to bureaucratic procedures;
- The identification of financial resources required for the preparation of the SEAP.

Precisely in this awareness-raising process, in early 2011, experimentation started within the Territorial Environmental Laboratory La.Terr.A. (INFEA node – Environmental information and training of the Veneto region – ARPAV), with a specific technical secretariat created to disseminate within municipalities and communities, the objectives and the values of the initiative, to assist the government in the definition of the membership of the Covenant of Mayors and to provide guidance for starting with the production of Sustainable Energy Action Plans. Thanks to the forces fielded by the Province, through the territorial technical secretariat of La.Terr.A and in collaboration with the IUAV University of Venice, it was possible to operate in a systematic way and raise awareness in the provincial territory towards environmental issues of climate protection, leading many local realities to signing the Covenant of Mayors with the European Union. At the date of commencement of this experimentation, which corresponds to March 2012, there were only 4 municipalities that joined in on the "walk" with Europe towards the 20% reduction of CO2 in 2020. Today, two years later, the work has led another 18 municipalities to sign the Pact and many others have

requested the documentation to pass on to the next phase of the agreement with the EU. Below are listed in the table all participating municipalities of the province

MEMBERS	SUBSCRIPTION DATA	POPULATION
Castelnovo Bariano	24/11/2010	3039
Costa di Rovigo	20/12/2010	2739
Taglio di Po	09/03/2011	8537
Bergantino	23/06/2011	2631
MEMBERS AFTER THE START OF THE PROJECT		
Melara	04/04/2012	1914
Castelguglielmo	13/04/2012	1698
Lendinara	24/04/2012	12181
Occhiobello	26/06/2012	11569
Polesella	04/07/2012	4201
Villamarzana	12/07/2012	1225
Fratta Polesine	12/06/2012	2780
Frassinelle Polesine	13/07/2012	1531
Badia Polesine	27/09/2012	10872
Canaro	28/09/2012	2907
Stienta	31/10/2012	3354
San Martino di Venezze	26/11/2012	4046
Bosaro	28/11/2012	1569
Gaiba	28/11/2012	1123
Crespino	21/12/2012	2030
Villanova del Ghebbio	28/12/2012	2192
Arquà Polesine	27/12/2012	2837
Pincara	29/12/2012	1285

Tab.7: Municipalities members involved in the project (Source: www.Eumayors.eu, Elaborated by Laboratorio La.Terr.A, Magni F. 2013)

The research developed so far, passed by a state of the art analysis of adherence to the Covenant of Mayors, has then continued on with the study of issues related to the implementation of territorial planning tools specifically geared to energy saving and climate protection. Thanks to the study of the processes in place conducted by the province of Rovigo and the constant and exhausting relationship with public bodies and public-private undertakings (including associations) operating in the province, a public-private task force has been established. It will deal with the drafting of the SEAP on a provincial level by supporting the municipalities that will require help. This working group, officially defined by a special convention, comprises government agencies such as the province of Rovigo and the Consvipo, public utilities companies, AS2, ASM Sets and Sodea S.r.l., category associations such as CNA and Confindustria Rovigo. Within this convention the IUAV University of Venice supports the provincial government providing scientific and technical support in the field of renewable energy, energy efficiency and environmental sustainability.

Fig.3: Members of the working group

Allowing municipalities to adopt a Sustainable Energy Action Plan, to launch an economic guiding wheel which enables the territory to develop economically with a special regard for environmental and energy sustainability is the real mission that the members of the working group took on when they began this shared path of action in the Polesine territory. Technical and entrepreneurial skills will be made available to municipalities to fill the gaps in the scientific and technical knowledge of municipal technicians, to find the necessary funds to prepare the SEAP and, above all, at a later stage, assist with the final design of the actions proposed by the action plans.

2.4 FUNCTIONING OF THE OPERATIONAL STRUCTURE

The signing of the Covenant of Mayors calls for burdens that each interested municipal administration must comply with if it does not want to be excluded from this initiative. The first step to be carried out is to deliberate with Council approval a mandate to Mayor to sign the Covenant of Mayors with the European Commission's Energy Directorate (DG EN). This commitment entered into with Europe provides a path divided into a series of steps, the main ones being: building a basic inventory of emissions, the presentation of the Sustainable Energy Action Plan (SEAP) within one year from the ratification of the Covenant and a biennial Report on the implementation of the interventions provided by the SEAP. In addition to the three required steps laid down by the European Union to make the procedure provided for by the Covenant of Mayors, province of Rovigo adds a fourth, in which local communities can delegate to the working group, with its leader being the province, the drafting of the SEAP and the operational technical support for the planning and carrying out of the works provided for in the plan.

Step 1: joining the Covenant of Mayors

To adhere to the Covenant, in addition to the political desire of the Administration, a number of documents need to be filled out and sent to Brussels, the Covenant of Mayor's Office. To provide this technical support to find such documents and to

fill them out, the province, through the Territorial Laboratory La.Terr.A, offers local communities its staff and its facilities.

Step 2: signing of the Covenant of Mayors with the Province

Compared to other steps, this is solely addressed to the province of Rovigo. Contracting authorities who wish to accede to the Covenant of Mayors, but their technical facilities or their financial resources do not allow them to, may through a convention rely on the Province to jointly lead them on the path indicated by the Covenant of Mayors without creating a burden for the municipality. At this stage, trade associations and unions help the municipalities by facilitating connection with enterprises and players in the sector, by promoting innovation, and supporting the training of employees in the fields of action of the Covenant of Mayors in order to ensure the presence of professional capacities at the local level for the planning and implementation of actions of SEAP. Unindustria Rovigo and CNA Rovigo, using resources made available by the Chamber of Commerce of Rovigo and from private companies, will provide the SEAP for those municipalities that join the convention to be signed with the province of Rovigo.

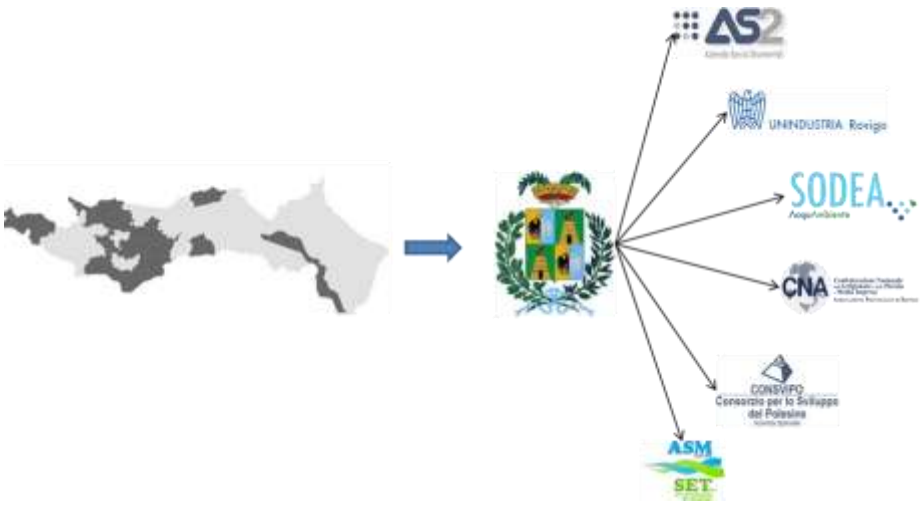


Fig.4: Signing of the Covenant of Mayors with the Province and the working group.

Step 3: implementation and approval of SEAP in the city council

Once an action plan has been drafted by category association technicians, the La.Terr.A laboratory, with the support of the IUAV University, will handle its assessment, to ensure consistency with the indications given by specific guidelines developed for the province of Rovigo. [1] Once this phase has been passed, the SEAP must be approved the City Council and then sent to the European Commission for evaluation and approval by the JRC. Once even this assessment has been happily passed, the plan becomes operational and the implementation of the actions for the completion of the 20% reduction of CO2 emissions will begin.

The CONSVIPO, which supports the province of Rovigo in the implementation of the program of the Covenant of Mayors, will deal with the development of actions of SEAP in a time frame in line with the plan, with the exception of actions relating to projects proposed by provincial public companies, which will be made or contracted out by those individual companies.

The CONSVIPO will be the public reference partner for local authorities in the establishment of the dedicated ESCO to be of mixed public-private participation that will involve instrumental public companies and those of public purpose, signatory of the Convention and private companies; This ESCO, Polesine branded, will handle:

a) The management/receipt of funding;

b) The final design and the execution of the works, either directly or by third-party contracts;

c) The realization or the contracting of the actions defined by the SEAP of the municipality's responsibility;

d) The management, ordinary and extraordinary maintenance works;

e) Monitoring the results of the individual actions according to the needs of individual SEAP.

Step 4: Monitoring of the development/realization of the actions of the SEAP

Monitoring the progress allows local government to measure the effectiveness of SEAP. Every two years from the date of presentation of the SEAP, the signatories of the Pact are to deliver a report on the implementation. This report contains a list of achievements, both in terms of measures taken both of CO2 emission reductions. Monitoring and evaluating the results is important to achieve further goals and develop future action plans. Local governments will have to measure the potential emissions reductions that their measures obtain in order to develop and continually improve the SEAP.

4 CRITICAL ISSUES AND PERSPECTIVES OF THE COVENANT OF MAYORS IN ITALY

To date, the Covenant of Mayors is probably one of the most successful initiatives among those taken to date by the European Commission.

Started in 2008, today it sees the participation of over 5000 local governments for nearly 200 million European citizens; as a comparison, just consider that in the context of the local Agenda 21 experience, which shares many aspects with the Covenant of Mayors, the cities that have signed the Aalborg Charter from 1994 to date are "only" 2,800. Such a success seems to have surprised even the Covenant of Mayors Office, the structure of which struggles to manage the increasing amount of work required to support the initiative, as demonstrated by the only 300 plans (approximately) evaluated and approved by the JRC against the 3267 submitted.

This positive outcome has so far been measured by the numbers which express the involvement of the initiative, and can be traced to a variety of causes. Among them, two are absolutely relevant:

A. The increasing focus on issues of energy and climate, which have become more and more a priority for citizens and which are increasingly bonded to prospects of emancipation from the current economic and employment crisis in addition to improving the quality of life;
B. Local governments are the new protagonists as they operate in the dimension most congenial to political experimentation and they are affected by both the loss of credibility of the political establishment and the spread of new movements from below, strongly rooted in the territory but at the same time connected globally through information technology.

However, despite this important result, the success of the Covenant of Mayors measured on the results obtained, i.e. the ability to significantly reduce the greenhouse gas emissions on a local scale, are far from obvious. At this particular moment, we might say that the initiative is "in midstream," and we might try to briefly summarize some of the critical issues related to the real fulfillment of the objectives as follows:

1. Innovation of the governance

This means innovation of municipal governance but also the ability to accept the challenge of innovation. The Covenant of Mayors is a process which begins with the drafting of the action plan and ends in 2020 with the achievement (desired) of the objective of reducing emissions. The main difficulty of this path can be found in:

- The lack of, within individual municipalities, experience and technical structures capable of supporting the commitments provided for by the Covenant of Mayors: the implementation of the action plan for sustainable energy (SEAP) at first and secondly the executive planning of the individual measures envisaged by the SEAP
- The lack of economic resources both for the design phase of the above mentioned documents and for the material execution of the measures forecasted for the reduction of CO2 emissions.

The current structures and procedures do not allow local authorities, especially if small, to govern a process of this magnitude. A response has been, at least in part, to activate control rooms and coordination tables variously arranged in order to create an area for interaction between government areas and sectors often not integrated between themselves and the stakeholders not involved in the Covenant but potentially interested in it. In this context, important witnesses were brought, in addition to that of the province of Rovigo, the province of Rome, that of the Abruzzo region, and on multilevel governance, which is establishing a new approach across Europe thanks to the united involvement of the Region, the 4 Provinces and the 305 Municipalities in the path to sustainability proposed by the Covenant of Mayors.

Of course the search for a horizontal integration alone is not enough to trigger an internal virtuous process, you must also be able to take new roads, to find new solutions, and to bet all the way through on the initiative, often one of the primary elements of block is the skepticism of technicians and municipal workers, in some cases justified by the failure of similar previous experiences. In this case the Mayor's figure is crucial in creating a positive environment, maybe even involving young staff and motivating the work group in a not so easy task that awaits the group: for good reason, it is called the Covenant of mayors.

2. Integration of initiatives on sustainable cities

The Covenant of Mayors, once signed by the local administration, may fit into a context of many initiatives which touch on the theme of energetic sustainability in a more or less direct way. In some cases, these processes are carried out independently, each tending to weaken and generating an inefficient use of internal resources (often already scarce in itself) or even enter into an open conflict where, for example, an overlapping of competences becomes evident. (Verones, 2012).

There are interesting examples of good management and some examples are the experiences of Turin, Genoa, Florence, Milan, Bari, and Pisa that are following the path to an integration of various initiatives using Smart City as the main container in which to also position the urban planning phase (Granelli, 2012). The province of Sassari has instead activated a project framework named Sassari 20-20-20 within which various activities including the Covenant of Mayors. In general, there aren't experiences that proceed autonomously towards the Committee of Regions' proposal, widening the range of action of the Covenant of Mayors or in any case making this initiative a catalyst for other processes (the contrary has happened). Do not forget that the Covenant of Mayors provides for a rigorous and codified procedure, it is very costly for municipalities and for the European Commission and perhaps it is not easily replicable in other fields.

The only shared common point on a hypothetical enlargement of the Covenant is that of adapting to climate change, a theme that is contiguous to sustainable energy.

3. Active involvement

The issue of participation is well represented within the Covenant of Mayors, and this ties the initiative with the local Agenda 21. It is a non-formal operational participation and it is immediately evident by the amount of work envisaged in SEAP which does not directly depend on the municipality but are endured by private citizens. The involvement action must begin immediately, giving rise to a genuine process of co-planning or participatory planning, and then continue into the implementation phase. However, experience teaches that enabling an effective participatory process is far from easy (Mercalli, 2010). The province of Teramo has funded an advertising and "info-training" campaign and considers it to be a key factor for the success of the Covenant of Mayors. In addition to the involvement of citizens and stakeholders, the involvement of several local authorities on the same territory and their mutual exchange of experiences must

be sought, something which has been the focused of the province of Modena that has created the Club of the Covenant.
The need to network is also linked to the issue of the size of most of the small and very small Italian towns participating in the initiative: over 90% of the signatory institutions are made up of municipalities with fewer than 50 000 inhabitants, and of these over 80% did not reach 10 000 residents. For towns like these, in the absence of major external support, it is almost impossible to follow a challenging course like the one outlined by the Covenant, and the creation of consortia and partnerships is practically a must.

4.The issue of funding

The financing of the measures is considered by those in the field to be the main (though not the only) barrier to entry into phase 2 of “implementation" of the Covenant of Mayors. In general, the reduction in transfers to municipalities which we have witnessed in recent years, coupled with the extreme rigidity of the constraints imposed by the Internal Stability Pact, which in practice almost completely reduces the possibility of direct investment by municipalities in the sustainable energy sector, makes it very complicated to undertake activities and actions especially in large-scale planning. Collaboration, through different types of partnerships with the private sector, is now more important than ever before. As part of the process of implementing the Covenant of Mayors, one must distinguish therefore the resources required for the preparation of SEAP from those that are needed for the implementation of actions and projects contained within this plan (Lumicisi, 2013). At a national level there is a set of incentive mechanisms, currently under revision, which, in fact, already support interventions on renewables and energy efficiency making them profitable from an economic standpoint. However, initial investment remains a problem. The majority of the municipalities that have written a SEAP have resorted to support beyond the municipal administration by speaking to support structures, societies and associations all working in the environmental and sustainable energy field. Collaborations with universities who, through special agreements, can provide a very low cost technical and scientific support in the preparation of plans may also become very interesting. As far as the financing of the actions of the individual SEAP, the situation is more complicated and difficult to manage in the short run. If currently in Italy there are no resources available for the implementation of the actions contained in the action plans (as stated above), why have over 2000 Italian municipalities taken this route?

The first aspect is an important contribution that came from the former Environment Minister Corrado Clini, who, recalling on how the green economy requires huge investments in this initial phase, emphasized the need to introduce some flexibility to the budget constraints (of course speaking at the European level), considering that the cost of the preparation of action plans is amortized, in most cases, within a year from when the main actions regarding the energy efficiency of public buildings (and lighting) are implemented.

Secondly, the path followed so far has been that of direct involvement of private enterprises in the initiatives promoted by the public administration, in many cases by proposing and implementing new systems of financing projects with the

support of recent new actors on the national energy scene as, for example, the company Esco. The problem of access to credit remains as banking institutions, with a worrying trend, lend money with greater difficulty and at increasingly prohibitive rates. This is also why we have often tried to use specific agreements with local banking institutions, or to use favourable loans from the European Investment Bank, as in the case of the Province of Modena, Milan and Chieti. The fact remains that the majority of small-medium municipalities remain excluded from the opportunity to participate in European funding and often even national funding: on this aspect, the Revolving Fund for Kyoto, announced by the former Minister Clini, should at least partially remedy this with 600 Million Euros of initial funding that should, after 2013, to be integrated with the market proceeds for carbon credits Ets, 400 million each year.

5 CONCLUSION

The trends already underway in the global climate scenario described by the IPCC reports do not allow us to assign the "fate of the planet" merely to policies for mitigation: by reducing emissions significantly, even within a few years, the first effects would be obtained in 40-50 years. Too many people expect results that would in any case not be very comforting when confronted with the anticipated benefits. As with any study that proposes to deal with a thematic area only weakly explored (such as the Covenant of mayors), some results are achieved while others require more time and a greater development to become comprehensive. Among the results which receive a broad consensus, as the great interest on the part of local governments toward the European initiative or the need to merely overcome the "limit" of mitigation policies, there is the need to understand, firstly how to extend participation to the rest of the non-participating municipalities and secondly, how to integrate adaptation policies to those already initiated for mitigation. As discussed in the previous paragraphs, in which a lack of experience and technical structures in addition to limited economic resources were stressed as the main problems related to the development and dissemination of the Covenant of mayors, both in Europe and in Italy, it seems only right to highlight how a third and more important motivation can enhance or adversely affect in the coming years the path towards the 2020 Pact: political support. In spite of the outcome and the political recognition at a local and a regional level, the Covenant of mayors has never received concrete political support at the national level. In order to optimize resources and efforts, as well as to implement the synergy of multi-level governance never actually fulfilled (but asked for by many), it is necessary for the national Government to officially confirm the strategic role of local authorities in the fight against climate change (Lumicisi 2013). Once political support is established at the national level, it will be necessary at that point that an appropriate national coordination structure be created in order to recognize the efforts and the work done so far, to communicate with the back-up structures which already exist and to provide support and assistance to municipalities which have not yet become signatories.

If in Italy mitigation policies have had a minimal national support (and not directly), those concerning adaptation to climate change still require an

appropriate focus at both national and local levels. The issues of adaptation and mitigation, even if closely related, are not often dealt with jointly; more accurately, adaptation policies need to be addressed nationally or at a macro regional level and must inevitably intersect with a lot of in-depth studies and analyses conducted at the local level (Musco, 2012). In order to achieve effective results from both a mitigation and an adaptation perspective, medium and long term plans and policies need to be supported in order to ensure a transition to a sustainable energy use and town planning adapted to the new climate scenarios. Strategies should be firmly anchored in local agendas, ensuring continuity even in the face of political-administrative changes allowing for the incorporation within existing planning tools of, in addition to specific measures to reduce risks, all the planning tools of voluntary nature such as the plan of Action for the Sustainable Energy sponsored by the Covenant of Mayors.

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Spanish Urban Planning and Energy: Challenges for the future

Beatriz Santos Sánchez

ABSTRACT

In Spain spatial planning and energy have never been treated together because energy has always depended on private sector without connection to urban planning.

In the last years the government has developed building rehabilitation policies with special influence in energy saving through economic aids and a new regulation with the requirement for solar panels to be fitted to new public buildings and dwellings to generate electricity for self-consumption, mainly hot water and heating.

However, these actions have not linked to urban planning which also needs to be adapted to new necessities. Keeping specific plots (areas) for energetic systems such as solar thermal or cogeneration plants, which means new urban land uses that allow new forms of urban energy production, developing new instruments like an energy urban plan or establishing a regulation of solar plates in roofs should be taken into account.

Moreover, our main urban planning instrument, the general plan of urban planning, has several limitations related to energy planning, the absence of alternative energies treatment or the lack of connection between planning and energy saving which is promoted through rehabilitation to improve the overall energy efficiency of the housing.

Therefore, the purpose of this paper is firstly to study these problems and later some pilot experience that has recently been presented considering the design (planning), cogeneration system (energy) and the finance (economy).

Key words: rehabilitation, energy, urban planning, sustainability

1 INTRODUCTION

During the past century, there has been a progressive and increasing growth of the cities which has raised large concentrations of population, consumption and emissions. This has caused lot of problems related to living in the city, such us the environment deterioration, traffic congestion or… which makes it necessary to define and implement several changes in the development and planning of our cities.

From the energy point of view, there is a long way to go and much to be done. Cities consume around 80% of the overall EU energy and half of the energy at world level so that the introduction of basic energetic requirements in the urban planning, as well as energy efficiency measures in the energy consumption of transport and buildings and in the management of resources, is an essential factor. In addition to all these issues, promoting the use of renewable energies on an urban scale is completely necessary.

However, in Spain spatial planning and energy have never been treated together because energy has always depended on private sector without connection to urban planning. Furthermore, electricity is not taken into account until the urban development project.

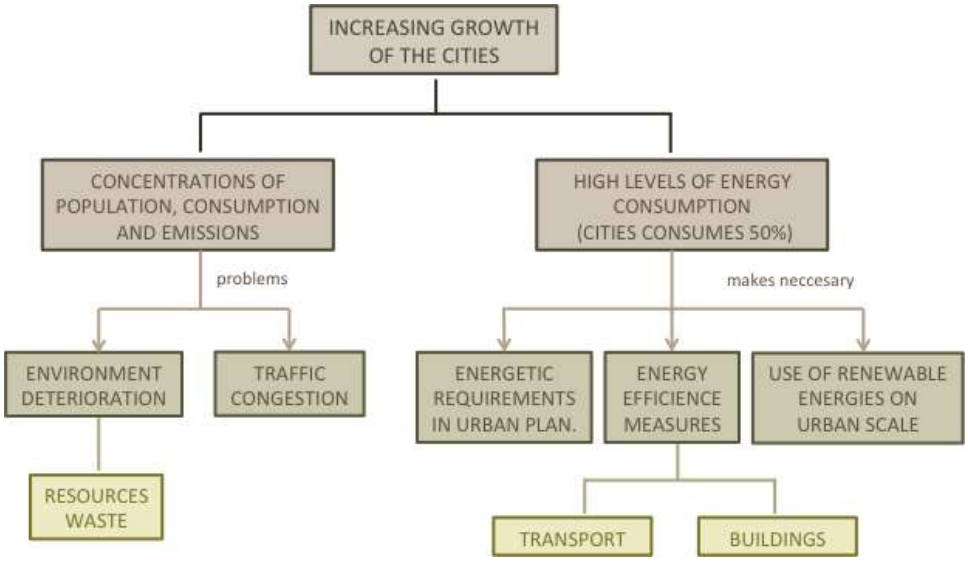


Fig 1. Problems caused by the cities growth

1.1 CURRENT LEGAL FRAMEWORK

In 2012 the EU approved The Energy Efficiency Directive (EED) which is the legislative result of the EEP that was published in March 2011. The new directive repeals the Cogeneration Directive (2004/8/EC) and the Energy End-Use Efficiency and Energy Services Directive (2006/32/EC). It is meant to fill the gap

between existing framework Directives and national/international measures on energy efficiency and the 2020 EU target for energy savings. It covers all sectors except transport, and includes, for the first time in an "energy efficiency" directive, measures for supply side efficiency.

Improving the energy performance of Europe's buildings is one of the priority areas for energy efficiency policy in the EU. Nearly 40% of final energy consumption is in houses, public and private offices, shops and other buildings. As the Commission's March 2011 Energy Efficiency Plan stated, "The greatest energy saving potential lies in buildings." The Plan further states: "A large energy saving potential remains untapped. Techniques exist to cut existing buildings' consumption by half or three quarters and to halve the energy consumption of typical appliances. But the renovation rate of buildings is too low, as is the uptake of the most efficient appliances. The barriers to energy efficiency buildings need to be overcome. The Commission invites Member States to establish promotion systems for private sector buildings."

The energy performance of buildings was also supported by elements of the Energy Efficiency Directive that promoted the renovation of public buildings and the development of long-term renovations strategies.

It also puts a major focus on targets and concerns specific energy savings: new buildings in the EU will have to consume 'nearly zero' energy and the energy will be 'to a very large extent' from renewable sources.

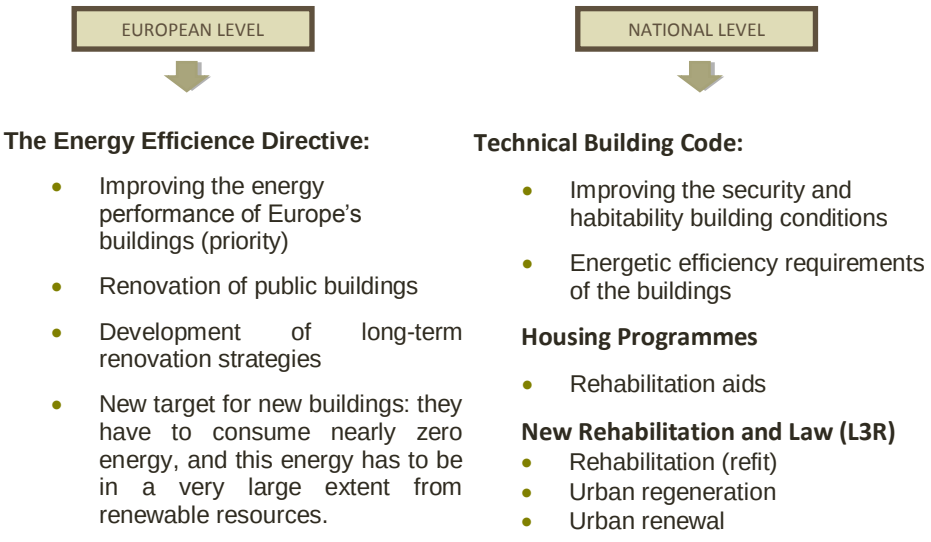


Fig 2. Legal framework in Europe and in Spain

1.2 PLANNING AND ENERGY IN SPAIN

Our main urban planning instrument, the general urban plan, has several limitations related to energy planning, the absence of alternative energies

treatment or the lack of connection between planning and energy saving which is promoted through rehabilitation to improve the overall energy efficiency of the housing.

Moreover it is necessary to review the specific areas zoning and the procedure to define rehabilitation and renovation areas.

During the last years the National and Regional Governments have promoted Rehabilitation projects at two different levels:

- Housing level: individual projects to improve the overall energy efficiency of the housing or the hability conditions.
- Neighbourhood level: collective projects to improve the overall energy efficiency of the installations; the accessibility conditions or/and install lifts in these blocks of dwellings.

2 PILOT PROJECTS OF REHABILITATION

2.1 URBAN REHABILITATION IN ZARAGOZA

The project is part of an economic concept of recycling and reuse, not only of the housing stock but also the urban fabric.

This program affects urban spaces and infrastructure very aged, that have a strong need of urban renewal and redevelopment.

The option of rehabilitating is in Zaragoza three times cheaper than building new buildings. And urban renewal of existing infrastructure is two times cheaper than the construction of new urban fabric.

This building has some singularities that should be explained to justify the constructive solution chosen for rehabilitation: the original brick fabric is very solid, has rigorous climatic conditions, limited living conditions, really poor thermal behaviour and poor individual heating facilities, heritage value of the whole, and the massive scale that arises the rehabilitation.

The scope of the rehabilitation is comprehensive and includes: the building facades, the improvement of its thermal envelope, the improvement of accessibility and the rearrangement of the facilities.

In general, this project only intervenes in common elements and form the outside of the houses, avoiding the movement of people living there, and in every moment in response to social and personal needs of the population.

Climate conditions

- Winter/Summer external temperatures
- Hard winds/ low fog and cloudyness
- High lightness and long period of sunlight
- Trend to worst summer conditions and smooth winter conditions (climate change).
- Good orientation of pilot building.

District description

These districts of 50's and 60's are basically urban areas with high compactness and density, good level of equipment and social cohesion. It shows lack of green areas and parking, low accessibility and bad thermal isolating in housing spaces and loss of urban functions because of the peripherical displacement (abandonment of commercial areas and traditional neighbourhood aging).

	Zaragoza (city)	"Las Fuentes" District	Girón Group
Population (1981_2006)	590.750 _ 660.895	50.713 _ 44.071	1.920 _ 1.438
Aging rate	17,50%	20,50%	33%
Homes without elevator		42,3%	100%
Unheated homes	17,7%	29,06%	81,52%

Table 1. Main characteristics of the district

Management

It must be highlighted the importance of ACRs (Areas of Complete Rehabilitation), the agreement between owners and administration and public agreement (at local, regional or central level of government).

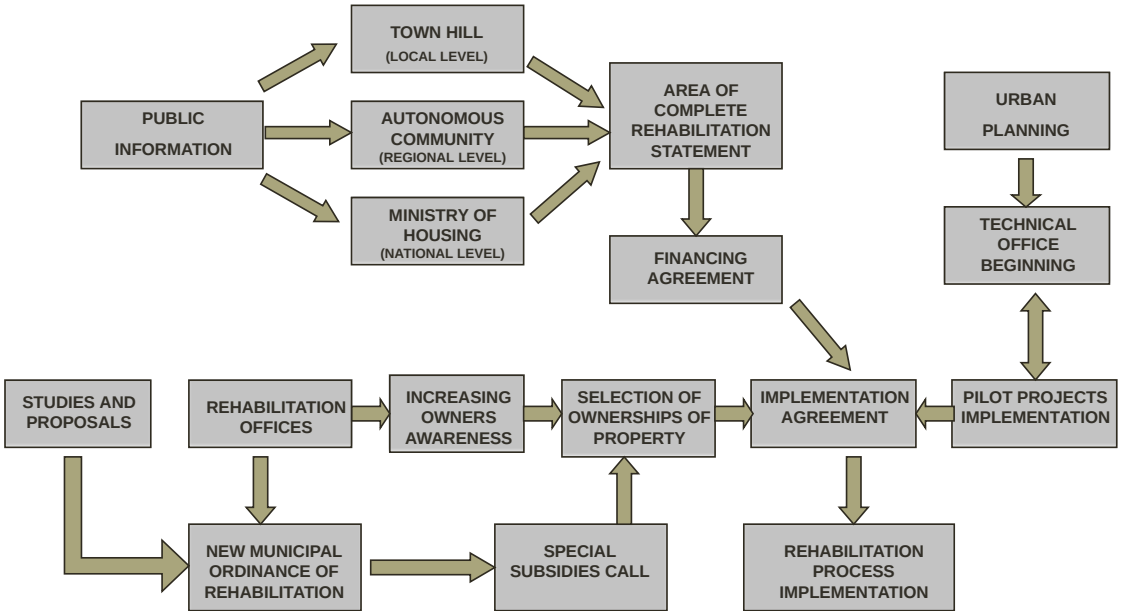


Fig 3. Complete process of management

Works included

- Elevator and new access
- Access to handicapped people and public green zone
- Tower of installations: a new heating and hot water installation was put up, solar support and independent heat-meter for each housing.
- Improvement of the surroundings: it is equipped with isolation in cover, façade and towers.

Fig 4.Public green zone and towers of installations

Fig 5. Final result

Energy saving and less consumption

The rehabilitation has been certified with the experimental program IAAE-CENER for existing buildings (the building comes from qualification type E (198 kg C02/m2) to qualification type B (14,1 kg CO2/m2) after rehabilitation.

For equal conditions of comfort, heating consumption goes from 100 (before) to 26 (after rehabilitation) in winter and from 100 to 37 in summer.

The consumption of warm water goes from 100 (before) to 38 (after rehabilitation).

	Percentage	Saving
BUILDING ENVELOPE (global) • Cover • Façade • Cavities	40.95% 8,70% 29,20% 38,95%	59,05% 91,30% 70,80% 61,05%
HEATING	63,83%	36,17%
SOLAR CONTRIBUTION TO HOT WATER PRODUCTION	38%	62%

Table 2. Energy saving rates

Costs of rehabilitation

The costs of works were 38.000 €/ apartment; the total works including urbanization, project and management was 43.000 €/ apartment and the average aid was of 75%.

AVERAGE COST PER DWELLING	OWNER CONTRIBUTION		ESTIMATED GRANTS			
			ZARAGOZA TOWN HILL		DWELLING MINISTERY AUTONOMOUS COMMUNITY	
	%	€	%	€	%	€
44.000	30,45	13.400	42,04	18.500	27,50	12.100

Table 3. Rehabilitation costs average

2.2 URBAN REHABILITATION IN TUDELA

The project consists of a building renovation of 8 Neighbours Communities with 122 dwellings throughout an energy efficiency project, which incorporates isolation solutions, and also the integral renovation of the heating system that includes the renewable energies use (biomass) and concerns 486 dwellings.

The intervention in this borough is accompanied by a re-urbanisation project of the area in order to renovate the water supply nets and pavements.

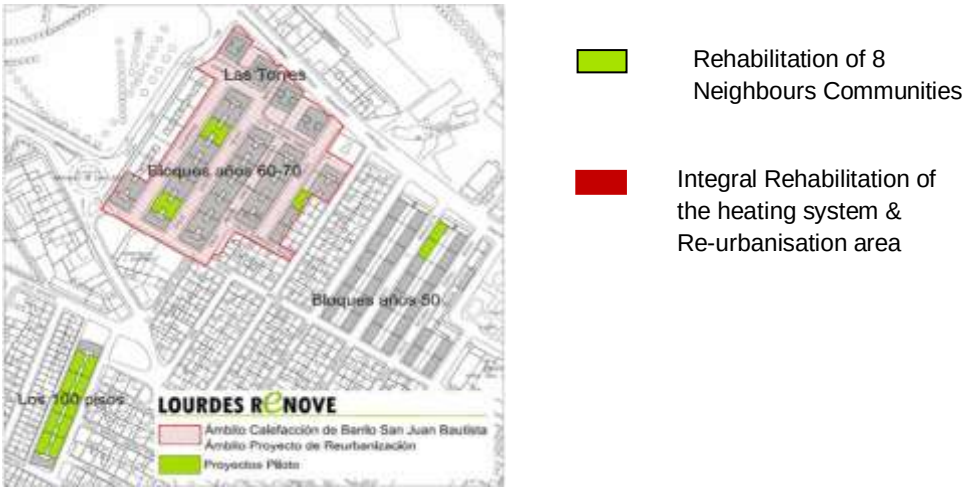


Fig 6. Site location plan

Relation of works:

BUILDING ENVELOPE	Cover	Replacement of tiles, gutters and downspouts
	Facades	Exterior isolation of the facades panels and cavities
	Healthiness	Relocation of chimneys
	Sanitary system	Complete replacement of downspouts, separated system of storm and faecal drains
	Water supply	Renovation of water scoring
	Electricity	Renovation of individual branches
	Telecommunications	Scoring down to dwellings and relocation of directional antennas
	Fire	Installation of fire protection and emergency lighting
ACCESIBILITY	Horizontal	Access to handicapped people
	Vertical	Elevators

Dwelling blocks of the 50's

The project includes the rehabilitation of building facades, the improvement of its thermal envelope, the isolation of the backgrounds, the improvement of accessibility and the re-planning of the interior courtyards. The budget of this work comes to 140.494 €.

Fig 7. Previous state and final result these blocks

Dwelling blocks of the 60's-70's

The intervention permits the rehabilitation of the common elements of the access area including facades, covers, the renovation of common installations, the implementation of new services and the construction of lifts for each vestibule. The budget of this work comes to 744.080 €.

Heating System

It sets out the integral renovation of the heating system that supplies 486 dwellings. With this transformation it will become in a milestone of the Energy Efficiency in Navarra and Spain because it will produce the majority of the demanded energy with a renewable source and also it will have systems to get the individual consume and demand that will allow an important energy saving.

The new boilers room Works with a new renewable energy source, biomass, from which it will be produced the 80% of the demanded energy. Furthermore, in the old boilers room three new gas boilers will be installed, they will have an energy power of 1600kw, enough to provide heating service to all the dwellings in case of a biomass supply fail. But in practice it only contributes 20% to the circuit.

It needed to find a place for the energy production (biomass) and design the general supply networks that cross the public space so it has to be coordinated with the re-urbanization project and also find the space to place the new uprights and the individual metering

The total budget for heating system renovations comes to 2.757.287€ and the subsidies reach the 62% of the investment (between the Town Hill, the Innovation Department of the Autonomous Community and the E.U.)

Re-urbanization project

- Recover the space for the pedestrians
- Inclusion of green areas
- Removal architectural barriers
- Measures of energy saving (new street ligtening designed with energy effficency measures)

Advantages of the energetic rehabilitation

Economics

- Job creation higher and more qualified than in new construction.
- Tax relief (income tax return).
- Efficiency in the infrastructure and service public waste

Social

- Improvement of the quality life of the owners (accessibility, thermal confort)
- Civic identity
- Social breakdown prevention

Environmental

- Reduce energetic consumes
- Reduces CO2 emissions
- Rational land use
- Not generate mobility

3 POSIBLE PROPOSALS

New measures in urban planning and in the design of buildings, promoting the efficient installations and the use of renewable energies, will be required to reach

these targets. Town and city planning is a great opportunity to introduce interventions to ensure the balance.

But the architectural design has also an influence on the energetic consumes of the buildings. Therefore, the shape (which could be adapted to the climate conditions), the orientation and interior distribution, sun screens, the isolation and ventilation should be take into account.

Another challenge will be achieving energy efficient installations as well-designed and efficient installations with a good maintenance can save up to the 50% of energy, so that we have to continue investigating new solutions of sustainable buildings.

By the other hand, apart from being consumers of energy, cities can also be producers. An important part of the global consumption of the city could be satisfied through solar energy (use solar thermal panels to provide hot water for sanitary use and heating), photovoltaic solar energy and biomass.

In the last years, the government has developed building rehabilitation policies with special influence in energy saving through economic aids and a new regulation with the requirement for solar panels to be fitted to new public buildings and dwellings to generate electricity for self-consumption, mainly hot water and heating.

However, these actions have not linked to urban planning which also needs to be adapted to new necessities. In addition, except in specific cases, there has not been faced the regulation or the organized management of rehabilitation and urban regeneration, the global intervention on the exiting city to recover the urban fabric as a whole.

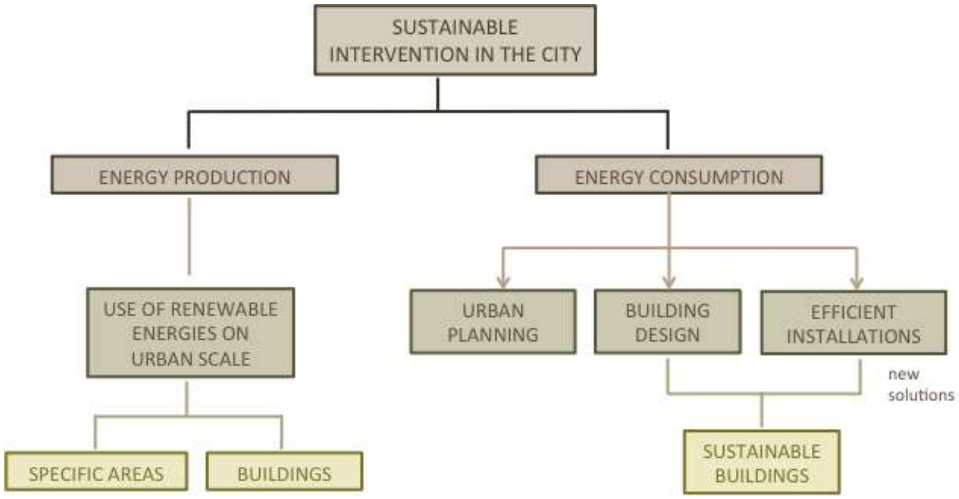


Fig 8. Energy in cities: planning and construction

3.1 USING THE URBAN LAND AS A RESOURCE

Due to the current situation, is not possible to continue with the develop of new urban areas, we have to work in the urban built environment: rehabilitate, rebuild or reuse. It comprises three different parts:

1. Control the urban sprawl

   It is the most difficult one because there are thousands of low-density hectares, urbanized in a fragmented form that depend on transport for people, food and energy and is not possible to maintain.

2. Intervention in the city center

   It also comprises two types of actions: the ones that try to recover the public space (urban regeneration) and the ones that improve the building conditions (buildings rehabilitation).

3. New constructions with sustainability criteria.

   New developments need a proper planning through these points:

   - A structural street grid responsive to wind and sun exposure conditions (hierarchy and transversal section).
   - Streets adapted to topography seeking out the best direction.
   - Public and green areas geared to the real needs of humidity and evaporation.
   - Building types adequate to the specific climate conditions of the place.

Rehabilitation of *the existing city*

The rehabilitation of the existing city is a complex and comprehensive process that requires a wide study:

a) Define the area of the intervention and identify its problems.

In relation to the city or urban centre, what is already consolidated, there are important and different problems that have to be treated.

The first one deals with urban renewal, in some areas (usually neighbourhoods located on the outskirts) it could be necessary to demolish and rebuild with sustainability criteria. It concerns very complex interventions which require an exhaustive study of their planners and managers.

The second one corresponds to the interventions relating to improve the quality of the urban and public space. Nowadays, the urban environment is understood like an extension of the private space so that the refit of a dwelling or an office building couldn't finish in the entrance gates.

The third one refers to the rehabilitation of the existing buildings. It is absolutely necessary improving their habitability conditions and this adaptation has to fulfill an essential new requirement: the efficiency. That

is, buildings have to be rehabilitated with effectiveness (to provide a modern quality life) but they have to get that efficiently: with the lower consumption of energy and causing the lower pollution.

b) Rehabilitation programming

A proper regulation about rehabilitation is essential, but it still remains a rehabilitation programming, based in the definition of long-term objectives and measures to achieve them which have to be framed under several policy-makers in a balanced way. Rehabilitation should be much more than a set of actions, it has to bear the strategic planning, in medium and long-term, of the sustainable intervention of the city.

c) Flexibility in renewal and retrofit actions

One of the most important issues of the renewal and retrofit actions is the funding by the property owners because in general, they pay it with their savings or if it is not possible through short-term individual loans with banks and financial institutions (if they grant it). And sometimes that amount can be very high, for example in Saragossa, the cost per dwelling ranges from 27.000 € to 55.000 €.

The new law of rehabilitation (L3R) has tried to introduce more flexibility in the management of the rehabilitation, renovation and regeneration interventions giving standing to communities and neighborhood associations, regulating their funding adding fractional credits and specific ways of inter-administrative cooperation.

So far, other possible sources of funding for the owners have not been explored. That could be the capitalization in advance of the energy bill savings or the economic resources of the photovoltaic energy sale to the National Grid.

3.2 DEVELOPING NEW INSTRUMENTS

It is also necessary to develop new instruments that link energy with urban planning. These new plans can be implemented at different levels, but the mayor developments should include them.

a) Sustainable mobility urban plans

This plan is a set of actions which aim is the establishment of different ways of movement more sustainable (walking, cycling and public transport) inside a city; that is, modes of transport that make compatible the economic growth, social cohesion and the conservation of the environment, ensuring a better quality of life.

The development of this plan requires a methodology of participation, information and education from the Local Authorities; a detailed analysis of the initial situation and the proposals, a progressive introduction of the measures with evaluation of the results and also organisation of pilot experiences.

Main characteristics:

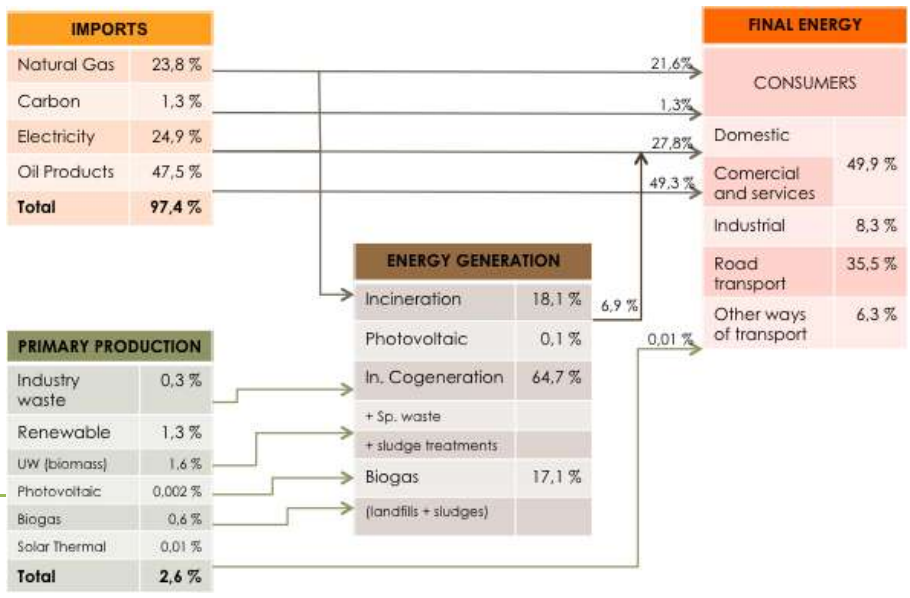
- They operate on a local or metropolitan level.
- They ensure the accessibility and the mobility needs of the municipalities.
- They cover all the modes of transport for people and goods.
- They are link to/ connected with local, regional and national plans or strategies.
- They must reduce the negative impacts of transport.
- They try to solve the increasing volumes of traffic
- They pretend to change the modal shifts of travel to environmentally friendly transport modes.
- Raise the urban planning taking into account the mobility and accessibility criteria generated by the different centres and activity areas.

Revenues generated with these plans:

- Reduction of traffic jumps and congestion impacts: noise, pollution, accidents…
- Reduction of non-renewable energy consumption.
- Improvement of public transport services.
- Improvement of accessibility conditions for everybody, including handicapped people.
- Improvement of the quality of the urban environment and the quality of life of the citizens.

b) Energy urban plans

Oil products and natural gas mean more than 70% of the energy consume of the Spanish cities. Residential, commercial and service sector consume more than 50% of the total energy. The second consumer in the city is the transport sector which can reach the 35%.



Energy balance scheme of Madrid

To develop an Energy Urban Plan an Energy Balance is necessary because we need to have information about the sources and uses of the energy imported, transformed, generated and consumed in the town, city or region.

The Plan should have four sections with these aspects:

- Energy imports and distribution
  - Provision of alternative and cleaner resources.
  - Efficient distribution energy systems.
- Energy generation and renewable energy
  - Energy deriving from waste.
  - Renewable energy and cogeneration in buildings and installations.
  - Exploration and development of subsurface.
- Final energy consumption
  - Energy efficiency in private buildings, planning and public space.
  - Energy efficiency in public buildings and equipments.
  - Energy efficiency in mobility and transport.
- Climate-change adaptation measures.
  - Sustainable management of water resources
  - Green spaces

The first part will identify the needs for improvement in the supply networks and promote the development of a distribution and supply network of alternative energies for the transport (in response to new requirements of alternative fuels in urban areas). It also could study the use of high efficiency grids of heat and cold that can incorporate the cogeneration, and smart grids (electricity).

The second part will study the possibilities of generating energy from waste (recycling yards and new installations for biomethanation, composting and energy recovery) and will identify the adequate buildings for the implementation of cogeneration systems and the opportunities to install solar panels in existing buildings.

The third part will study three important issues: private buildings and public space which includes the building rehabilitation (envelope and installations) and the renewal of the degraded public spaces; public buildings (investment in energy saving and efficiency) and mobility and transport which includes measures to reduce the use of private vehicles, promoting non-mechanised ways of transport (cycling and walking) and reducing the energetic consume of the vehicles.

c) Other measures

New forms of urban energy production should be studied with a revision of land uses, because although is not an instrument in itself, land uses are an essential part of the urban planning and new possibilities related to energy could be developed.

Keeping specific plots (areas) for energetic systems such as solar thermal or cogeneration plants, which means new urban land uses that allow new forms of urban energy production should be included in planning instruments.

4 CONCLUSIONS

In Spain public and private action on the city has focused on urban expansion, giving priority to the building of new plant. In the last years, this has changed and public aids and programmes have tried to promote the intervention in the city and the existing buildings. The works of rehabilitation usually have been performed in the homeownership by providing minimum conditions of useful surface or improving its distribution, facilites, energy consumption, lighting, ventilation, or on common elements of the property in ways that improve the safety, sealing, accessibility and energy efficiency.

Moreover, except in specific cases, there has not been faced the regulation or the management of rehabilitation and urban regeneration, so there is still too much to do.

Firstly, urban planning has to be adapted to energetic requirements which means developing new tools such us:

- New instruments: an Energy Urban Plan should be necessary in medium and big cities to identify important issues such us the adequate buildings for the implementation of cogeneration systems, the opportunities to install solar panels in existing buildings, the urban areas to renewal the degraded public areas or mobility and transport which includes measures to reduce the use of private vehicles, promoting non-mechanised ways of transport (cycling and walking) and reducing the energetic consume of the vehicles.
- New land uses: New forms of urban energy production should be studied with a revision of land uses because new possibilities related to energy could be developed. Keeping specific plots (areas) for energetic systems such as solar thermal or cogeneration plants, which means new urban land uses that allow new forms of urban energy production should be included in planning instruments.

- New criteria: New developments need a proper planning through these points based on sustainability and renewable energies.

Secondly, a comprehensive study of the urban areas is necessary to:

- Define the regeneration and rehabilitation areas.
- Develop the rehabilitation programme with the long-term objetives and measures to achieve them: select the priority areas of intervention.

Finally, other possible sources of funding for the owners has to be explored to allow the development of more rehabilitation projects.

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The Eco-town: A New Vision towards Sustainability

Nuha Eltinay

ABSTRACT

The historical development of Utopian town planning in the United Kingdom has long been observed to introduce better democratic, environmentally balanced living standards. This study will examine the application of the compact city decentralized and centralized forms on the housing scheme and transportation patterns of the Eco town model within the British context.

An Eco-town development framework is based on the application of sustainable spatial planning strategies, and green urban design policies. In 2009, large opposition protests of local community campaigns and environmental agencies, arose against the new O&H Marston Vale Eco town proposal. This proposition enforced urban sprawl over the Vale greenfield lands, eliminated it's strategic location, diverse topography and distinctive environmental characters.

Accordingly, this project persuades filling the gaps in the local planning system and improving the Vale's public realm, incorporating the natural woodlands, wetlands and open spaces as ecological stratagems of the design scheme. Aiming to contribute into the rise of ecological footprint levels, and demand on affordable housing units, this study will formulate a green living agenda serving both investor profits and community demands. This project will investigate housing environmental control technologies within the frame of urban design theories and the Eco-town governmental planning policies, in order to shape sustainable demographic models of urbanization rates, to perform better infrastructural services, green travel modes, and energy consumption patterns. This can be achieved with the application of zero housing simulation model, which facilitates testing the utilization of green spatial planning transportation modes, and investigate the constructional application of environmental passive technologies, to support decision-making about building lifecycle, materials, and performance from feasibility programming, through conceptual design and final, manufacturing stages. Eco-town model performance analysis will setup the design guidelines to achieve the required zero carbon housing design principles, and city scale sustainable living outcomes.

1 INTRODUCTION

The historical development of the Utopian town planning in the United Kingdom has long been observed to introduce better democratic-environmentally balanced living standards. This study will examine the application of the compact city decentralized and centralized city forms on the urban transportation patterns and green housing performance of the Eco town model in the British context.

An Eco-town development framework is based on the application of sustainable spatial planning strategies and green urban design, energy consumption paradigms. In 2009, large protests, opposition of local community campaigns, and environmental agencies arose against the new O&H Marston Vale Eco town proposal. The proposed planning strategies, all conflict with the Vale strategic location, diverse topography and distinctive environmental characters.

Accordingly, this project persuade filling the gaps in the planning system and improve the Vale public realm, incorporating the natural woodlands, wetlands and open spaces as ecological stratagems of the design scheme, aiming to contribute into the rise of the ecological footprint levels, demand on affordable housing units, creating sustainable proposal that will serve both investor profits and community demands.

This project will investigate housing environmental control technologies within the context of urban form theories and the Eco-town governmental Green design principles, in order to shape sustainable demographic models of urbanization rates, to perform better infrastructural services, green travel modes, and energy consumption patterns. This can be achieved with the application of an zero housing simulation model, which facilitates testing the utilization of Green spatial planning strategies, and investigate the constructional application of environmental passive technologies, to support decision-making about a building lifecycle, materials, design scheme and performance from feasibility programming, through conceptual design and final planning stages.

1.1 THE STUDY AREA- Design Problem

The Marston vale lies in the centre of three administrative areas Bedfordshire County Council, Bedford Borough Council, and Mid-Bedfordshire District Council. For several years Marston Vale was used to mine Oxford Clay as a resource for brickworks. The ecological consumption for natural landscape, created a huge damage for the site typology.

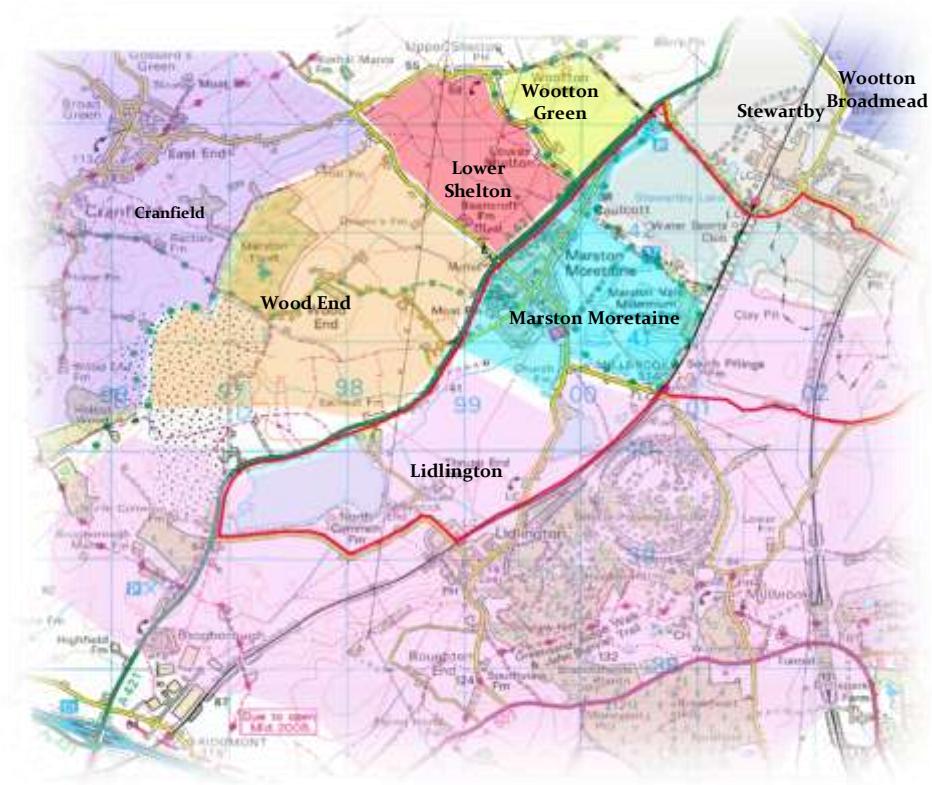
In Bedford Borough, an overlap existed between the planning schemes of two property management and development companies, the O&H properties and Gallagher, were the options the government opted for; an Eco town proposal in the Marston Vale and New Marston starting by 2021.Both proposals were rejected by the local community stakeholders, but the O&H appraisal was mostly criticised by the Lidllington and Marston Action Groups, at different levels. They believe that the urban expansion of developments along the areas of Brogborough, Lidllington, Millbrook, Marston Moretaine, Stewartby and Kempston

Hardwick, would destroy the village life of local communities and the wildlife of natural habitats, plants and aquatic life in the lakes. In view that this will enforce urban living on over two thousand people with the sprawl of houses all the way to Bedford. They also considered the O&H Eco-town to be an “irreversible development on green-field land”. The proposal covers 90% of the area Greenfield lands, and this will cause the loss of local farming and jobs and erosion of village communities” MMETAG (1).

1.2 THE STUDY AREA-Socio-economic Characters

Taking into account the ARUP consultants (Regional scale settlement study), the government has set an overarching growth agenda, which considers both, the development growth points in the East of England region, and the adjoining growth areas, this will help evaluate the impact of the Marston vale urban expansion on the East of England regional development “Relationships with adjacent regions would potentially have a beneficial impact on the ability of an area to support the development of a regional scale settlement”. (ARUP, 2009,p.16)

Fig 1.*Regional Districts- Spatial Analysis*



While the East of England does not have a Core City, choosing the Eco town location close to Bedford, one on the Country’s twenty-one key centres for development and change, will reinforce the region polycentric network.This strategic location, proximity to the urban centers, and high quality of Landscape character, encourages strong levels of population growth over the last decades.

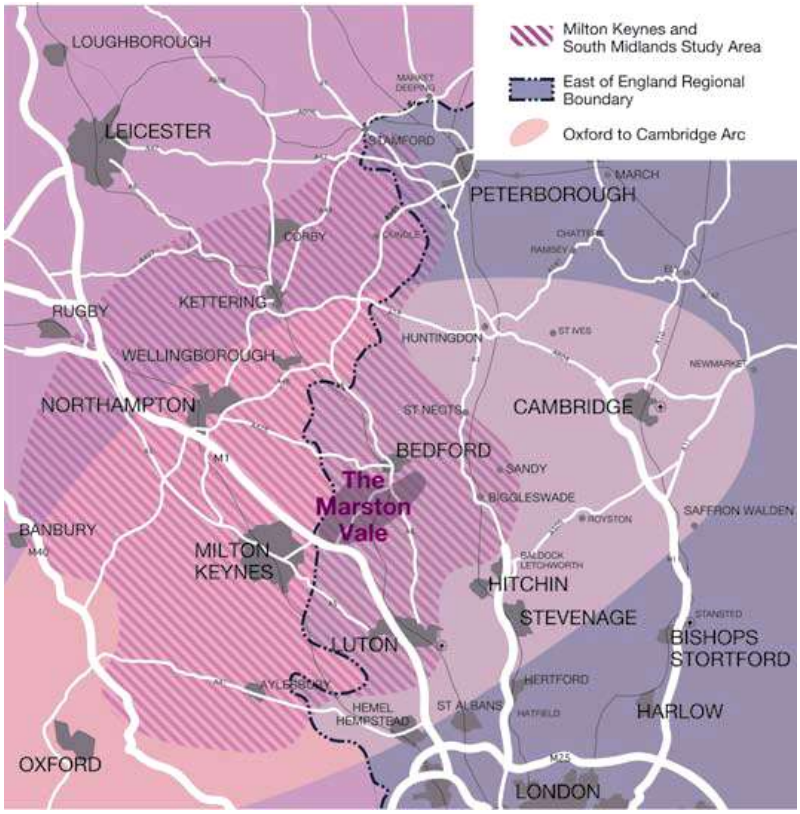


Fig 2.*Engines of Growth-Source: O&H Marston Vale Eco-town Bid*

The rate of job creation over this period has not match the population demographic changes, leading to increasing number of local residents, with lack of employment opportunities. At the regional level, employment deprivation levels vary between 20%-60%. This witnesses a strong economic performance and high deprivation levels. The rural inequality in the adults' educational attainment levels ranges between 24-36% reflecting the high deprivation rates. The creation of new educational and scientific organizations will insure the rise in employment levels and numbers of skilled workers

While at the local level, residents commute to the surrounding growth points (London, Luton, Milton Keynes and Bedford) for regional employment opportunities. While, the brickworks, Cranfield University, the Forest Centre, local garage, shops and schools are considered to be Marston Vale local employment hubs.

With regard to the Mid Bedfordshire Character Assessment study (3), and landscape designation outcomes, the study area is considered to be a part of Marston Vale Community Forest, one of England's twelve community forests. This emphasize on the role of the new Eco town form in preserving the exiting natural features and improving access to heritage trails, sidewalks and recreational activities. This will broaden the local community social networks across the neighbourhood boundaries.

The economical footprint of growth engines will expand beyond the Eco-town boundaries, to have a distinct impact on the surrounding areas. A new Urban Centre will strengthen the existing urban hierarchy and overcome the existing settlements constrains. Bedford for example is one of the regions designated areas suffering from lack of social housing units and access to social infrastructure. Meeting the local needs for affordable housing is essential to reach the region's identified need for 11,000 homes per year.

2 THE ECO TOWN

2.1 THE ECO TOWN- Definition

The Eco town concept has been defined by the Town and Country planning Association to be, "Small new towns of at least 5-20,000 homes. They are intended to exploit the potential to create a complete new settlement, to achieve zero carbon development and more sustainable living, using the best new design and architecture". (TCPA and David Lock, 2007).

In order to consider the new Eco town as a fundamental need to tackle the climate change problems and create the ideal vision for sustainable communities, examining the impact of the existing proposals on the area, is important to build upon existing design opportunities and avoid the constraints in future planning strategies. The understanding of the relationships between the study area and the surrounding neighbourhoods (topography, settlement patterns and developments in human activities) will identify the site townscape typology and landscape visual character.

2.2 THE ECO TOWN- Legislative and Planning Policy Context

According to the Eco town planning policy statement, the government produces the national PPS/G series, based on the European environmental standards, which defer from the existing planning legislations and create higher Eco town development standards. The government's planning policies (4), and the proposed Eco town development will deliver potential benefits in the following significant areas:

Energy: Minimise the annual energy consumption levels and maximise energy efficiency, by using waste heat from the surrounding power stations.

Promote renewable energy sources (CHP plants, PVC Panels, Wind turbines, and biomass fuel from planting and harvesting surrounding woodlands).

Water: Protect the existing water surfaces, and improve the wildlife. Encourage the sustainable behaviour against water use. Improve the urban drainage and protect from flash flooding risks.

All eco-towns must comply with national planning policies, except where we have set a standard which is either more specific, or is more stretching, than that set out in wider national planning policy. These include:
The delivery overall, of sustainable development **(PPS1)**
Requirements to build developments which help secure reductions in carbon emissions and are resilient to a changing climate, for instance to take account of landform, layout, building orientation, massing, avoidance of solar gain in the summer **(PPS1)** supplement on climate change) – and to take account of the risk of flooding **(PPS25).**
Requirements on local renewable and low carbon energy generation **(PPS1)** supplement on climate change
The provision of sustainable waste management **(PPS10)**
The provision of open space, sport and recreation, se out in **(PPG17)** – which incudes green space, space for allotments, children's play areas etc.
The protection, conservation and enhancement of our biodiversity and geological conservation **(PPS9)**
The role of planning in controlling pollution (including air and water quality and land affected by contamination **(PPS23)**
Requirements relevant to coastal planning **(PPG20)** and planning for sustainable development in rural areas **(PPS7)**

Table 1. Resource: Draft Planning Policy Statement: Eco towns Consultation, Communities and Local Government, P.4

Materials: The use of locally produced materials to provide new job opportunities. Encourage the recycling of construction materials, and provide materials from sustainably managed sources.

Waste: Provide an efficient storage, collection, and sorting on site system. The use of underground system for waste collectors.

Transport: Provide walk-able neighbourhoods, where mixed use services are available within the local catchment areas. Introduce well connected to key destinations and local supply networks, and provide the mode of choice, ranging from green routes, bus priority schemes, car clubs and free public transport. Discourage the car use for short journeys, by variable charging and remote parking schemes.

Food: Provide allotment spaces to encourage individual food production. Integrate green roofs into buildings design layouts.

Public Space: Adapt the public spaces layouts and size, to meet the different uses and densities. Secure by Design and accommodate the needs of cycling, pedestrians and public transport.

Green infrastructure: Provide green spaces to reduce the urban heat island, buffering protected conservation areas and networks for wildlife habitats.

3 LITERATURE REVIEW

3.1 O&H Marston Vale Eco-town Bid DESIGN BRIEF

Being short listed by the department of Communities and Local Government as one of the Eco towns 15 designated locations, the O&H Eco town bid promotes a number of 15,400 new settlements, in advantage of the landownership of 1,513 hectares of the Marston Vale land and water surfaces.

Looking into the distribution of new developments along the O&H Master planning proposal in relation to the landownership, reflects the significant impact of the economic gain and investment factors on the conceptual land use scheme. The dispersed Eco town form follows the landownership strategy, without taking into account the impact of transforming green field land on the Vale ecological balance and natural biodiversity. The fragmentation of activities generates longer travel journeys that would maximize the car ownership levels, increase the pressure on existing roads capacity, and contradict with the Eco town environmental planning objects and sustainable living principles.

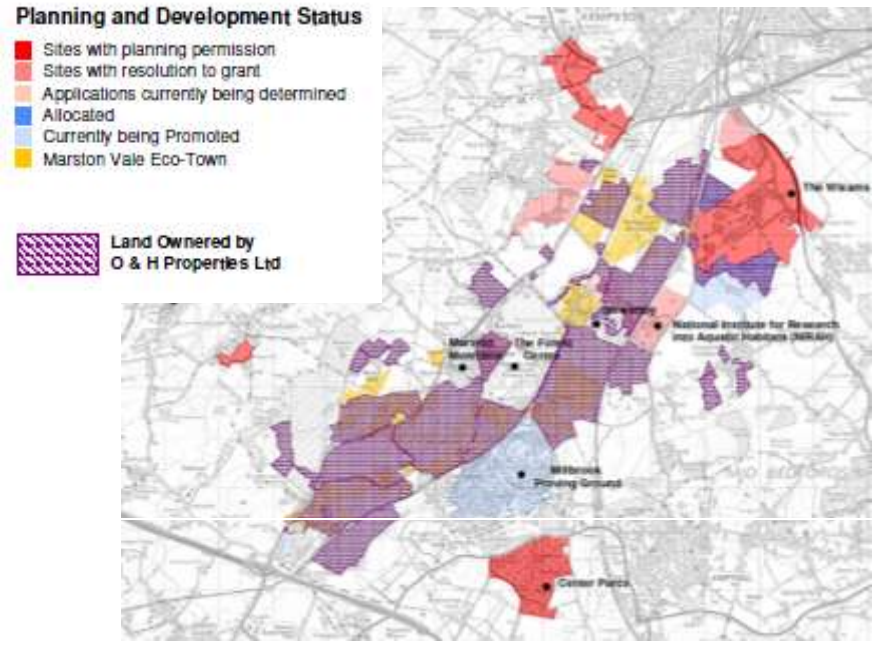


Fig 3.*Planning and Development Status - Map by David Lock Associations*

3.2 O&H Marston Vale Eco-town Bid EVALUATION

SOCIOECONOMICS	ENERGY EFFICIENCY
The sprawl over 90% of the Greenfields surrounding Lidllington. This covers an entire farm that has been operating for around 120 years. The replacement of farmlands with new developments will cost the loss of great number of farm jobs. This is not replaced with local employment opportunities	The proposed energy from waste plant will push the heat out to surrounding developments. Passing this heat for more than two kilometres is not viable.
The design project will propose new planning strategies to serve both investors profits and community demands, it will also insure the balance between the built up area and the Greenfield, to reduce the loss of farming jobs and provide the	The use of different types of renewable energy sources will cover the financial expenses for improving local infrastructures and expanding
MOVEMENT AND TRANSPORT NETWORK	**URBAN FORM AND POLICY CONTEXT**
• The Newly developed A421, is heavily utilized at stretched capacity, and is not able to cope with proposal additional demand. • A new trunk road is proposed to come along the bottom of the valley, through the Greenfields to NIRAH and Wixams developments. This road will be heavily utilised by traffic coming in and out the proposed Eco-town for jobs in Milton Keynes and Bedford, and commuting down to London.	• The O&H have proposed building 9,000 new homes, 2000 will be affordable houses. This is below the government's request of 30-50%. • Most of the dwellings are normal houses and eight storey height flats. No consideration for the government requirements for big family houses.
Regenerate the existing settlements and enhance their eco-credentials, by creating green rapid public transport routes through Marston Vale and improve the existing trails, and waterways helping to connect local communities with green links to Bedford and Milton Keynes.	The manufacturing of bricks worsens the landscape topography. The Millennium centre efforts to develop the forest of Marston Vale, together with the proposal of new Eco-town will help regenerate former industrial sites, and insure social equity with the provision of balanced mix of density, tenure, and provide more affordable housing

Table 2.*Case Study Evaluation: O&H Marston Vale Eco Town Bid*

4 SUSTAINABLE DEVELOPMENTS– Urban Design Guidelines

4.1 Sustainable Urban Form- CONTEXT AND BACKGROUND

The sustainable urban form challenge circulates around the compact city debate. The compact city forms a mixed use, and highly dense city core. This represents a sustainable energy consumption structure, where travel patterns to employment and public facilities depends on public transport within walk-able neighbourhoods. Theoretical contradictions against the compact city favour the integration of green spaces into the urban fringe, the decrease of transport congestion and the downsize of settlement density will to impart the social and environmental equity for all natural habitats. In order to reach a conclusion of the dispersal versus concentration contest, eliciting the city form development history, might be useful to form the guidelines for the eco town design framework.

The Urban Utopia-British town Planning Challenge *(fig. 4 in the Annexes)*

With the evolution of the British modern town planning action in the 19th century, the utopian living concept was extremely fostered by early planners to liberate the city from the industrial urbanisation legacy. These movements emerged the Garden City Utopia. A proposal of low density residential villages, surrounded with green belts in the rural countryside, and connected with a network of highways.

The transformation to this urban form was first applied by Ebenezer Howard, as a solution to escape from the environmental and social deprivation of life in London city in early 1898. Then this model was developed by Frank Lloyd Wright in 1934 to create the decentralized Garden City, named “Broadacres” (Dantzing and Satty, 1973), which comprises the integration of farming lands and agricultural activities into the residential cores to provide independent employment and living qualities.

Through the twentieth century, the Garden city decentralization model was deeply rooted into the British Town Planning principles by Raymond Unwin’s cottage architectural approach. The Garden city concept also flourished to create the Satellite city, which is an urban structure that comprise of number of small Garden cities. All are well connected to a central large city. The primary commercial and employment activities are concentrated in the city core, providing a mixed use high density residential zone. While the low density residential units and secondary services and available in the satellite towns, providing the opportunity of the expansion of new developments.

To refer back to the question that which urban development form is more sustainable, the theoretical arguments between the decentralized and the compact city generated intervening combinations of urban forms, that interrelate to the compact city energy efficiency strategies, and the desterilized city livelihoods.

The literature review draws on the history of the city form and compact models, in order to generate the basis of the design problem, formulate and evaluate the design concepts against this knowledge. The assumptions built upon this data, conclude that for the first glance, Marston vale urban form reflects the image of decentralized, low density rural settlements, with a balanced and self-sufficient organic system, which establishes their own eco villages character. Although, the rural housing market pressures and employment needs, have emerged social equity problems, and increased the travel demands to the surrounding urban centres.

Thus, the Marston Vale eco town proposal will create a model of a compact mixed use, high density centre that links between their rural villages, Marston Moartaine, Stewartby and Lildlington to reduce the energy consumption levels and achieve better environmental, social and economic living standards. This model will combine the compact city urban core character, and the village ecological life style to form the Marston Vale eco town.

4.2 Sustainable Urban Form-DESIGN BRIEF

Sustainable development is associated with the environmental impact of resource consumption in three major sectors, transport, housing and food. According to the Oslo region study, the utilization of natural resources is dominated by “private household consumption” at a level of 80 %(8). This integration on new technologies into the housing industry is essential to reach the aimed zero carbon levels.

Empirical and theoretical studies reported the differences in household energy consumption patterns between single families, multi family, and detached housing units. The period before 1980s witnessed the deficiency of energy saving in single-family housing. While in the last two decades, the difference in energy consumption has decreased to reach 20%. *(Fig 5 in the Annexes*).

This reflects the high impact of new technologies (Triple glazing, air thigh construction, high insulation material), and the delivery of energy saving methods on the general performance of housing units. The rise in environmental awareness and sustainable behaviour among individual residents per household also has a wide impact of the ecological bill. Accordingly, the weight of evidence would suggest that the coalescence between the compact city single housing models, and the decentralised city family housing units can be economically and environmentally workable to achieve zero carbon levels.(Holden and Norland, 2005). (8)

A further study worthy to consideration by Williams (Williams et al, 2000) asserts that “the possible impacts of urban forms are not limited to travel behaviors, the built form also influences social conditions, economic issues, environmental quality and ecology within the city” (Cited in Holden and Norland, 2005). Thus, this research emphasizes on improving the environmental quality of urban forms,

the provision of different types of housing units, will insure social equity, and reduce the significance of household consumption on the built environment.

***Table 3**. Environmental Control Comparison-Existing and New*

Environmental Control Measures	**Existing Housing (RETROFIT)** **"Greening the Box"** Sustainable Ecological Architecture Ltd	**New Housing (ZERO carbon)** **"Code for Sustainable Homes"** Planning Portal-Communities and Local Government
Goals	• Reduce heat-loss • Heating load halved • Mitigate carbon emissions by four tones a year	• Identify different ways of achieving up to Code level five. • Cover a range of building types, including:Detached and terraced homes, Flats and apartments and Live-work units
The Envelop (Insulation Materials)	• Increase the R Value: existing 9in external walls to be clad with extra 100mm of extruded polystyrene insulation • Thermal mass: Super insulated structure with dense concrete ground, delay heat release for three months	• Timber frame with (cavity wall of concrete external block and insulating internal block/ pre-fabricated solid cross timber laminated panels and external insulation) • Wall U-values ranging from 0.10 W/m2 K to 0.29 W/m2
The Envelop (Glazing and Daylighting)	• All windows refitted into high efficiency double-glazing • Window size: reduce the size of north oriented openings (reduce the building's rate of heat-loss) and increase the size of windows on southern elevation (maximize solar heat gain, natural light access and generate passively heated building).	• Windows triple-glazed FSC certified with U-values of 1.2W/m2K. External doors U-value of 1.1 W/m2K • Low energy LED lighting • Windows are timber, thermally broken frames with weather and draught seals.
Heating/Cooling passive and active	• Low-grade electric underfloor heating system (No radiators, gas fires, oil or mechanical boiler, flues) • Preserve internal Cooling loads(human and appliances/average person emits 90w of heat) • Passive Stack and Cross Ventilation: 600mm of quilted recycled plastic insulation in the roof, a rotating cowl on the roof to	• Low air-permeability • Biomass pellet boiler and MVHR (Mechanical Ventilation with Heat Recovery) incorporating a heater coil for space heating, including weather compensated control.

	draw air through the house, and breathable wall structure to reduce condensation.	
Renewable Energy and Waste Management	• Water: 1,000-litre rainwater collecting tank • Solar Water Heating: 300-litre unvented water heater • Solar energy: 800W of photovoltaic panels	• Solar thermal water heating • Mechanical Ventilation with Heat Recovery (MVHR). • Rainwater harvesting and Green Roof • PV Cells: Roof designed with the optimum orientation
Implementation and Design Challenges	• Environmental education: Inhabitants will take part in a three-year monitoring programme covering life-cycle analysis, thermal performance and energy consumption studies.	• Houses sale value uplift of 15% over standard build costs. • Specific additional costs dedicated for training to use new construction technologies and sustainability features. • Design detailing for the Code can be time consuming and labor intensive if the overall design concept is complex.

5 SPATIAL ANALYSIS

5.1 TOWNSCAPE ANALYSIS

The relationship between land topography and views over green lands, urban areas and watercourse will be strengthened by the conservation of the most popular visual corridors, and the organizations of buildings heights and masses according to the land slopes and landscape patterns.

Marston Vale is well connected to the A421, which lave a direct link to the M1 through junction 13. This road runs to the north, connecting to Bedford southern bypass, and running along the site western border creating a strong physical edge and noise generator (environmental constraint). *(Fig 6 in the Annexes).*

5.2 TRANSPORT AND MOVEMENT NETWORK

The site has access to a number of strong green links, forming part of the wider green infrastructure. The Stewartby Lake dissects the site to two northern and southern parts, running the district most popular sailing activities. The cycle routes spread along the lake side, up to the Marston Vale Forest Centre, Cranfield to the west and Lower Shelton and Wooton Green to the north. A new development scheme is under construction by the Highway Agency to release the traffic congestion at the A421, reduce accidents risk and create wider two to three lane dual carriageways.

Running southeast and west from the site a large network of footpaths and bridleways provide access to the countryside wet and wooded lands for both commuting and recreational purposes.

The conservation and improvement of these green links is important to encourage the environmental friendly transport modes, and strengthen the local landscape character. The Millbrook proving ground and the green sand ridge high slopes are both considered as barriers against the green links to the site across the south east access.*(Fig 7 in the Annexes)*

6 DEVELOPMENT FRAMEWORK

6.1 CONCEPTUAL ANALYSIS-DESIGN OPTIONS

Option 1: Compact City Form *(Fig 8 in the Annexes).*

This option proposes the creation of one major mixed-use central district which provide recreational and employment services, surrounded with three high density residential zones. The catchment areas radius varies from 300-400m to the main bus stops along the guided routes, and from 400-800m to main community facilities.

The physical and social integration with the existing settlements is highly achieved, overcoming the existing severance of the A421, and Marston Vale railway line stretching the development to the east, north and west.

Option 2: Polycentric Form *(Fig 9 in the Annexes).*

This option proposes the creation of three major mixed use central districts, two are linked to the existing town centers in Lildington and Marston Moretaine, while the third centre maximize the benefit of a new transport interchange along the Marston vale line.

The catchment areas exceed the 500m to the main bus stops along the guided routes, which requires a proposal of new transport corridors. The accessibility to the mixed use districts is also restricted to the surrounding residential settlements. This will increase the separated identity of each town.

Option 3: Linnear Form *(Fig 10 in the Annexes).*

Design Evaluation Principles	OPTION 1	OPTION 2	OPTION 3
	Overcoming the severance of the A421, and create strong connections with Cranfiled University for better educational opportunities	The avoidance of traffic managements and new links along the A421, and preservation of the existing treatments	Direct link between the site western and eastern edges, and strengthening the continuity of ecological networks and forest trails
Location of central transport and services nodes	The central district is located in the heart of the site, with high density and concentration of services and public facilities. Producing difficulties with phasing the development schemes, and the balanced reach of facilities by local residents	The distribution of services among three central districts, with separate catchment zones, might create better access to public facilities, but severe the social and economic segregation between the existing settlements	A balanced distribution of facilities is managed between the existing settlements and new developments. Although, the linear form controls movement patterns along the high street corridor, and reduces the level of social activities around the inner residential zones
Treatment of existing settlements	A strong consideration for the existing settlements is clear, but fall beyond the 500-700m catchment zone of the proposed central district	The treatment of existing settlements is concentrated at the local level and restrict the expansion beyond the 500-700m catchment zones	The overlap between local catchment zones, and the new central catchment area harmonise between density and activity distribution levels

SELECTED OPTION: Modified Options 1&3-Cell Cluster Model *(Fig 11 in the Annexes).*

The modification of the selected options will propose a cell cluster model, which considers the radial spinal axis as the main high street core for the Eco town. A multi-functional high street will insure the integration of new developments with the existing settlements, and the expansion of the town centre functions to include better services and more accessible facilities. The proposal also breaks the severance of the A421 as a physical and visual barrier by stretching the development to the northern part with a green bridge. The distribution of services along the transport nodes will produce new development magnets, and reduce the travel trips and footfall to Milton Keynes and Bedford adjacent large employment and commercial hubs. A separate pedestrian, cycle and bridal spine will overlap the vehicular route to provide better access to the water transit system, open spaces, and green infrastructure.

6.2 Conceptual Analysis-STRATEGIC DEVELOPMENT

Accessibility-Catchment zones *(Fig. 12 in the Annexes).*

The catchment areas radius vary from 300-400m to the main bus stops along the guided routes, and from 400-800m to main community facilities. The educational campus zone interrelates between two main transport interchanges, and remains the accessibility to peripheral edges in the radius of 700m.

The green link between the eastern and western parts of the site, will improve accessibility to the garden market, the forest centre, and the proposals of Centre Pancs, and NIRAH developments. The high footfall to the new train station will provide new financial resources and better employment opportunities. Linking the green bridges over the site main physical barriers to the existing bridleways, cycle and pedestrian routes will also improve the Cranfield University educational connection to the science park and the new educational campus.

Transport and Movement Network ***(****Fig. 13 in the Annexes).*

An improved transport network is considered to create sustainable movement patterns, and reduce the travel demands to main centres. This will include Bus transit system, improved pedestrian, cycle and bridal networks, that will have direct links to existing heritage trails and the new Bedford and Milton Keynes waterway.

Population and Densities ***(****Fig. 14 in the Annexes).*

High population densities are located within 500m from the main transport nodes and communal facilities. Then moderate and low densities extend to the outer parts of the proposed neighbourhoods. Further identification of densities also depends on the flood plain encroachments, and soil permeability levels. The proposed drainage system, and flood defence methods, will be decided upon existing flood models and detailed study of flood zones.

Clear consideration is also given to the site wetlands in order to protect wildlife natural habitats, and use water surfaces as groundwater filters for mitigating flooding hazards.

Vegetation cover and natural woodlands are also preserved as physical buffers surrounding the urban developments.

Land-Use *(Fig. 15 in the Annexes).*

A regeneration of the existing facilities in local settlements is proposed in order to achieve the maximum accessibility to the main services and employment hubs.

Access to the site visual characteristics is highly achieved with the venue of block heights and masses along the wetlands and woodlands edge.

7 CONCLUSIONS

7.1 CONCLUSIONS

The aim of this research is to investigate new ecological sustainability approaches, to be applied to the Eco town planning policies and design context. Following an in-depth review of literature and further design analysis, this research concludes that sustainable urban form theories and the government's Eco town planning principles are descriptive terms, which cannot be considered as a distinctive Eco town definitions or standard design evaluation agenda to follow in practice.

It would appear reasonable to conclude that the governmental proposal of the Eco towns might be considered as an environmental response to the climate change problems, and the increasing demands on affordable housing units, although developing Marston Vale as an Eco town requests further studies to justify the efficiency of the government's planning policies, at the long term scale. The reliance on the European Eco town model, as an ecological formula must be expanded, to reach real life models developed in the British context, and recover from the garden city urban sprawl living patterns. The implications of implementing the existing strategies in practice will establish clear guidelines, for urban sustainability researchers to evaluate, criticize and develop into better standards.

The weight of evidence in this research would suggest that the compact Eco town urban form is fundamental to establish strong social, economic and ecological networks between the new and existing dispersed settlements. Nevertheless, social and physiological verifications of the relationship between man and nature, are essential to achieve self-sufficient, and sustainable behaviors. Statistical analysis and detailed examination of ecological footprint levels, the frequency of travel trips and capacity of the existing infrastructure need to be conducted, to achieve sustainable travel modes, and energy consumption patterns.

The identification of the site ecological identity at early analytical phases establishes a clear design framework to follow and avoids filling the public realm gaps with vandal-proof green surfaces at late stages. On balance, it would seem that economical appraisal and market assessment studies need to be carried out

to estimate the financial cost of infrastructure upgrade schemes, building constructions, and property values. This will insure the achievement of affordable housing targets and the provision of community facilities within the available feasible funds. Further technical studies can also provide management strategies to maintain the long-term working order of the Eco town zero carbon technologies

7.2 RECOMMENDATIONS

- The application of democratic regeneration plans and community involvement schemes are essential to achieve sustainable design and management standards
- Financial contributions and development management strategies must be established prior to setting up the land use and design schemes to insure the balanced fund and delivery of local community needs, and avoid the acquire of obligatory private landownership schemes.
- The proposal of innovative transport forms must be considered as one of the Eco town design standards to create sustainable travel modes, and reduce carbon print levels.
- Monitoring the implementation of local development strategies by regional planning bodies is important, to expand sustainability measures into the wide context, and build social bridges that connect local communities to wider development networks. This will also balance the impact of adjacent development pressures, in the surrounding areas on the local settlements cultural and urban fabric.
- Promoting appropriate level of tenure mix is the key to create sustainable living standards for all income groups.

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8 ANNEXES

Fig 4.*Compact Urban structure*

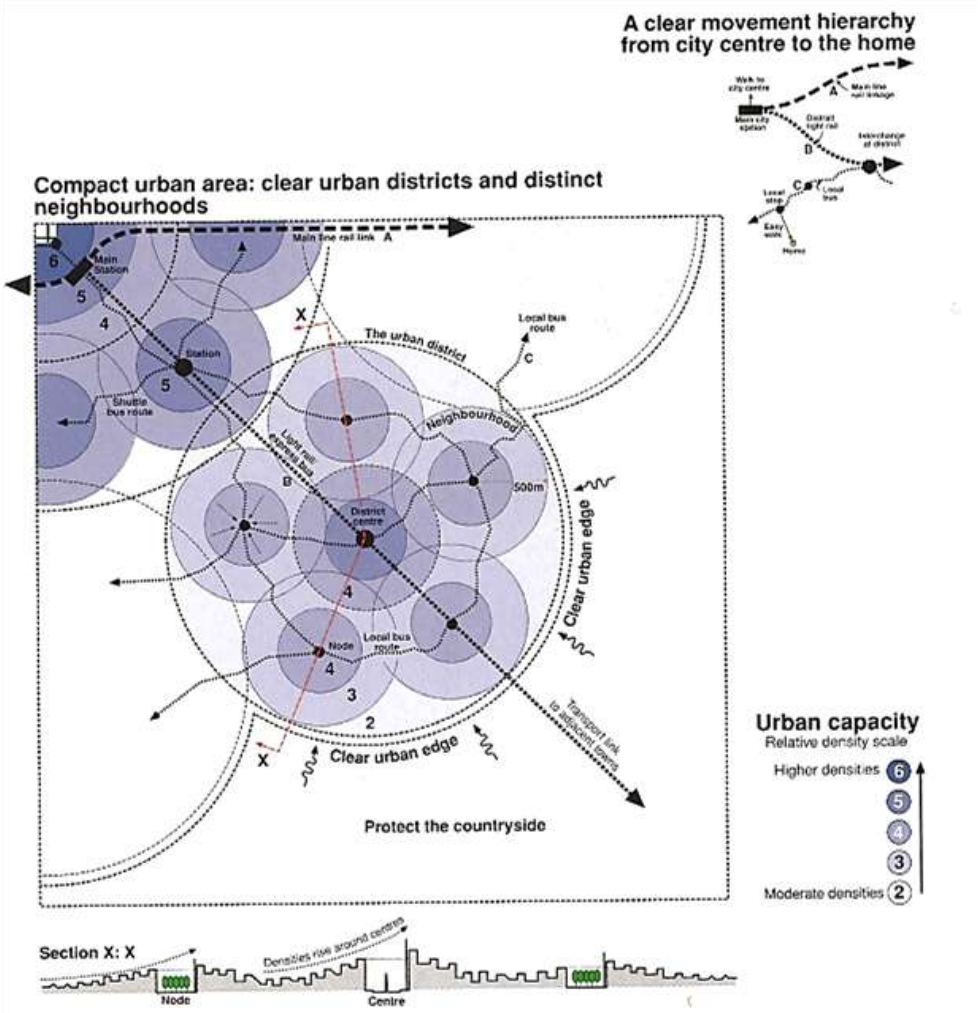


***Fig 5**. Ecological Design Brief*

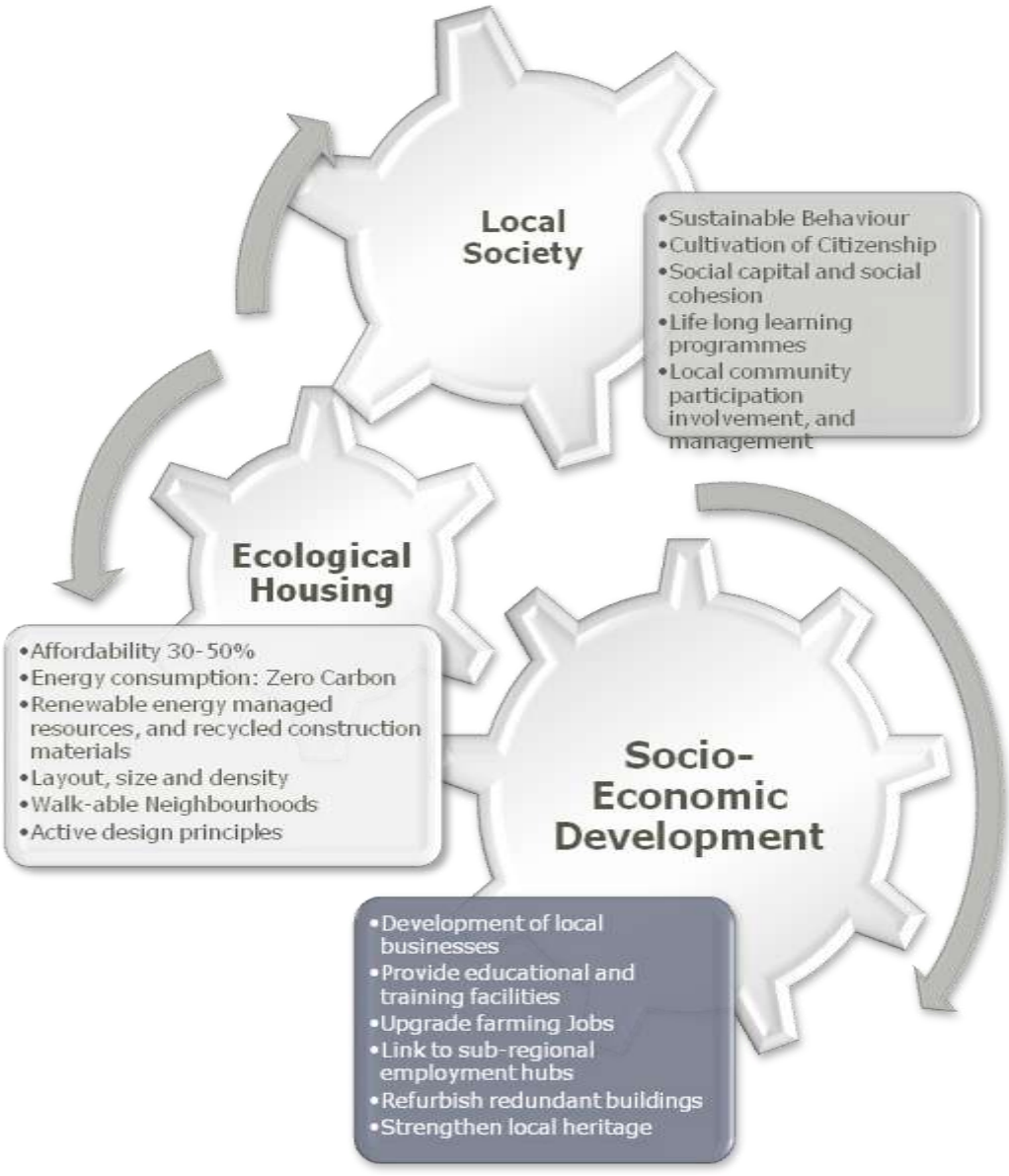


Fig 6. *Townscape Analysis*

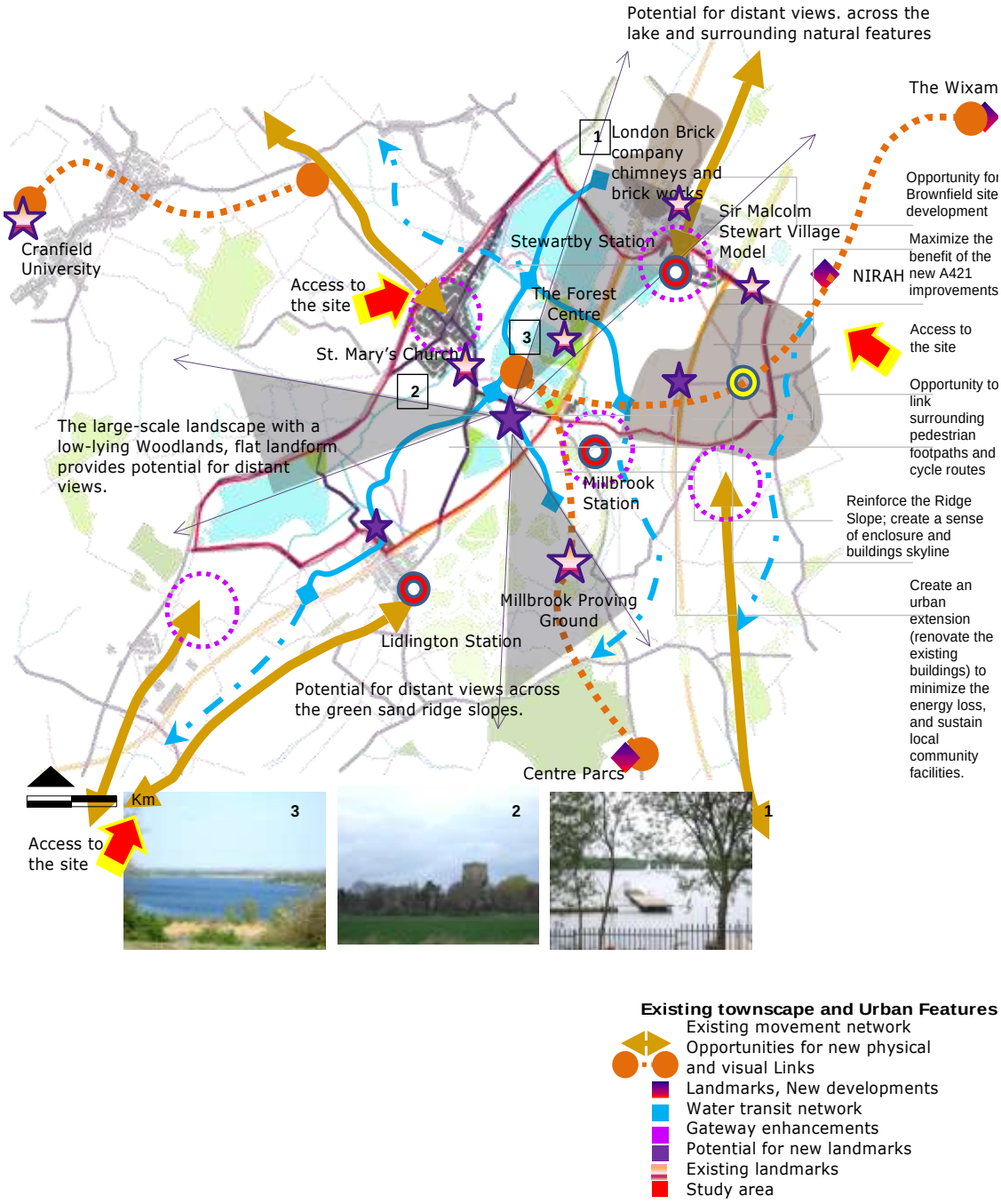

Potential for distant views. across the lake and surrounding natural features
The Wixam
1
London Brick company chimneys and brick works
Sir Malcolm Stewart Village Model
Stewartby Station
Cranfield University
Access to the site
The Forest Centre
3
St. Mary's Church
2
NIRAH
Opportunity for Brownfield site development
Maximize the benefit of the new A421 improvements
Access to the site
Opportunity to link surrounding pedestrian footpaths and cycle routes
The large-scale landscape with a low-lying Woodlands, flat landform provides potential for distant views.
Millbrook Station
Reinforce the Ridge Slope; create a sense of enclosure and buildings skyline
Millbrook Proving Ground
Create an urban extension (renovate the existing buildings) to minimize the energy loss, and sustain local community facilities.
Lidlington Station
Potential for distant views across the green sand ridge slopes.
Centre Parcs
Km
Access to the site
3
2
1
Existing townscape and Urban Features
Existing movement network
Opportunities for new physical and visual Links
Landmarks, New developments
Water transit network
Gateway enhancements
Potential for new landmarks
Existing landmarks
Study area

Fig 7.*Transport and Movement Network*

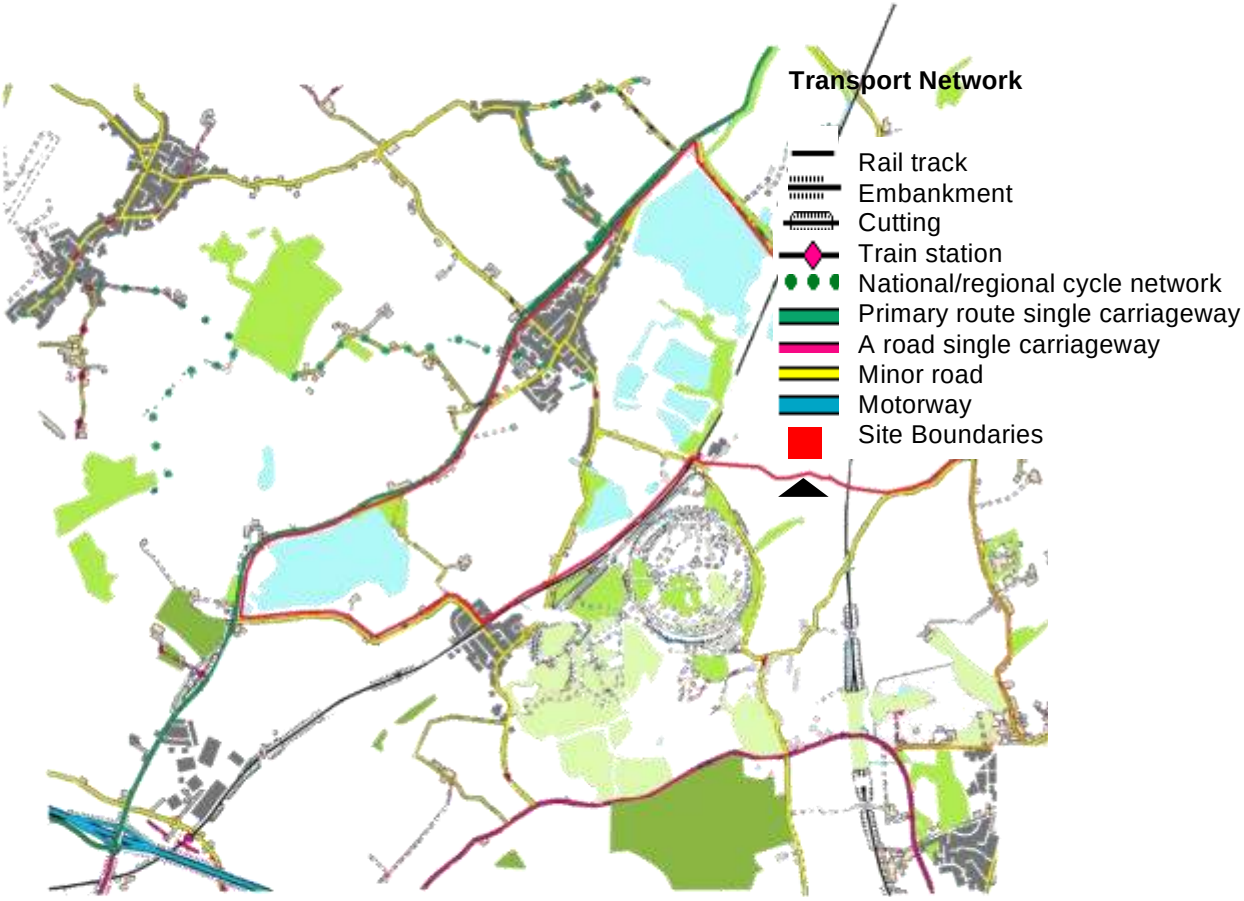


Fig 8.*Conceptual Analysis- DESIGN OPTION 1*

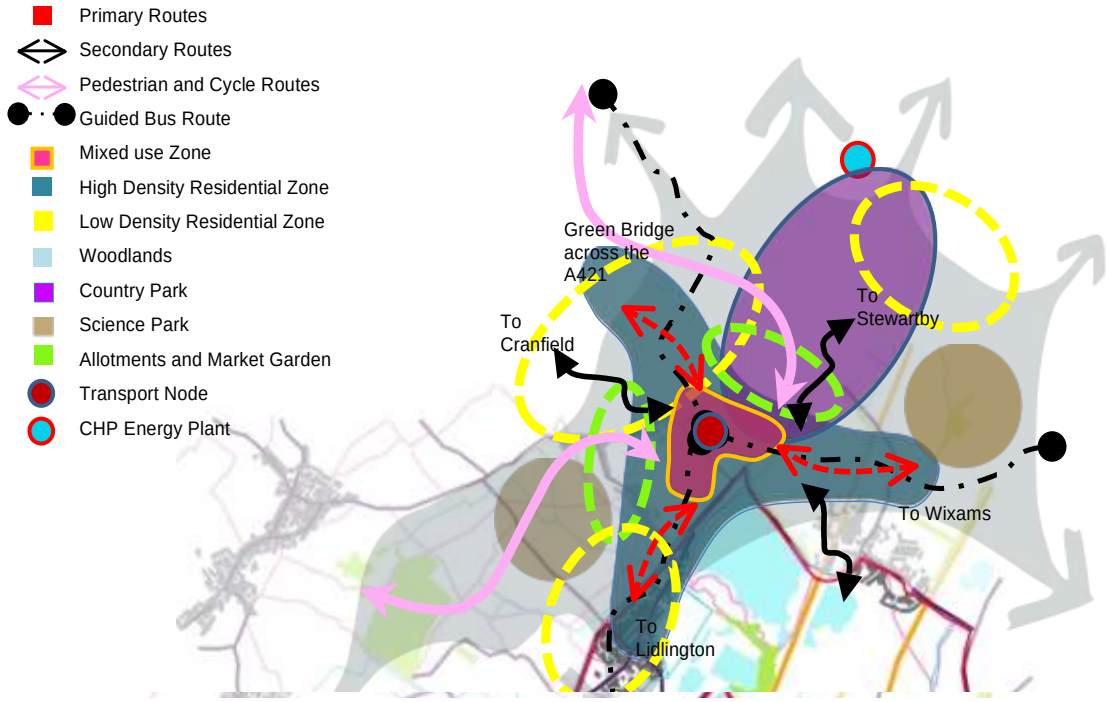


Fig 9.*Conceptual Analysis- DESIGN OPTION 2*

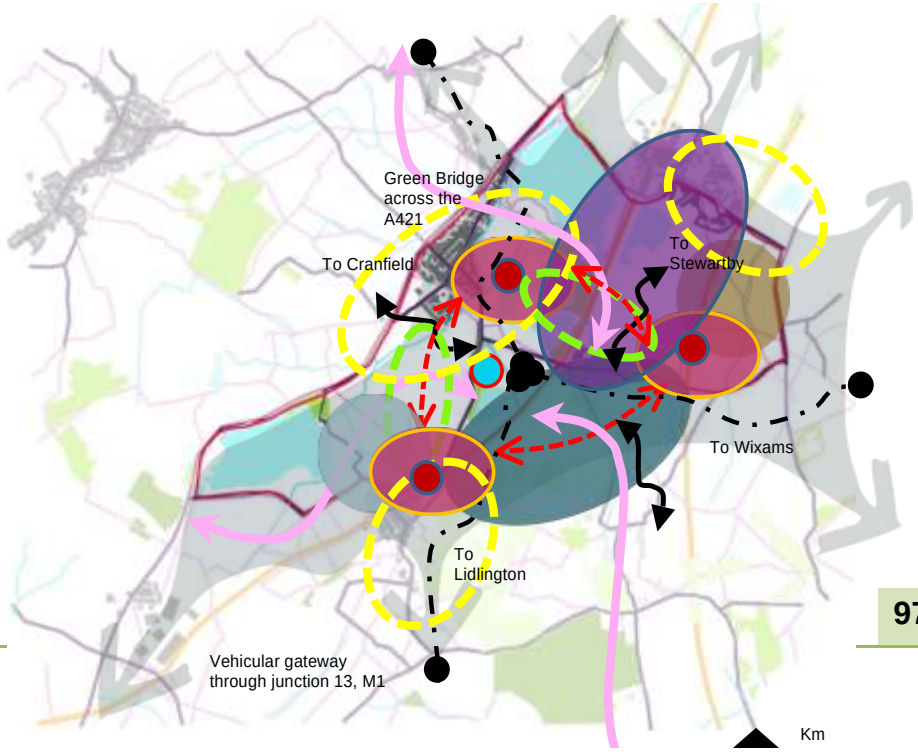
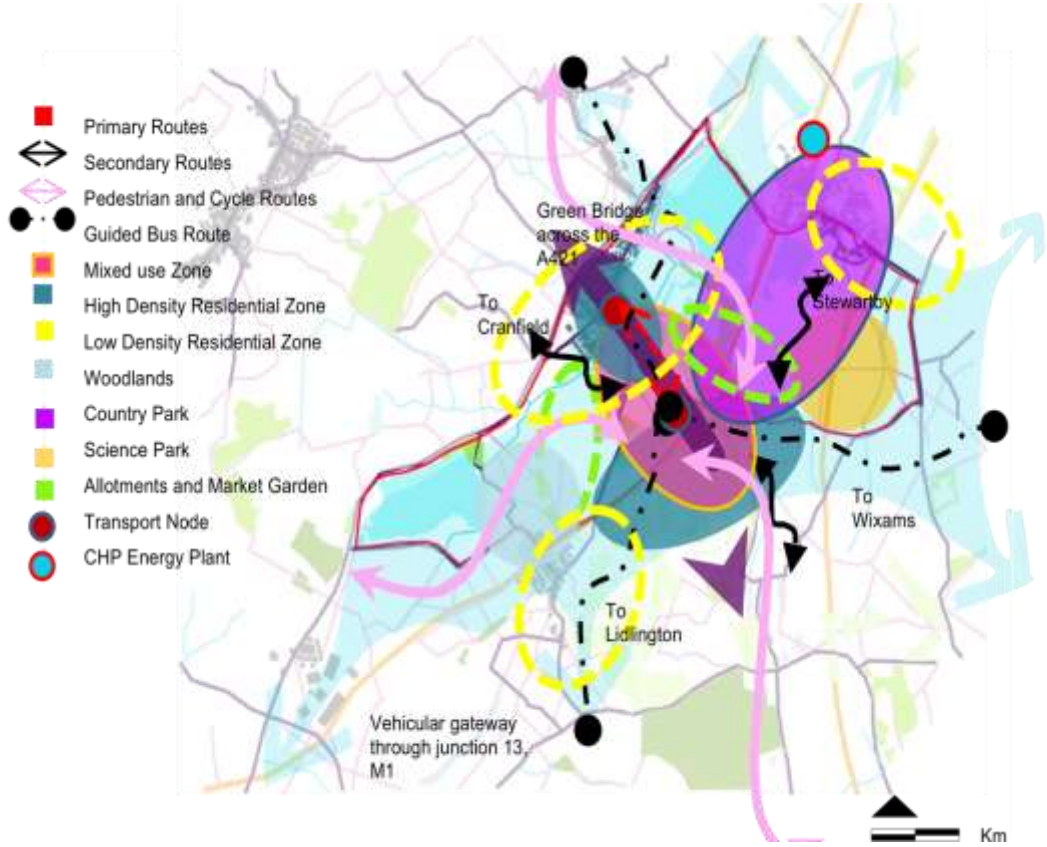


Fig 10.*Conceptual Analysis- DESIGN OPTION 3*



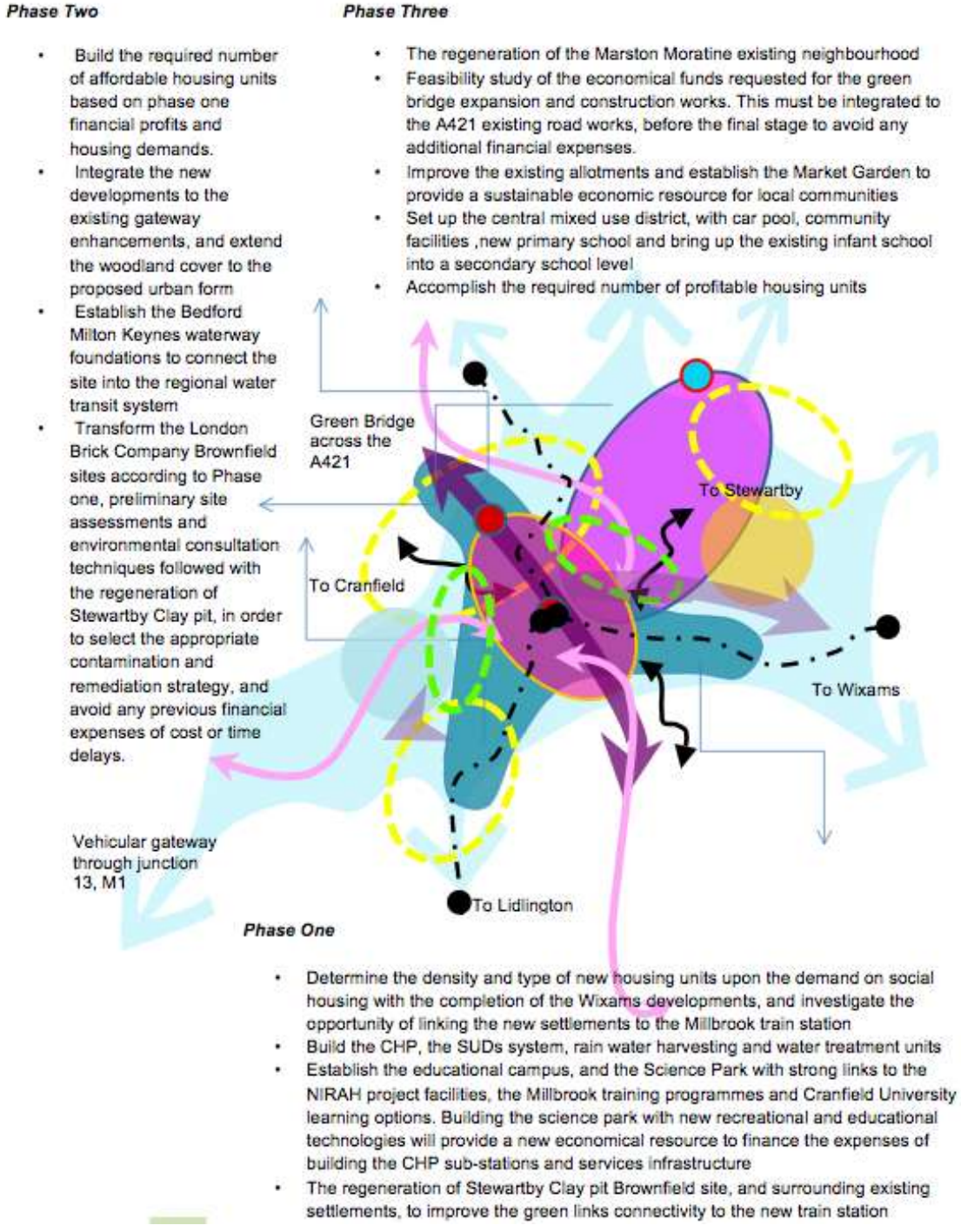


Fig 11.*MODIFIED OPTION 1&3-CELL CLUSTER MODEL*

Fig 12.*Development Framework: Accessibility-Catchment zones*

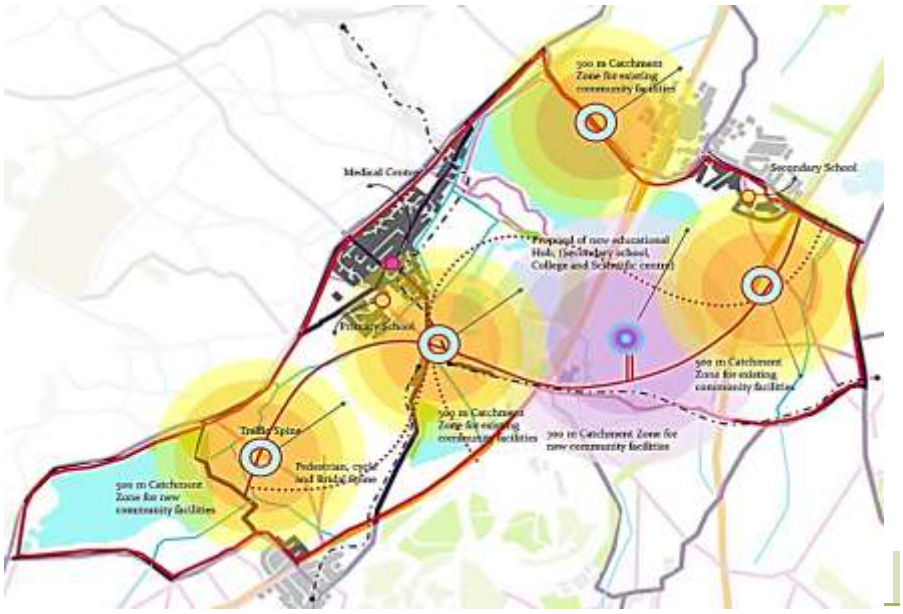


Fig 13.*Development Framework: Accessibility: Transport and Movement Network*

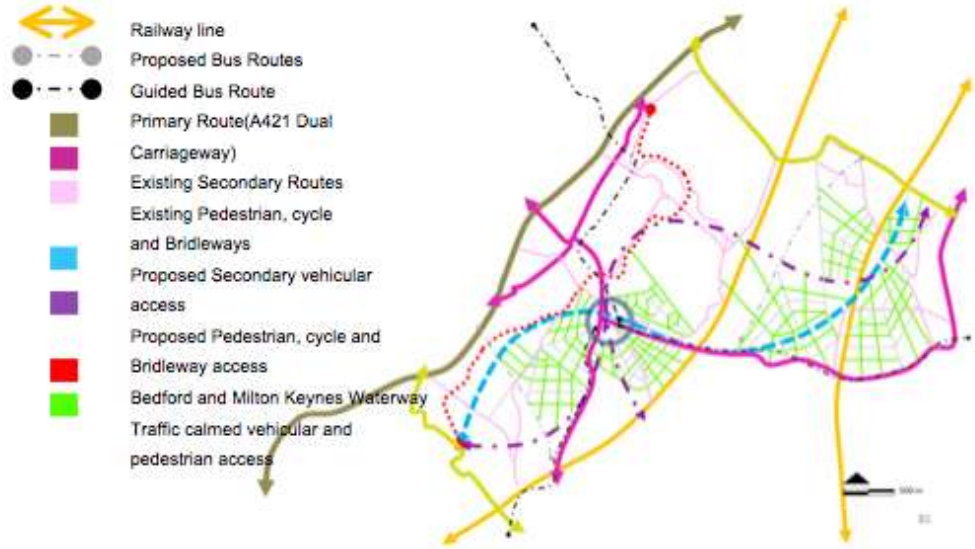


Fig 14.*Development Framework: Population and Densities*

Fig 15.*Development Framework: Land-Use*

Business Park with direct link to the regional economic growth destination (new proposal of railway station), providing new potential for investments and employment opportunities in tourism, construction, forestry and agricultural activities

Energy Park, providing energy from waste plant, located at a central distant from both existing and new settlements, to reduce the loss of heat and energy power along the transfer process. Environmental technologies and learning facilities will be connected to the educational campus through forestry green bridges and water ways to the Scientific Park

Based on Bedfordshire County Council educational forecasts for school sizes and existing capacities, the Eco town proposes a new Educational Campus which includes a primary school, secondary school, and community college to reduce the pressure on the existing centres, and establish learning partnership with the surrounding facilities(Cranfield University). This will also include a sports centre to encourage health living standards along the learning process.

Leisure facilities connected to the Millennium forest centre with enhanced green and blue links, to expand the site recreational facilities, natural habitat network, and strengthen the existing ecological character

Primary Care health centre, connected to the existing local facilities

Long life learning facilities, scientific and cultural centre includes an indoor botanic garden connected with the Scientific park

- Community facilities(Library, primary school, sports centre, police station)
- Leisure(Café's and restaurants with residential above)
- Employment(live work units, and residential above)
- Mixed Use facilities (Retail with high density Residential flats above
- Low density Residential dwellings
- Urban parks, squares, allotments, woodlands and Country parks
- Lakes and river streams

Evolve, not change. Improve, not replace.

"Urban conservation as a strategy for sustainable spatial development"

Daniel Radai, Todor Kesarovski

ABSTRACT

Our world is undergoing an unprecedented process of global urbanisation. Cities have been growing, both spatially and demographically, and are projected to accommodate almost all of the world's population in 2050. This pre-determines a constantly rising pressure on energy and mobility systems challenging the sustainability of the urban environments. Striving to deal with these issues the existing building stock and transportation networks, which serve the ever changing urban lifestyles, demand certain adaptations. Conservational approach towards the urban fabric could be indeed employed as a tool for general spatial development strategy in order to foster a sustainable prosperity and the quality of life in cities. However, the physical preservation must also incorporate and emphasise an energy conservation and renewable resources utilisation strategy because the long-run effects of restoration projects may be harmful in terms of environmental sustainability. The essence of this concept is the belief that future urban demands could be met on the basis of the richness of the past with the right means applied.

This project addresses the conservation of existing housing fabric based on a technological solution, which ensures energy-positive buildings and a conceptual vision enabling to facilitate self-sustaining habitat on urban scale. Our case study is developed on Honselersdijk, a residential town located in the greater metropolitan areas of The Hague (the Netherlands). The essence of the project relies on the establishment of distributed energy generation and shared consumption grid, promoted simultaneously via top-down and bottom-up planning approaches. In order to enhance the transport flow efficiency, an integrated strategy developed on cycling and shared vehicles is elaborated within the existing major mobility network on metropolitan level. In particular, our ambition is to manifest an urban concept where sustainability is not just about creating energy efficient and durable spaces but it is fundamentally about promoting lifestyle based on shared communal responsibility and awareness regarding the performance of the multi-scalar urban systems.

Key words: spatial planning, sustainability, energy efficiency, transportation, rural areas

1 INTRODUCTION

Considerable amount of researchers and professionals from various scientific fields would acknowledge the statement that the contemporary world confronts the issues of supplying and sustaining its existence. This challenge seems to be beyond humanity's strength in long-term projected future if the current construction and resource consumption patterns are kept. Therefore, there is an urgent necessity of reconsidering the global development and promoted lifestyle of today. On the other hand, our world is undergoing an unprecedented process of global urbanisation where these areas are generally recognised as significant energy consumers. Cities have been growing, both spatially and demographically, and are projected to accommodate almost all of the world's population in 2050. This seems to determine that the global effort for sustainability will be won, or lost, in the world's metropolitan regions.

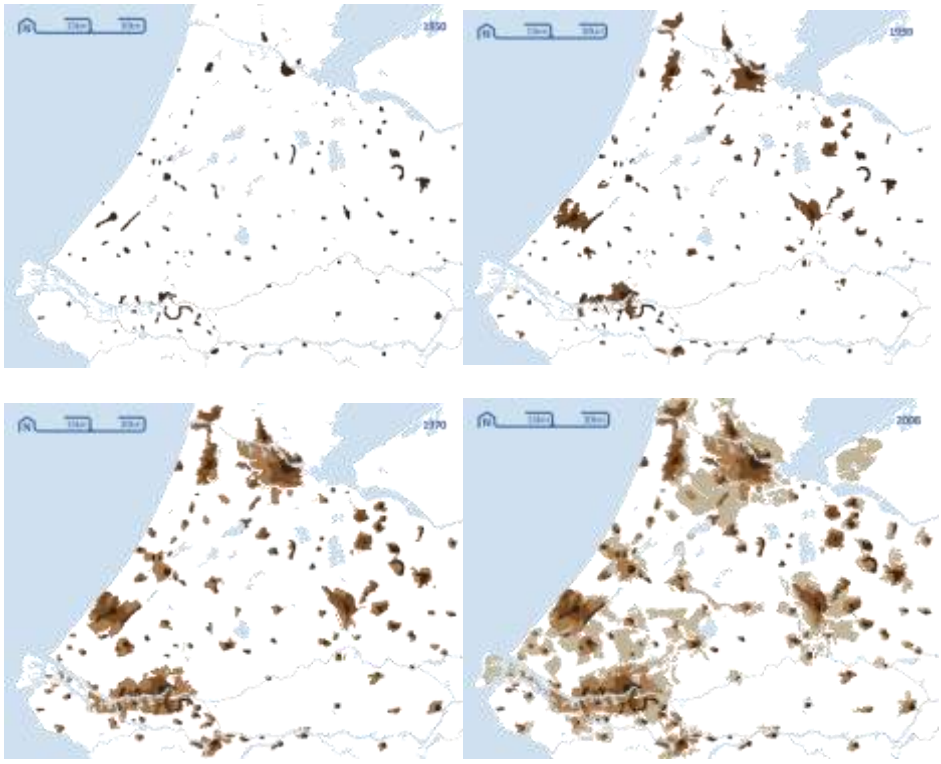
This context destines the considerable awareness that has been already raised regarding the construction of new structures which are energy efficient and resilient to change ensuring a 'bright' future for our cities. Nonetheless, the vast majority of urban fabric all around the world consists of urban sprawl structures developed during late 19th and 20the centuries. Indeed, the adaptation and upgrading of these existing urban systems to meet target energy reduction seems to be a main obstacle confronting the urban practices due to the estimation that 75% of today's buildings will still be in place by 2050 (Futcher& Mills, 2012). Striving to deal with these issues the existing building stock and transportation networks, which serve the ever changing urban lifestyles, demand certain adaptations. The crucial importance of interventions with such a focus is supported by the assumption that urban design might influence over 70 per cent of people's Ecological Footprint by means of planning decisions, spatial organisation and technology (Wackernagel et. al., 2006).

Following this line of thought the major challenge within the field of urbanism in terms of sustainability shifts from 'how to create sustainable urban systems for the future' to 'how to transform and retrofit the enormous body of existing spatial morphology in sustainable structures'. Within the framework of urban regeneration the contemporary practices tend to focus on urban centres as places which consume a higher amount of energy and consist of older urban fabric urging for physical renovation (Jeffrey & Pounder, 2000). However, considering the generally higher transport energy consumption and emitted emissions hampering the environmental balance there seems to be a necessity to review the impact of the suburban and rural areas in this sustainability discourse (Susilo& Stead, 2008).

Figure 1: Position and extent of Randstad within the territory of the Netherlands

During 20th century suburbanisation became a global phenomenon. Although it has been initially introduced in North America and Australia it has been successfully exported. The suburbs in Western Europe accommodate the majority of the population of the metropolitan regions (EEA, 2006). Employment

is also decentralising and Western Europe has become increasingly poly-centric. The case of the Netherlands could be outlined as a representative example of this process. The urban growth within the country has been significantly accelerated since the end of the late 1960s until the beginning of 21st century. The period 1960-80 was especially dominated by substantial urban deconcentration when the massive introduction of the automobiles in the country enhancing the individual possibilities of mobility (Ottens, 1990). In the 1980s and 1990s, deconcentration was less dramatic, partly because of the emphasis on new construction within and close to existing urban centres. But housing and employment continued to grow in suburban areas in the periphery around the large cities of the Randstad[10]succeeded in relocating more and more of their population overspill (Dieleman&Jobse, 1997).



Figures 2-5: Growth of the urban, semi-urban and rural structures in Rands¬tad (Netherlands)

This defines a regional structure where substantial share of the population lives in a large amount of medium-sized and cities and even larger amount of small towns and villages (OECD, 2007). Thus, it highly depends on commuting

[10] *Dutch 'metropolis', spatially defined by the area between the four largest cities in the country (Amsterdam, Rotterdam, The Hague and Utrecht) in the Western part of the nation*

between the urban, sub-urban and rural areas. In order to facilitate a brighter future for this urbanised region a considerable attention should paid to the improvement of the performance of the large cities as well as the small towns and the efficient connection between them. Within the perspective of sustainability very often the impact of the semi-urban and rural areas in the equation is being underestimated. However, in the case of Randstad these structures seem to be fairly essential for the sustainable prosperity of the region.

Indeed, the following paper looks at the outlined relationship of interest between urban form and transportation within already defined framework of energy efficiency and sustainability in the context of Randstad (Netherlands). In particular, the executed study is a design exploration which has been developed as a part of Solar Decathlon competition (2014)[11] by the team of TU Delft - Prêt-à-Loger[12]. First, the theoretical discourse, within which the design experiment is executed, is discussed. Second, a review of the adopted research methods and analysis approach is made. Afterwards, the description regarding the proposed vision is presented and finally a reflection on the processed interventions is made aiming to outline the outcomes of this study.

2 THEORETICAL DISCOURSE

Understanding how to intervene in respect to the major objects of interest i.e. energy efficiency and sustainable development requires a better comprehension of the seemingly correlated housing and transportation. Traditionally central urban structures are focal points in the discourse of interest because of their complex nature and substantial energy consumption (Steemers, 2003). However, in the last decades the negative impact of suburban and rural areas on the environmental balance has been gradually explored as a main problem causing spatial inefficiency and further waste of energy (Newman &Kenworthy, 1989; Anderson et. al., 1996).

These areas are generally characterised by lower densities and manifest a spatial sprawl developments. Although in its initial image the suburban town, as designed by Ebenezer Howard, the transportation system relies on trams and railways in practice the automobile has been utilised as a solution for servicing the transportation demands. The private motorised vehicle offered urban planners and developers freedom from solving the problem of providing effective public transport in rural areas (Mees, 2010). This has gradually lead to a state of extreme car-dependency for the residents of rural areas which promotes highly energy inefficient lifestyle in a long run (Newman & Kenworth, 1989).

For many years in the end of 20th and the beginning of 21st century in order to deal with the issue of transforming the rural areas into more sustainable structures, the introduction of policies designed to promote densification of the existing areas through land-use planning has been widely employed (Mindali et. al., 2004). This perspective insists on the argument that transport patterns are

[11] *www.solardecathlon2014.fr/en/*

[12] *www.pretaloger.nl/*

outcome of urban form and the only way to establish a successful collective transport system is by the development of compact cities, smart growth or transport-oriented designs (Mees, 2010).

Nevertheless, implementing the aforementioned concepts in already established sprawled urban fabric could take a substantial amount of time and effort to achieve sustainable structures. Unfortunately, in the contemporary context of energy scarcity, time is a lacking resource and interventions could not wait decades to be grounded. Furthermore, the urban system is not only the result of the planner's script, but also a mixture of location decisions of companies and households as well as the interaction between these decisions and the transportation system. Any change in the urban structure is likely to generate significant changes in the residents' behaviour and lifestyle. Therefore, utilising land-use planning and spatial densification as policy measures to change energy consumption could be hardly considered as a method that leads to an obvious improvement (Crane &Crepeau, 1998).

Paul Mees argues in his book 'Transport for Suburbia' (2010) that an efficient public transport system could be designed in areas with low density following the examples of the rural region surrounding Zurich (Switzerland) and the suburbs of Toronto and Vancouver (Canada). Therefore, the existing urban form of the rural structures should not be used as an excuse for incapability of organising a sustainable transport network. In addition, according to Danish urban designer BjarkeIngels (2010), it seems that there is a misconception regarding the issue of sustainable development and the promoted way of pursuing it through personal sacrifice and public penalties. He suggests that urban practices should not aim to adapt our lifestyle to sustainability but rather adjust our sustainable designs to the way we want to live (BIG, 2010). In this perspective sustainability could be achieved not by changing the people but changing the world. A transition which is more likely to be implemented regardless the socio-cultural contexts.

In respect to these statements an assumption that an effective transportation network could be successfully established on the base of technological improvement e.g. electric vehicles, smarter use of the individual modes of transportation i.e. automobiles, bicycles etc. and development of a concept that individual mobility patterns could be aggregated towards more collective ones without causing private discomfort. A holistic task that could be achieved by means of transport planning and urban policies in theory but needs to be further explored in practice (Hulsmann&Fornahl, 2014). This theoretical discussion leads to the major research question of this explorative study:

How spatial planning strategies can enhance the energy efficiency in relation to housing and transportation in the Western-European rural context?

The design exploration that is presented in this paper aims to examine the already described major objects of interest by proposing a possible solution seeking for enhancing the performance and the energy efficiency of specifically selected rural area. In the following section a more detailed elaboration of the

utilised research approaches and analyses is presented regarding the main research question.

3 RESEARCH DESIGN

The study addresses the practical problems of creating an effective transport system in the rural setting without densifying the existing urban form. In order to provide assumptions regarding this issue a design exploration is developed utilising research by design approach. A method which is capable of generating rigorous design hypotheses that could be further testified (Koskinen, 2011). In addition, aiming to establish a reliable basis for the development of urban strategy techniques comprising data (statistical) analysis, spatial and space syntax analyses have been executed. The employment of these approaches provides explicit foundation for the further elaboration of the design.

The design exploration focuses on a single case ensuring strong internal validity and depth of the examined context. According to Gerring (2006) this approach ensures strong plausibility for generating (design) assumptions. However, in order to develop a design strategy that can be applied in practice a typical urban case should to be selectedproviding with at least modest level of generalizability of the outcomes. On the basis of the discussion taken place in the previous sections two major criteria for identifying a typical case in respect to the research purpose could be defined: (1) small town located within the boundaries the metropolitan region of Randstad and (2) absence of well-established and efficient public transport network.

The case of Honselersdijk

Based on these two criteria the study addresses the case of Honselersdijk, a small industrial and commuter town with a population of 7500, located in the municipality of Westland in-between the greater metropolitan areas of The Hague and Rotterdam (Randstad, Netherlands). More precisely, the research focus on a neigh-bourhood where the predominant urban fabric is consisted of post-war, energy inefficient row houses. According to Eurostat (2011) the row houses in the Netherlands also make up 42% of the current building stock. 1.4 million post-war dwelling have an essential impact on the sustainability of Dutch urban, semi-urban and rural areas. In order to facilitate a brighter future of this urbanised region a considerable at-tention should paid to the improvement of the performance of the large cities as well as the small towns and the efficient connection between them.

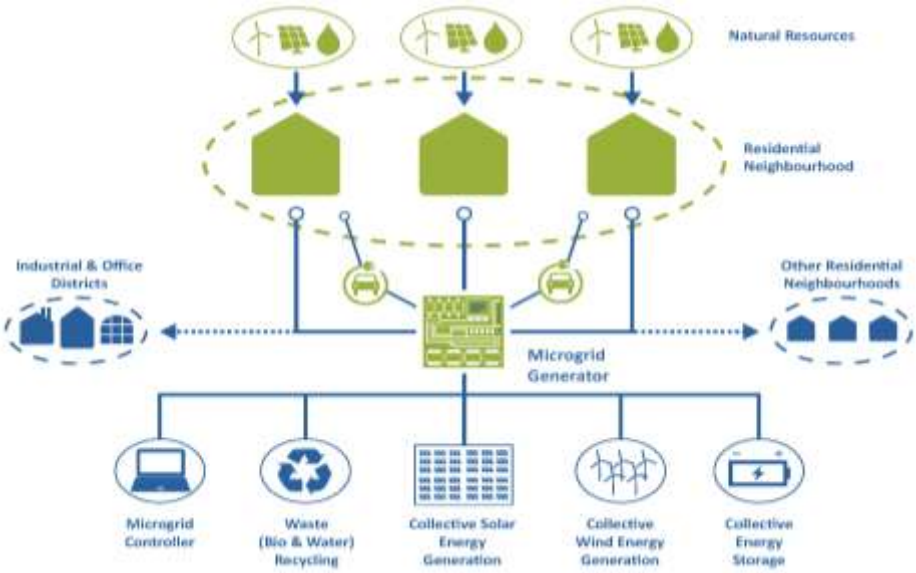
4 DESIGN EXPERIMENT

The physical preservation must incorporate and emphasise an energy conservation and renewable resources utilisation strategy. By respecting the

material and energy flows between the built environment and the ecosystem it is possible to take the existing dwellings and neighbourhoods into the future. The proposed design experiment seeks a solution where sustainability is not just about creating energy efficient and comfortable spaces, it is also about promoting life-style in balance with the environment. The fundamental part of the concept is a technological solution for an energy self-sustaining unit e.g. energy neutral house. However, it promotes the development of a self-sustaining system on larger scale e.g. neighbourhood, town. In this paper the emphasis is kept on energy neutral housing and transportation.

4.1 ENERGY CONCEPT

In respect to energy efficiency the concept is built upon a completely special dual process where the top-down and bottom-up initiatives coexist and enhance each other. A special emphasis is paid on sharing resources for the establishment of balanced and cohesive communities instead of reinforcing the competition between the different social classes that leads gradually to a more social as well as spatial segregation in cities. According to Lovins (2002) for the society it is beneficial to have energy neutral buildings but this does not seem sufficient. On the basis of the energy self-sustaining houses this concept aims to create self-sustaining streets and neighbourhoods which will be part of a collective energy grid. By doing so we would like to promote distributed energy generation, storage and re-distribution where local residents will be actively involved in the production and managing of the electricity.



Figures 6: Distributed energy generation

4.2 DISTRIBUTED ENERGY GENERATION CONCEPT

The major motivation underlying the establishment of decentralised, renewable energy technologies is that they can be located closer to the demands. In this

way the distribution and transmission cost and consequently energy and capacity loss are reduced (Lovins, 2002). In addition, since solar panels produce energy during daytime, they reduce the need for energy generation during peak hours, which is more expensive than the base load energy. The purpose of this concept is to provoke public awareness and shared responsibility regarding energy production and consumption. By utilising this approach our long-term vision seeks for neighbourhoods which will be self-sustaining relying on local energy grids that all together can service larger areas and even whole cities.

4.3 TRANSPORTATION AND MOBILITY STRATEGIES

According to the recent policies of the province (Structural Vision for Zuid-Holland, 2012) these tendencies are opposed by accepting the rule of permitting new constructions only within the already urbanised areas although the region still accommodate newcomers. In this context the only possibilities for further development seems to be by optimising the transportation networks allowing the densification of smaller towns and rural areas. Aiming to create favourable conditions to organise a network on sustainable principles a transportation plan including enhanced public transport, electric vehicles e.g. bicycles and cars and shared automobiles is elaborated.

Since this project strongly addresses energy production and consumption we cannot underestimate the essential issue of regional and urban mobility. In fact, approximately 20% of the carbon footprint of an average Dutch family is due to the different modes of transportation where almost 18% in total are result of the car usage in the country. As it was already mentioned the town of Honselersdijk similar to other urban and rural areas located in close proximity of larger cities within Randstad tend to be car-dependent. This justifies the case study as a town with relatively high ownership of private motorised vehicles and poor public transport connections.

Furthermore, this tendency pre-determines the existing condition where streets are explicitly functioning as car-serving spaces and are being devoid of intensive social activities. In particular, this hampers the quality and vibrancy of the urban environment since the streets are forming a major part of the public space within the town. In order to investigate the demands on the street network of Honserlersdijk a Space Syntax study has been conducted. On the basis of it sufficient number of roads has been identified as links with minor connectivity frequency serving only few households but still occupying considerable amount of public space.

4.4 URBAN SCALE

Considering the aforementioned arguments and the size of Honselersdijk the Prêt-à-Loger team plans to pedestrianize numerous service streets within the urban area on the basis of the Space Syntax analysis to promote green mobility i.e. cycling and walking as major mode of movement circulation to promote green mobility. This concept combined with an enhanced public transport network connecting Honselersdijk with the surrounding areas on larger scales seems to be an appropriate approach towards establishing sustainable mobility system.

What is more, this urban mobility strategy is developed with strong consideration of the team's vision by providing new possibilities for extra utilisation of the street environment developed as community gardening and gathering space.

However, this strategy does not aim to promote totally car-free town. The project places a particular emphasis on the fact that residents from satellite towns such as Honselersdijk are mainly commuting workers and students who are impossible to be served on 100% via green mobility modes and public transport system. What is urged for is a smarter and more efficient usage of the private motorised vehicles. Therefore, the concept proposes collective parking areas which are strategically located in order to provide a parking spot for every household within a maximum of 150 meters. The new parking areas compensate in full extents the amount of removed parking spaces previously taking place at the pedestrianized streets.

Incorporated with the energy and architectural concepts of this project our team proposes the introduction of electric cars usage among the residents of Honserlersdijk. For this purpose, a car-sharing program will be implemented where these automobiles will be electric. The sharing of motorised vehicles between the local inhabitants will reduce the necessity of private ownership of automobiles and respectively lower the impact on the existing infrastructure. As a part of the house skin a car charging station can be optionally established as a place for energy exchange of between the dwelling and the private cars. The individual storage is incorporated with the technological improvements of the houses as the cars batteries can be charged. At the collective parking locations extra solar panel installations will be established as a place for energy exchange of between the dwelling and the private cars. Moreover, the projected collective parkings would be clustered around the energy micro generators or other electric hubs aiming to incorporate electric, hydrogen and hybrid cars to plug in the town's electric grid. In an idealistic future vision the local residents will be able to supply energy not only for their local needs but also for their transportation demands feeding their private or shared cars. However, it is calculated the solar energy through the parking PVs will not be able to provide with sufficient energy, therefore, using the possibilities of a grid wind turbines are proposed to be installed to the system with a capacity of 5,670 MWh peek per year considering the wind conditions in this region of the Netherlands. This defines the adaptation of wind energy as powerful alternative that has a sufficient capacity to supply the electric cars' demands.

Figure 7: Energy and parking strategy plan

4.5 REGIONAL SCALE

A primary characteristic of the 'Randstad' South Wing metropolitan area, in which the case study area is located, is the very high connectivity via train and other public transport modes. Nonetheless, in the case of Honselersdijk, the town is very poorly connected with neighbouring cities despite the minor distances. Thus, the mobility network is highly car-dependent which is pre-condition for favouring urban sprawl and further consumption of energy resources. Aiming to avoid this negative process we propose strategic improvements of the transport network with providing new alternatives. A fundamental feature for achieving a more sustainable metropolitan future is, indeed, an efficient and transportation network prioritising collective and fuel free mobility modes.

In addition, as it was aforementioned in respect to the South-Holland province the recent policies do not allow new construction outside the boundaries of the existing urban areas. Thus, towns such as Honselersdijk are seen as an option for accommodating further population growth by densifying the existing structure. In order to facilitate this growth sustainably an improvement of the transport network is necessary.

4.6 ELECTRIC BYCICLE CONCEPT

Until recently an organisation of metropolitan mobility network on the basis of bicycles seemed to be impossible because of the limited distance that the users can commute on daily basis. The concept of the electric bike is that it can be powered by a human strength but an electric motor also delivers extra capacity. Nowadays the engine has a maximum speed of 25 km per hour without utilising

the pedal mechanism, however, the industry already point to increase the comfortably achievable 40 km per hour speed (TREK Bikes, ebikes.ca, 2014). Research (Milieucentraal, 2014) shows that people can easily be transported by this bicycling mode to longer distances, up to 20 kilometres i.e. a higher range than the one which can be travelled by a regular bike. Thus, the electric bike is a good competitor of the car on short distances (up to 10 kilometres). Furthermore, it is a cheaper mobility mode than the car. Apart from this, it is self-evident that there is a substantial difference between the electric bicycle and motorised vehicles impact on the environment which determines one more benefit of utilising this mode.

An employment of an electric bicycle concept in the case of the Netherlands seems to be a reasonable choice. The use of regular bikes in the country has been adopted as a popular mode of transport since few decades. They are utilised by different range of population varying by age and social class as a main means of transport composing a considerable part of the modal split in 2008 (an average of 22.5%, EPOMM). In almost all parts of the Netherlands including the municipality of Westland a sufficient infrastructure such as separate bicycle lanes on both urban and metropolitan scale is already established.

Therefore, there is no necessity of further public expenses. In order to popularise the utilization of the electric bikes, stations which provide rented and shared vehicles will be established and spread in the region. The private bicycles can be also charged from the self-produced energy of a single household developed by the implemented technological adaptations.

4.7 PUBLIC TRANSPORT

Another key action towards sustainable mobility network for the region is the proposition of three new ‘green’ fast bus lines and re-organisation of two existing bus routes in the region. These express lines are additional to the existing system in order to increase speed and frequency transforming the regional bus system into a competitive rival to cars. The buses connect the main cities of South Holland Province through the Westland on the existing infrastructure. With relatively limited investment compared to completely new infrastructure nodes, the applicability of a light rail system planned in the next decades finishing the Randstad Rail circle can be tested out. In addition to the bus network, the railway route from Rotterdam to Hoek van Holland will be transformed as a part of the successful Randstad Rail network utilizing the existing railway infrastructure. These interventions are necessary since target groups such as elderly and family with children are most unlikely to employ the electric bicycles as a major mode of transportation on metropolitan scale.

In short, the ambition of this mobility vision is to bring together different towns, e.g. Hoek van Holland and the second Maasvlakte with The Hague or Delft creating a more complex multi-level and faster network promoting lower dependency on private motorised vehicles and urban densification. As a result of these interventions, by 2030 significant changes are aimed to be visible in the region’s modal split. By shifting to (electric) bicycles and giving up private ownership on personal vehicles, a fall of 30% in the total amount of cars in

Honselersdijk could be reached by 2030. This means the disappearance of 4 individually owned cars for each one shared.

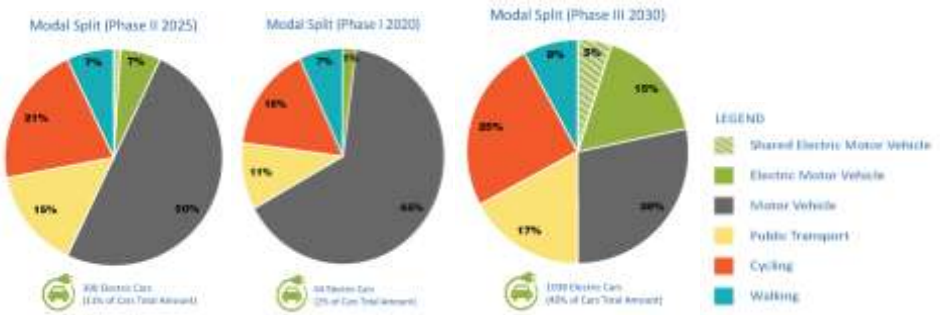


Figure 8: Shifting Modal Split

4.8 HOUSING, TRANSPORTATION AND ENERGY

Prêt-à-Loger has been driven to combine sustainability with affordable living. Since major unbalance in relation to the future of the planet is connected to the urban sprawl in the Netherlands with high percentage of private vehicles (1,7/household) and low housing energy efficiency due to the post war mass produced stock, the rural setting is addressed. Families move out to these towns to provide with a calmer living environment and on many occasions cheaper housing opportunities but energy and commuting prices are gradually rising. Therefore, in our proposal we want to prove that self-sustaining dwellings, community driven neighbourhoods and renewable energy based transportation system can be created in coherence on different scales.

As presented earlier energy generation through solar PVs on the roofs could produce sufficient amount of energy for housing but also could support the daily full charge of an electric bicycle (or more bikes with less frequency) as well as the street lights in the neighbourhood. Electric cars and hybrid buses are supported by solar energy but predominantly relied on wind energy that can efficiently supply the system of a whole region. Based on our estimation one wind turbine could support more than two Honselersdijk-size (7500 inhabitants) towns' energy demands for cars in 2025 and fulfil one town's need in 2030, even so, it is fairly hard to predict the energy demands and technologies 15 years ahead.

Figure 9: Housing, transportation and energy

5 CONCLUSION

As presented earlier the sub-urbanisation and sprawl within the territories of Randstad (Netherlands) has been substantial in the second part of 20th and the beginning of 21st centuries. Therefore, interventions in terms of the existing mobility networks are highly necessary in order to facilitate the commuting flows every day. Honselersdijk is a typical case of low-density town within Randstad, on the basis of which a design exploration of possible solutions is developed. In particular, the proposed transportation strategy aims to enrich the possibilities for mobility of local inhabitants on both urban and metropolitan scales. The outcomes of the research seem to justify the necessity of further economic and political feasibility studies in order to verify whether is viable to implement the elaborated design in practice.

In terms of the generalizability of the proposed solutions the executed study aims to provide more conceptual approach which could be elaborated in the cases of other small towns and rural areas, at least within the region of Randstad. The plans pay considerable attention to the contextual conditions within the territories of South-Holland province. Nevertheless, the concepts of electric automobiles promotion and sharing vehicles i.e. bikes and cars are approaches which seem to be applicable to other regions in the Netherlands in order to tackle the issue of car dependency. Although relying strongly on the societal aspects such as desirability of the sharing vehicles and resources the presented mobility strategy possesses powerful capacity to transform the region into a highly sustainable and environmental-friendly area by optimising the transportation networks enhancing the accessibility of smaller towns and rural areas.

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Transforming London into the Energy Neutral City

Zoe Green, Rachel Ferguson, Jonathan Manns, Donald Messenger, Harry Manley, Jonathan Douglas-Green

ABSTRACT

London is a city facing considerable energy challenges, but also pioneering new approaches to generation and consumption. The Mayor of London has stated and aims to achieve 60% reduction in CO_2 by 2025; a target which is far more ambitious than new European Union's objective of a 40% reduction by 2030.

We consider that a strategic planning outlook on London's future energy needs is an absolute requirement given the city's rising population, ageing electricity distribution infrastructure and political pressure to shift towards more decentralised energy sources. London will need to respond to these pressures by introducing more localised low carbon energy sources into its energy network – but how can this be facilitated through planning?

Our Study therefore proposes to focus on addressing key questions, such as "How can London become a less energy and carbon intensive city?" and "How can we move to a lower carbon energy system, which is both more secure and more affordable for London's population?"

Our approach to the Study will be to analyse the existing planning instruments and policies in place before exploring these through best practice case studies, from the local level (Brixton Community Energy Project) to the district level (Stratford City and the Olympic Park). In doing so, the Study will propose new approaches that could be adopted to facilitate London's transformation into the energy neutral city; and applied elsewhere across the European Union in similar circumstances – addressing significant issues such as the heat loss, energy pricing and security in addition to the emerging concept of energy masterplanning.

Key words: energy netural city, retrofitting, command and control regulation, decentralised energy, London heat map.

1 INTRODUCTION

This paper provides high-level consideration to the potential which exists for *Transforming London into the Energy Neutral City.* It identifies existing and potential approaches that could be adopted to facilitate London's transformation and be applied to other areas within the European Union. It addresses specific energy-related issues such as heat loss and local energy generation, energy prices and security but does not refer in detail to broader matters such as transport and mix of uses. It therefore seeks to address the following question:

> *"How can **London** move to a **lower carbon energy system**, which is both **more secure** and **affordable for the city's population and businesses?"***

The London Context

London is a city facing considerable energy challenges, but also pioneering new approaches to generation and consumption. The city's population has grown every year since 1988 and is currently growing faster in real terms than at any other point in its 1000 year history. The current population is estimated to be approximately 8.2 million people, although recent growth has accelerated at a level greater than anticipated. For this reason London's population is expected to continue to grow to over 10 million people by 2030.

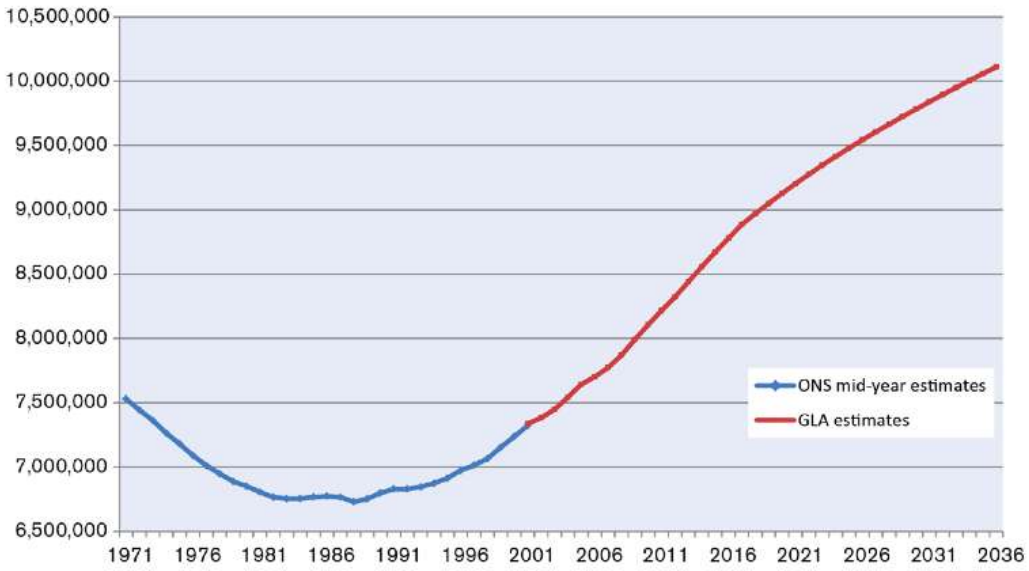

Figure 1 – Population Growth Forecast (up to 2036)
Source: Greater London Authority (GLA), 2011a, The London Plan

The city's growth in population will give rise to a rapid increase in the number of new households, many of whom will need to be housed in an already dense urban environment. The average density of London is 52 people per hectare,

which is considerably higher than England, which only achieves 4.1 people per hectare. Inner London has a much higher density with 101.2 people per hectare, in comparison to outer London which has 39.4 people per hectare.[13] This is expected to equate to household growth from 3.28 million in 2011 to 4.26 million by 2036 (Census, 2011).

Similarly, London's economy is expected to expand in real terms. This is already occurring, with increases of 2.0% over 2013 and forecast to be 3.8% in 2014. The city's growth is significantly outpacing the United Kingdom (UK) as a whole and it is expected that London will contribute almost a third of the UK growth in 2014. This is disproportionate both spatially and in terms of output per capita. It is also growth that will impact on London's energy needs.

The number of jobs in London is projected to increase from 4.9 million in 2011 to 5.8 million by 2036 (growth of 17.6%). Recent employment growth has occurred most quickly in central and inner areas of London where financial services and business services have historically been concentrated. However, there has been comparatively lower level of employment growth (and some decline) in Outer London, despite this being where the majority of Londoners live. The map below at Figure 2 illustrates this situation (where the majority of the employment growth is located in already dense energy intensive urban environments). Importantly, this growth pattern has the potential to increase pressure on London's existing energy infrastructure and impact on the sustainability of certain areas.

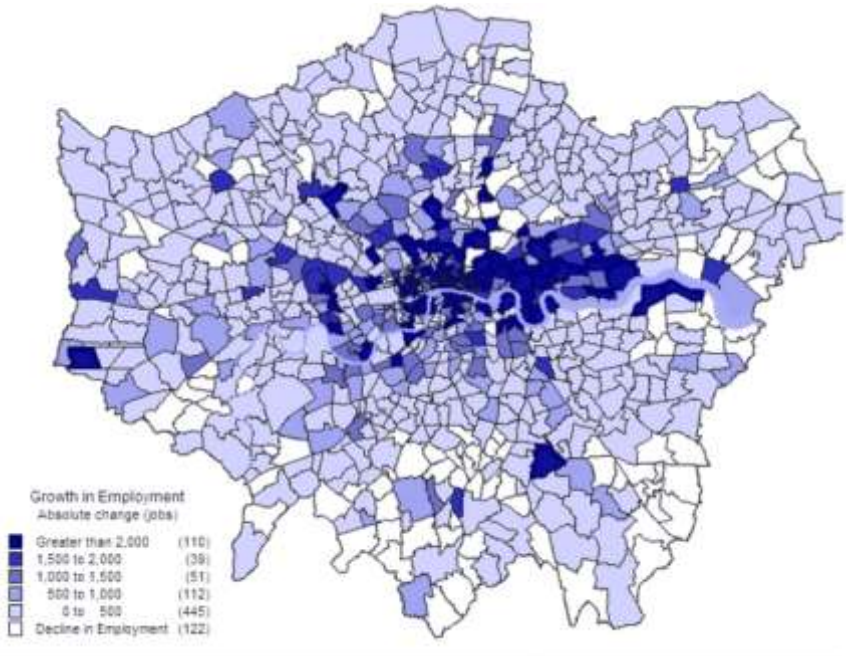

Figure 2 – Growth in London's Employment
Source: GLA, 2011a, The London Plan

Sitting behind these rapid population and employment growth projections is a political context wherein the energy needs of the capital are becoming increasing important. London is currently the driving force of the wider UK economy and the government is seeking to fuel its growth in order to stabilise the national economic recovery following the post-2008 economic downturn. Providing plentiful and affordable energy to accommodate the growing number of businesses and homes is therefore paramount to the success of the capital and the Government.

1.1 CURRENT LEGAL FRAMEWORK

London's current planning approach is about prioritising and planning for integrated economic, environmental, transport and social framework Environmental issues, including

The policy basis is two-fold. Firstly, it seeks to address matters of short-term influence on the determination of planning applications. This looks at using energy reduction targets to ensure that developers use technology (e.g. Combined Heat and Power (CHP) plants within large developments) to reduce the immediate pressure new development creates on the existing energy infrastructure. Secondly, it seeks to provide long-term consideration to the way in which London can use its increasing influence on national policy and investment (e.g. by increasing powers over spending London's own tax revenue) to invest in improvements to its own infrastructure and capture new technology to make improvements to the existing networks.

London Plan

The London Plan (2011) sets the strategic vision for London and includes ambitious targets to reduce energy consumption. The Mayor of London ("the Mayor") aims to achieve 60% reduction in CO_2 by 2025; a target which is far more ambitious than the new EU objective of a 40% reduction by 2030.

To support the energy ambitions the Mayor recognises it is essential that the additional energy infrastructure is required to power a growing London can support low and zero carbon energy (London, 2011a).

The Mayor's strategy is to tackle energy consumption through de-carbonising London's energy supply, reducing the energy consumption of London's existing building stock and moving towards zero emission transport.

Key to this is the Mayor's commitment to delivering 25% of London's energy supply by decentralised energy (DE) by 2025. These aims are considered on each major planning application made to London's Boroughs, including strategic developments decided by the Mayor.

Decentralised Energy and the London Heat Map

London's current centralised model of energy production is inefficient – 65% of primary energy input is lost through waste heat and a further 9% if lost from transmission via the national grid (GLA, 2006). A decentralised energy system captures and uses locally the heat produced through electricity generation and minimises the power lost through transmission.

The Mayor has produced the London Heat Map to support the requirements in the London Plan, which identifies opportunities for decentralised energy. In addition a number of energy masterplans have been published to give practical support developers to identify decentralised energy opportunities in areas of Greater London which have been allocated to provide major housing and commercial development.

The Decentralised Energy for London programme was set €3.3m funding (90% of which was secured from the European Investment Bank's ELENA facility). This provides London boroughs and other project sponsors with technical, financial and commercial assistance to develop and bring decentralised energy projects to market (see Figure 3).

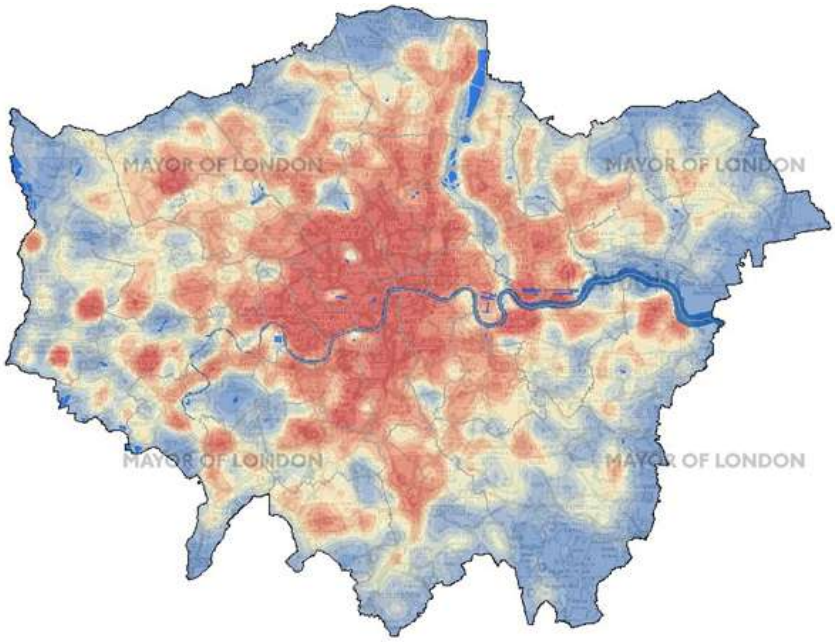

Figure 3 – London's Heat Map
Source: GLA, (2014c), London Heat Map,

Draft Long Term Infrastructure Investment Plan for London

The Mayor will shortly publish a draft Long-Term Infrastructure Investment Plan for London which will form part of a wider strategy to provide the infrastructure required to 2050. London needs infrastructure investment to the value of £75 billion by 2020. Of this, around £24 billion is needed for transport and about £8

billion for energy and water. Any future plan will however need to allow a degree of flexibility in the face of unknown changes and consider potential financing and investment mechanisms. London Enterprise Panel's London Infrastructure Group have, however, rightly acknowledged that funding needs to be directed to places where it can have "greatest economic impact in terms of supporting existing activity, increasing productivity, and providing a platform from which to compete for growth".

This investment is required to ensure that funding is being spent in the right places to support the predicted growth of London, against a back drop of the "short-term" national economic downturn, which has had a knock on impact on national investment in nationally controlled infrastructure providers. There is currently no allowance in national law to encourage investment in their networks proactively. Instead, investment relies upon applications for connections to the energy networks which appears to be holding back development in London by imposing time delays and unexpected costs on developers.

2 IMPROVING ENERGY USE THROUGH SPATIAL PLANNING

There are various ways in which energy neutrality can be improved. This involves recognised approaches such as limiting urban sprawl, densifying development around service and transport hubs, building heat networks, avoiding the construction of new infrastructures, building a pedestrian path network and integrating energy issues in planning permission.

We consider these under the following four broad headings:

- Retrofitting existing built stock, and;
- New Development.

2.1 RETROFITTING

London's existing buildings account for nearly 80% of London's carbon emissions. With 80% of buildings anticipated to still be standing in 2050, retrofitting is therefore a key to securing neutrality (GLA, 2011a). Whilst the Mayor's target for reducing carbon emissions is embodied in planning policies the retrofitting of most buildings is not directly controlled by the planning system. This limits the extent to which we can plan for energy neutrality and arises because building refurbishment will only require planning permission if external works or a change of use (for example from office to residential) are taking place or the property is listed. Thus many buildings fall outside the development control system. There are however other means by which retrofitting can be managed, being (1) command and control regulations, and (2) financial incentive programmes in place to encourage retrofitting.

Command and Control Regulation

Building Regulations are required for most building works in the UK, even where planning permission might not be. Part L of the Building Regulations set standards for the conservation of fuel and power which new and existing buildings must achieve. These standards include: insulation values of buildings, allowable areas of windows, heating efficiency of boilers and encouraging use of renewable energy. Buildings must achieve a specific threshold of carbon reduction or above for works to be allowed to proceed. Part L standards are different for new and existing buildings, and for homes and non-residential buildings; all however are continuously increasing to raise the level of energy efficiency.

In addition, any buildings being sold or rented (and all new buildings) must have Energy Performance Certificates ("EPC"). EPCs tell you how energy efficient a building is and its impact on the environment. Properties are rated on a scale of A-G (where A is most efficient). The England and Wales average for an existing building is D (BRE, 2014). The certificate will inform potential purchasers and tenants on the efficiency of a building and may influence their property decisions. Under new regulations buildings with an EPC of level F or below will not be allowed to be let from 2018. It is estimated this could affect one fifth of commercial and residential property in the UK thus providing an incentive for landlords to refurbish (Hughes, 2012).

Financial Incentives Programmes

Central Government, the Mayor and Boroughs have introduced a number of financial incentives based schemes to encourage retrofitting. At the national scale the Government has introduced the Green Deal. This enables householders to pay for energy efficiency improvements through savings in their energy bills. Loans are available for householders who are not able to pay for the improvements up front. Improvements include insulation, heating, draught proofing, double glazing and renewable energy technologies e.g. solar panels.

Another mechanism at the national scale is the Energy Company Obligation (ECO). This places legal obligations on the larger energy suppliers to delivery energy efficiency measures to domestic energy users, combining command and control and financial incentives. It is intended to work alongside the Green Deal to provide additional support in the domestic sector, with a particular focus on vulnerable consumer groups and hard-to-treat homes.

The Mayor has introduced a number of models programmes to help achieve his targets and use the Green Deal. In 2009 he launched:

- Re: Connect – ten low carbon zones ("LCZ"s) were selected to receive funding and support from the Mayor to reduce emissions by 20% by 2012 and develop innovative delivery models to do so. The scheme aimed to leverage private sector investment, show new and innovative ways to reduce energy use and bring together local authorities, community organisations, residents, business and utility companies to work in partnership in a target geographical area.

- Re: New – provides free whole-house energy surveys and energy efficiency advice and "easy" energy efficiency measures. Households are then referred on to programmes that offer loft and cavity insulation. The scheme aims to visit 1.2 million properties by 2015; saving 40,000 tonnes by that date by installing" easy" measures with loft or cavity wall insulation opening the opportunity to save 1,344,000 tonnes (London Councils, 2014). Given domestic properties account for 36% of London's carbon emissions (GLA, 2011) this is an important programme. Moreover, it helps to alleviate fuel poverty through improving energy efficiency of homes, thereby reducing fuel bills.
- Re: Fit – uses an energy performance contracting model to retrofit public sector buildings. The pilot retrofitted 42 buildings (including fire stations, police stations and head office buildings) identifying average savings of 28% across the portfolio of buildings, saving £1 million a year in energy costs and creating a payback period of seven years. It is now underway in a number of public sector buildings.

Whilst financial incentives are a useful tool in encouraging homeowners to contribute to reducing the nation's carbon footprint by improving energy efficiency, they have also been criticised for the low up-take by the public. In particular, the Government's Green Deal has been branded a failure by industry experts, as fewer than ten UK homes had taken out the loans offered by the scheme to improve their energy efficiency (The Independent, June 2013). Critics said that Green Deal loan scheme was "confusing and, with an interest rate of about 7 per cent, not particularly competitive."

Case Study: Brixton Energy Project

There are currently well in excess of 2,000 community energy projects operating across the UK (Energy Saving Trust, 2013). Many of these are influenced by a series of recent government initiatives to create opportunities for communities to generate renewable energy. A pioneering example of a community energy project is the Brixton Energy initiative in South London. Located on a large housing estate, an innovative individual saw an opportunity to install solar panels on one of the estate's blocks whilst the roof was being replaced. The electricity generated is used to power communal areas of the estate. The excess energy is then sold to the National Grid.

The initiative was able to secure funding through private finance by encouraging local residents to pledge small financial investments in exchange for an annual 4% return on their investment. In addition, government initiatives such as the 'Feed in Tariff' and the 'Seed Enterprise Investment Scheme' offer subsidies and financial incentives for communities that generate renewable energy.

The scheme proved so popular that now the community initiative has been implemented across other housing estates in Brixton. In addition to the 4% return for investors, the projects have also generated additional funds for community projects alongside encouraging carbon conscious thinking within the communities.

The Brixton Energy initiative successfully demonstrates how local communities can come together to drive carbon neutral energy usage.

Figure 6 – Brixton Energy Initiative Team
Source: Brixton Energy Project, 2014

2.2 NEW DEVELOPMENT

New development is regulated by the planning system and provides London with the opportunity to build more low carbon infrastructure. Between 2010 and 2025, policies and actions on new development are expected to save a cumulative total of 2.44 $MtCO_2$. New development also provides opportunities to develop exemplars and models for zero carbon development in the future.

The London Plan's carbon dioxide reduction targets for new developments are in excess of building regulations. By 2016 new residential buildings are expected to be zero carbon[14] and non-domestic dwellings should be zero carbon by 2019.

New developments are required to achieve these carbon dioxide savings on-site following the Mayor's hierarchy:

- **Be lean**: use less energy – by adopting sustainable design principles;
- **Be clean**: supply energy efficiently – by prioritising decentralised energy;
- **Be green**: use renewable energy such as photovoltaics, combined heat and power (CHP) and ground source heating.

[14] A zero carbon development is defined by GLA (2014) as a development whose net carbon dioxide emissions, taking account of emissions associated with all energy use, is equal to zero or negative across the year.

As part of any planning application, all major developments must include an Energy Assessment which sets out how they will meet the Mayor's carbon reduction targets in line with the energy hierarchy.

Opportunities will vary from site to site subject to circumstances and the target emissions reductions are a move away from the previous planning policy approach of prescriptive technology targets for measures (GLA, 2011b).

This approach allows developers to create tailored and innovative designs that integrate the most economically viable solutions into the design of their development. Where proposed on-site carbon dioxide savings are not sufficient to meet policy requirements, because it is either unfeasible or economically unviable, developers can offset off-site or through financial contributions; these are called "allowable solutions".

The offsetting is managed and delivered at the Borough level. At present not all London Boroughs have set up an offset fund, although one example is the London Borough of Islington. Developers wanting to build in Islington have to pay for energy-saving work on social housing to offset the carbon footprint of their projects. (Islington, 2013).

The Mayor has also proposed pooling the money from each Borough and using it towards decentralised energy systems or for a London Green Fund with a more strategic remit. For this system to work effectively, Planning Officers in London boroughs will nonetheless need to be trained to improve their knowledge and understanding of energy issues to ensure new developments commit to appropriate energy performance levels.

Energy and carbon emissions can also be reduced by the way in which we design our urban areas. This includes reducing the need to travel by car, reducing the distance travelled, encouraging a mix of uses, higher densities and supporting public transport. Planning policies seek to locate development around public transport hubs; higher densities will be allowed in such locations.

Case Study: Vauxhall, Nine Elms and Battersea Decentralised Energy Network

Vauxhall, Nine Elms and Battersea is a large brownfield site in south London undergoing significant high density, large-scale regeneration. It was recognised by the Mayor and local planning authorities ("LPAs") as offering huge potential for development of a coherent, low carbon energy supply system, rather than piecemeal, stand-alone solutions on individual development sites.

The GLA and LPAs worked with landowners and developers to develop an Energy Masterplan having modelled existing and predicted heat demand (see Figure 4).

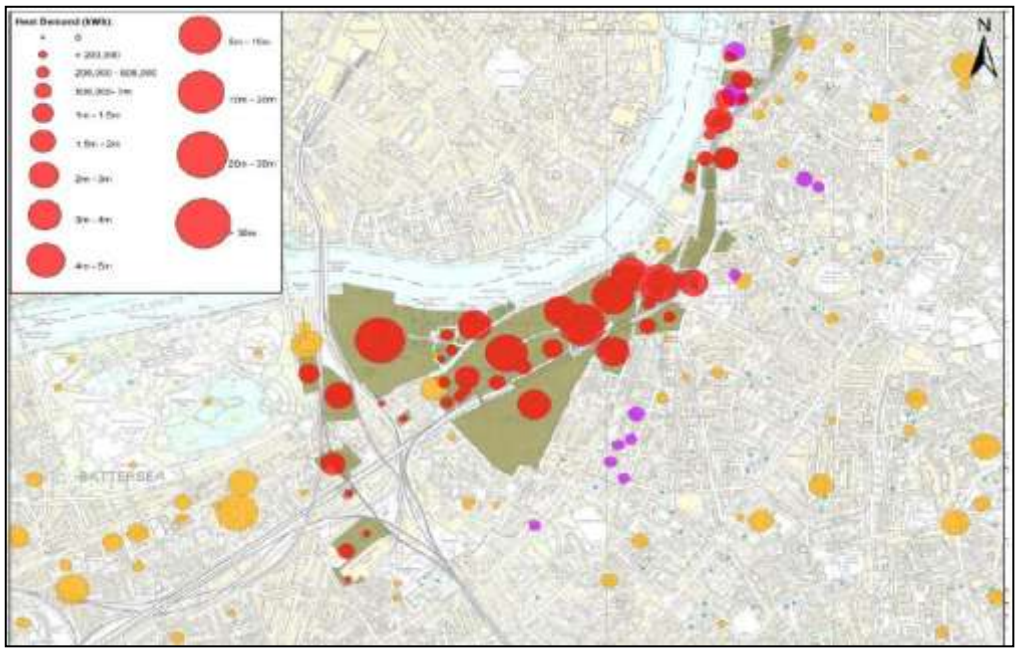

Figure 4: Area Heat Mapping

Note: (Red – new development, Yellow – existing development)

The Masterplan sought to provide a path to:

- Implement kick-start networks based around early loads, to capture the first developments coming forward. This would ensure a collaborative approach before individual solutions are installed;
- Identify and secure energy centres for kick-start networks;
- Preserve a district heating network route through the wider area (underneath a Linear Park);
- Put planning policy in place to oblige developments to connect to a district heating network.

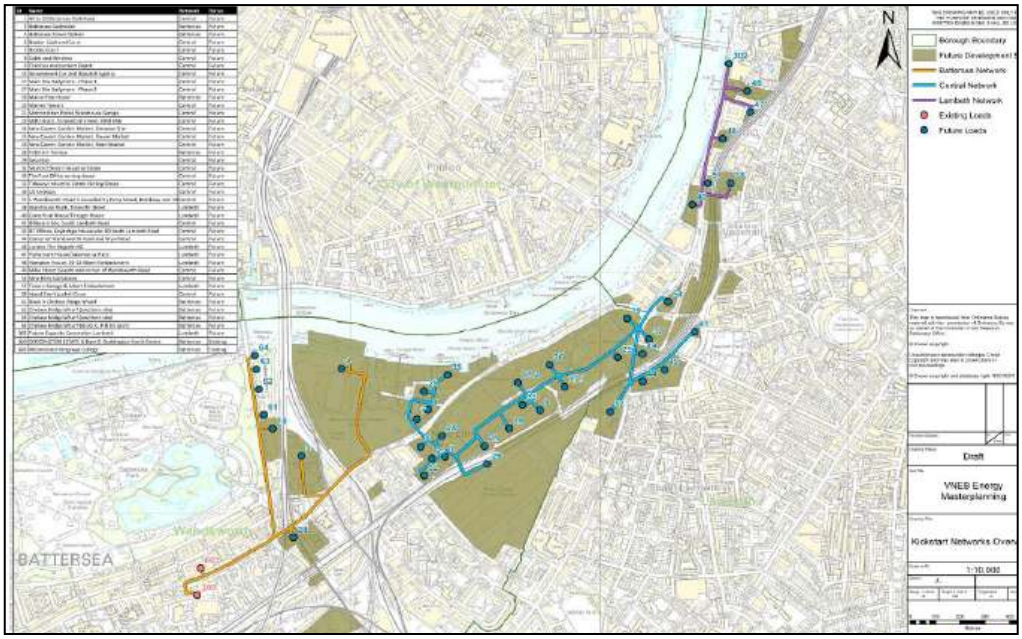

Figure 5: Proposed Energy Networks

Implementation of the network has commenced as the early developments have come forward. Planning policies and legal obligations requiring connection to the identified network, enforced by LPAs, have been crucial to its implementation.

Case Study: Queen Elizabeth Olympic Park

Sustainability and the environment were two key factors which underpinned London's successful bid for the 2012 Olympic and Paralympic Games. A key component of delivering the games was ensuring that the emphasis on green-thinking and sustainable initiatives lives on throughout the legacy of the games and the local area.

As the new park is located across four different local authority areas, a bespoke development organisation unit was required to ensure that the legacy ambitions for the area could be delivered effectively. The London Legacy Development Corporation ("LLDC") was formed and entrusted with securing the legacy of the games for London and the wider area. The corporation, taking direct instruction from the Mayor of London, was the first of its kind in the UK. In order to deliver the overall vision, LLDC was gifted with authority for establishing planning and development principles throughout the park.

The Games themselves aimed to be the "greenest games ever". This was achieved through:

- Sustainable materials – 2/3rd of the stadium roof was made from recycled steel;
- 97% of construction waste was diverted from landfill;

- The games achieved 47% CO2 reduction compared to a business as usual scenario;
- Wild flower meadows were sown to enhance biodiversity;

However, there were shortcomings; for example whilst 20% of energy was promised to be delivered from new local renewables, very little was delivered.

Paramount to LLDC's vision was ensuring that the Park and associated infrastructure were built in a way that encourages its future visitors and residents to live sustainably. To achieve this, LLDC Masterplanners are currently creating plans for five new sustainable neighbourhoods to be delivered over the next 30 years, creating up to 8,000 homes around new public parkland. Specifically, LLDC are seeking to deliver their ambitions through:

- Building new zero carbon homes
- Using construction materials and methods with minimal environmental impact
- Creating neighbourhoods which are accessible to pedestrians, encourage cycling and promote the use of public transport
- Creating new natural habitats to encourage biodiversity
- Supporting sustainable events within the park

The LLDC provides an aspiring example of how an organisation can implement sustainable thinking and living at a district wide level.

Figure 7 – The Olympic Park

Source: Queen Elizabeth Olympic Park, 2014

3 FUTURE OF ENERGY IN LONDON

The scale of delivery is key to securing energy neutrality for the city-region because there is not a 'one size fits all' approach to sustainability. The distinction is one which this paper explores through the following two case studies, being (1) the local level Brixton Community Energy Project and (2) the district level Stratford City and Olympic Park regeneration.

The energy neutrality of London is an issue which requires a flexible policy context and extends well beyond the remits of the planning system. Securing the necessary change and ambitious targets set by the city nonetheless depends upon the being a balanced approach which addresses site-specific issues at both the local, district and regional scale. The amount of new development sought over the coming two decades creates a significant opportunity to 'future proof' London's energy infrastructure and improve the energy efficiency of the built environment. It also, however, requires commitment from all stakeholders involved in the development process to avoid the opportunity cost of failing to secure possible improvements.

The key issue for the planning system, whether dealing with forward-looking policies and financial incentives or using those which are already adopted as a mechanism for development control will be to consider the city as a whole rather than a collection of sites. The problem, however, is that new schemes typically come forward on a site-specific basis and (unlike with the Olympic Park) require integration on a piecemeal basis. Likewise, as energy provided commonly opérate independently of both developers and Local Authorities there's a clear need for a more joined-up approach.

Additionally, there is also the potential to move away from a focus on carbon which, by virtue of national and international legislation, has become the measurable focus for energy reduction. This is perhaps something which can be addressed through the forthcoming draft Long-Term Infrastructure Investment Plan for London but may equally benefit from central Government guidance as to how the city evolves.

This being the case, effective leadership appears to be the key to London's transition towards a lower carbon energy system. Whether led by Government, facilitated by Local Authorities or delivered by communities, action at all levels is necessary to secure the investment and downstream benefits. Ultimtaley, however, a decentralised and sustainable solution will inevitably prove to be both more secure and more affordable for the city's population and businesses.

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Energy Efficient Building Technology & Management: A Case for New Housing in Dublin

Ciaran O' Sullivan, Niall O' Byrne, John Carty and Catriona Lynch

ABSTRACT

The recent EU directive on energy efficiency (2012/27/EU) is due to be transposed into Irish Law by the 5th June 2014. The directive was deemed necessary due to the assessment from the European Commission that Union is unlikely to reach its target of a 20% reduction in energy emissions by 2020, based on current policy.

Ireland was recently referred to the European Court of Justice for failing to meet emission reduction targets, while the Environmental Protection Agency confirmed that Ireland will miss its targets within the next five years.

Meanwhile, a recent study has projected that 79,660 new housing units will be required in Ireland between 2014 - 2018, with 37,581 (47%) of these in Dublin. Residential buildings account for the highest rate of CO^2 emissions in Dublin City at 32%, and represent the biggest possible opportunity for CO^2 abatement costs.

This paper provides an outline of the existing plans and policy related to energy efficiency in Ireland with a particular focus on housing provisions in Dublin. It provides a clear indication of the existing framework within which initiatives to reduce emissions and increase energy efficiency operates. Subsequently, a methodology for the construction of a net zero energy residential building that has the potential to be rolled out across Dublin, and implemented into the new build of the 37,581 houses required in Dublin is outlined. The intention is to provide an adoptable method, which will accelerate the pursuit of increased energy efficiency, limit carbon emissions of a new build and hopefully ensure the country is closer to meeting its 2020 targets. Following this an evaluation of the plans, policy and practice in respect of energy efficient housing in Dublin is outlined. As a result of this evaluation, and the outline of the building technology methodology, a series of recommendations are made, in order to help ensure increased energy efficiency, to reach efficiency targets, and to reinforce the role of planners in Ireland.

1 INTRODUCTION

The EU directive on energy efficiency (2012/27/EU) is due to be transposed into Irish Law by the 5th June 2014 and is just one of the many guidelines and statutory directives emanating from the EU in relation to energy efficiency in recent years. This directive was deemed necessary due to the assessment of the European Commission that the Union is unlikely to reach its target of a 20% reduction in energy emissions by 2020 based on the current policy mix. With buildings accounting for 40% of CO^2 emissions globally (EC, 2012), the role of increased energy efficiency in buildings cannot be understated. Ireland meanwhile, was recently referred to the European Court of Justice for failing to meet emission reduction targets (Europa.EU, 2014), while the Environmental Protection Agency confirmed that Ireland will miss its targets within five years (Flynn, 2014). This is an indication of the countries stuttering record in meeting emission reduction and energy savings targets. Implementing energy policy documents has proven difficult in Ireland.

The residential sector currently accounts for 27.1% of Ireland's overall energy use. Fossil fuel combustion for heating in residential dwellings accounts for almost 18% of non-EU Emissions trading Scheme (ETS) emissions for 2010 (DoEHLG, 2012). Improvement in the energy performance of residential buildings is therefore a critical factor in reducing Ireland's overall energy demand (DoEHLG, 2012).Recently, a decision was taken to reduce minimum densities in a number of key development areas in order to kick start development and to allow lower density housing. Meanwhile, it has been predicted that Dublin will require almost 37,581 new housing units by 2018. These predictions, together with the move to reduce densities pose a threat to the national energy efficiency goals. It remains to be seen how much emphasis will be placed on energy efficiency and related technologies when plans for the 37,581 new units begin (Housing Agency, 2014).

Residential buildings account for the highest rate of CO^2 emissions in Dublin City at 32%, and represent the biggest possible opportunity for CO^2 abatement in Dublin (Dublin City Council, 2010). An opportunity exists to ensure the highest standards of energy efficiency within new housing developments. With currently available and proven technologies, reductions in energy consumption on both new and existing buildings are estimated to achieve 30% - 80% (Dalene, 2012). Therefore it is imperative that such technologies are integrated into these potential homes, in order to ensure that Ireland gets as close as possible to meeting its emissions reductions target of 20%, by 2020. The paper outlines a transferrable example of achieving net zero energy in a new home, starting at initial development, throughout the building lifecycle, and suggests that such an approach is an appropriate method that can be implemented in Dublin. It emphasises how sustainable energy commitments and economic considerations can work in tandem to achieve a net profit over the life-span of a new home. It is suggested that energy savings begin making a net financial profit after 15 years. Considering that an average mortgage in Dublin is 30 years, it only takes the development half its life span to begin making a profit.

It is the intention of the paper to firstly provide a pretext by describing the current context with regard housing in Dublin (as most of Irelands new housing will be developed here). An outline of the existing plans and policy relating to energy efficiency follows, with focus particularly regarding new housing provisions. This will provide a clear indication of the existing framework within which initiatives to reduce emissions and increase energy efficiency operate. Subsequently, a methodology for the construction of a net zero energy residential building with the potential to be rolled out across Dublin is described. The intention is to provide an adoptable method, which will accelerate the pursuit of increased energy efficiency, limit carbon emissions of a new build and hopefully ensure the country is closer to meeting its 2020 targets. Following this an evaluation of the plans, policy and practice in respect of energy efficient housing in Dublin is outlined. As a result of this evaluation, and the outline of the building technology methodology, a series of recommendations are made, in order to help ensure increased energy efficiency, to reach efficiency targets, and to reinforce the role of planners.

In similar vein to a report on optimal cost for residential buildings under the Energy Performance of Buildings Directive (2010/31/EU - Recast), the focus of this paper is on Dublin, as the greater Dublin area contributes to a significant proportion of newly constructed dwellings, and is the focus of current construction activities (AECOM/SEAI, 2013). The focus of this paper is on new housing and energy efficiency and the opportunity to adopt new building technologies. It is not within the scope of the paper to discuss other measures such as retrofitting existing buildings.

"It is relatively inexpensive to include extra insulation and more energy-efficient equipment at the design and construction stage of a building but much more costly to retrofit into existing buildings" (DCC, 2010).

2 DUBLIN HOUSING IN CONTEXT

At this current time, our housing stock does not reflect the requirements of the countries demographic profile. Only 40% at most of our households are families with children, while at least 80% of the stocks are family houses. This represents a market shift and a new housing need.

Recent reports have predicted that a minimum requirement of 79,660 of new homes will be required in Ireland between 2014 and 2018 with up to 37,581 units (47%) of these needed in Dublin (Housing Agency, 2014) [Figure 1]. Over this period, 57% of new households in the Dublin region are calculated to be one or two bedroom homes, while three bedroom households account for only 18%. The construction sector has already shown signs of recovery, with output up 11.5%, year-on year in the first quarter of 2014, including a 14.1% increase in residential building work (CSO, 2014). Output is forecast to increase by 30% in the next four years (SCSI, 2014).

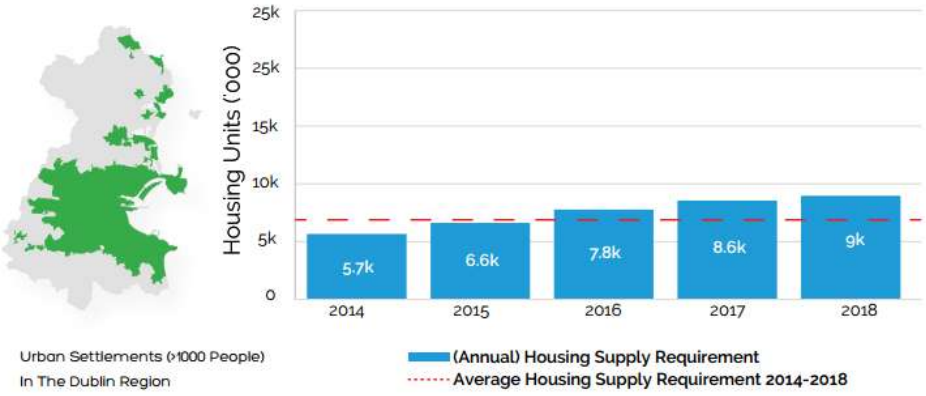


Figure 6: Dublin Housing Supply Requirement 2014-2018. Source: Housing Agency, 2014

These trends and forecasts (including Figure 1) represent an opportunity to oversee a new era of energy efficiency in the built environment in Dublin. Ensuring these homes implement the latest in building technologies will aid the endeavour for Ireland to meet EU energy targets. Enforcing greater energy standards in residential development will provide long term energy and monetary savings, both at home, and internationally.

Proposals for any new housing developments will be decided by the local authority within which it is located. Local authority planners in Ireland are guided primarily by development plans when deciding on whether to grant or refuse a development. This next section will outline European Directives, national and local policy relating to energy efficiency and new residential buildings. Chapter five will attempts to evaluate policy and practice with regard new housing development and energy efficiency. This is done in order to discover what the planning system can currently do to enforce energy technologies, and to suggest improvements to existing processes.

3 ENERGY EFFICIENCY PLANS AND POLICY

Local authority planners are primarily guided by the policies in development plans when making decisions on planning applications. Proposals for development must be seen to be adhering to the existent policy at national, regional, and local level in order to be given approval. Much of the policy effecting energy efficiency in Dublin and Ireland is influenced, or is in response EU policy. For the purposes of understanding the mechanisms available to planners in encouraging increased energy efficiency, the existent policy at the various spatial levels is outlined here. It is important to understand what instruments are available to planners in order to recommend improvements or changes that will ensure planners can affect meaningful change in respect of energy efficiency in Dublin.

Title	Function	Application to Roadmap	Related EU Directive
Towards 'Nearly Zero Energy Buildings' in Ireland planning for 2020 and beyond.[5]	Sets out the nearly zero energy performance levels and measures for new and existing buildings to 2020	Provides policy measures to 2020 for Low Carbon Roadmap	Directive 2010/31/EU on the Energy Performance of Buildings (Recast)[6]
Report on the Development of Cost Optimal Calculations and Gap Analysis for Buildings in Ireland under recast EPBD	Performs a lifecycle cost analysis to different buildings and measures	Informs performance levels for Building Regulations from a cost perspective	Recast EPBD
Part L of the Buildings Regulations Conservation of Fuel and Energy[7]	Sets minimum energy and carbon performance standards for new and existing buildings for works subject to Building Regulations	Sets minimum energy and carbon performance standards for new and existing buildings for works subject to Building Regulations	National Requirements and Recast EPBD
National Energy Efficiency Action Plan (NEEAP)	Sets out national energy efficiency target, and policies and measures to achieve it	Provides a list of energy saving (and CO_2 emission reductions) policies to 2020	EED
National Renewable Energy Action Plan	Sets out the national renewable energy targets and the policies and measures that will deliver them	Provides an overview of policies and measures to promote the use of energy from renewable resources	Renewables Directive
SI 243 of 2012 European Union (Energy Performance of Buildings Regulations) 2012[8]	Implements the provisions of the Recast EPBD in Ireland	Provides for BERs and databases for BERs to track progress towards low carbon buildings.	Recast EPBD

Figure 7 Policy documents related to the built environment and energy (Source, DoECLG, 2014)

Reduction of CO_2emissions in Ireland will be driven primarily by the EU's Energy Efficiency Directive, Energy Performance of Buildings Directive, and Part L of the Irish Building Regulations dealing with conservation of fuel and energy in buildings.

3.1 EUROPEAN UNION POLICY

A wealth of policy documents relating to energy efficiency and climate change has been ratified by the European Union. It is not within the scope of this study to analyse every morsel of policy, but to assess recent and relevant directives and initiatives as they relate to Ireland, and particularly new residential buildings in Dublin.

The need to increase energy efficiency is part of the triple goal of the '20-20-20' initiative for 2020, which means a saving of 20% of the Union's primary energy

consumption and greenhouse gas emissions, as well as the inclusion of 20% of renewable energies in energy consumption (Ec. europa.eu.). So far the EU is not on track to meet its energy reduction targets (Figures 3 and 4).

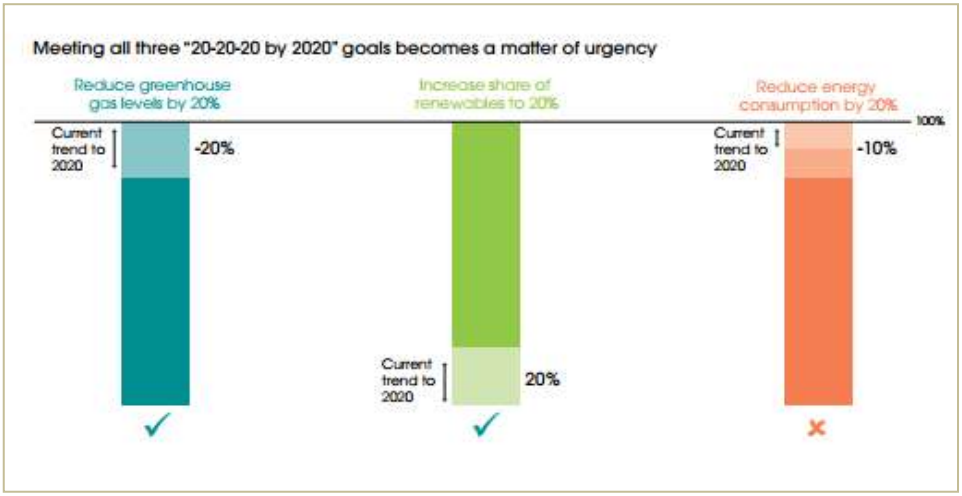


Figure 8 EU Energy Targets. Source EU Commission, June 2011 (See DCENR (2013))

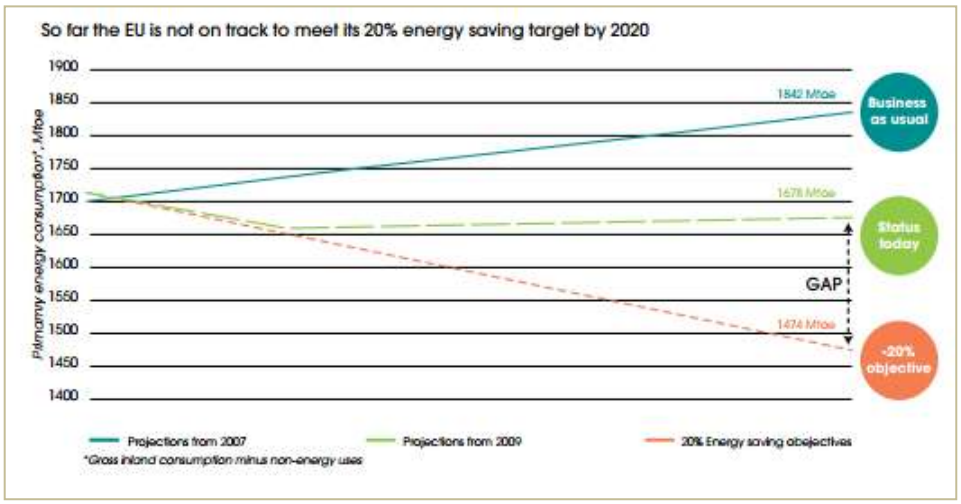


Figure 9: Progress to EU Energy Targets. Source EU Commission, June 2011 (DCENR (2013).

3.1.1 ENERGY PERFORMANCE OF BUILDING DIRECTIVE (EPBD)

This directive required Ireland to ensure, among other things that 'minimum energy performance requirements are established for new buildings', and 'a national plan is developed to increase the number of low or nearly zero-energy buildings' (DCENR, 2013). All new buildings by 2020 must be 'near zero energy

buildings'. The directive requires that from July 2013, all new buildings (public or private) be designed with an energy performance that leads to the lowest cost of that buildings over its economic life cycle (Lee, 2014). It requires that if measures such as increased glazing, solar panels, or energy management systems might initially increase the cost of a new building, but would result in savings over its life cycle, then these measures must be implemented in construction (Lee, 2014). Otherwise there will be a breach of the European directive, and subsequently the Irish Building Regulations.

3.1.2 DIRECTIVE 27/EU/2012 ON ENERGY EFFICIENCY

This directive requires member states to create long-term strategies aimed at mobilising investment for improving overall energy efficiency of housing through initiatives such as renovating existing residential and commercial buildings. This strategy is required to be published by April 2014 but has so far not been released in Ireland. The aim is to remove barriers and overcome market failures that thus far impeded efficiency in the supply and use of energy (ec.europa.eu). It obliges member states to set an indicative national energy efficiency target in a form of their choice. The statutory indicative national energy efficiency target for 2020 that Ireland has set in response to the directive is as follows (ec.europa.eu):

"20% energy savings in 2020 along with a public sector energy saving target of 33%"

Ireland is aiming to achieve 66% of this 2020 target by 2016, and by 2020, it is intended to have exceeded its target, reaching 107%. The government is proposing initiatives such as energy efficient boiler regulation, domestic lighting (Eco – Design Directive), Greener Homes Schemes (GHS), Warmer Homes Schemes (WHS), smart meter roll-out and better energy homes (residential retrofit).

3.2 NATIONAL POLICY IN IRELAND

3.2.1 IRELAND'S SECOND NATIONAL ENERGY EFFICIENCY ACTION PLAN TO 2020 (NEEAP II)

The plan includes an analysis of Dublin's current energy use and carbon dioxide emissions and sets out how the city can reduce its energy consumption. The report examines both the cost and the potential of these proposed measures.
It aims to go beyond the targets of 20% reduction by 2020. The plan contains 97 actions and measures that will contribute to meeting Ireland's obligations under the Energy Efficiency Directive, as well as the national energy saving target. It cites recent initiatives which have improved the energy efficiency outlook and states that most of the initiatives of the first NEEAP have been progressed. According to the Plan, Irelands mandatory minimum energy requirements for buildings are among the highest in Europe (DCENR, 2013). The Plan describes how the SEAI is supporting the development of Sustainable Energy zones from 2015. It is argued that the programme has the potential to stimulate a national move towards sustainable energy practice, creating savings for homes and businesses, and attracting investment (DCENR, 2013: pg 91).

This plan provides a detailed explanation of specific policy actions (DCENR, 2013). One of the Key Sectoral Measures of the Plan is as follows:

> *Residential: ''…encourage industry to work towards the building requirements outlined in the framework for achieving low-or nearly zero energy housing on a voluntary basis from 2013.*

Ireland's third National Energy Efficiency Action Plan is due to be published this year.

3.2.2 BUILDING REGULATIONS 2014

Part L of the Building Regulations 1997 - 2014 introduced requirements for buildings to be designed in such a way that enhances the energy performance of a building. This is done in number of ways:

- Limiting the amount the calculated primary energy consumption and related carbon dioxide, which are calculated by the Dwelling Energy Assessment Procedure (DEAP),
- Limiting heat loss and availing of heat gain through the fabric of the building,
- Water heating systems with efficient heat sources and effective controls,
- All oil and gas fired boilers should meet a minimum seasonal efficiency of 90%, and
- Educating the owner of the building about the fixed building services and their maintenance requirements, so that the building is operated in such a manner that uses no more fuel and energy than is reasonable.

There is only a small number of low energy buildings in Ireland. However, the situation is expected to change as the market responds to high standards of performance now in place, under the latest Part L requirements (DoECLG, 2014). The NEAAP(2) describes how the building regulations have delivered a 60% improvement in new-housing energy efficiency standards since 2005 (DCENR, 2013: 92).

Part L (Dwellings) has already made a significant move forward in the effort to establish zero energy buildings. It has been regarded as an intermediate step necessary to advance towards 2020 performance levels. A draft standard for dwellings in 2015, which will be Ireland's Nearly Zero Energy Buildings (NZEB) standard, is currently being developed for publication by or before 2015. This NZEB standard will be passed into legislation in the timeframe between 2015 and 2020 but may be applied on a voluntary basis once published (DoECLG, 2014). As well as this, by 2020, all new buildings in Ireland will have an Energy Performance Coefficient (EPC) and Carbon Performance Coefficient (CPC).

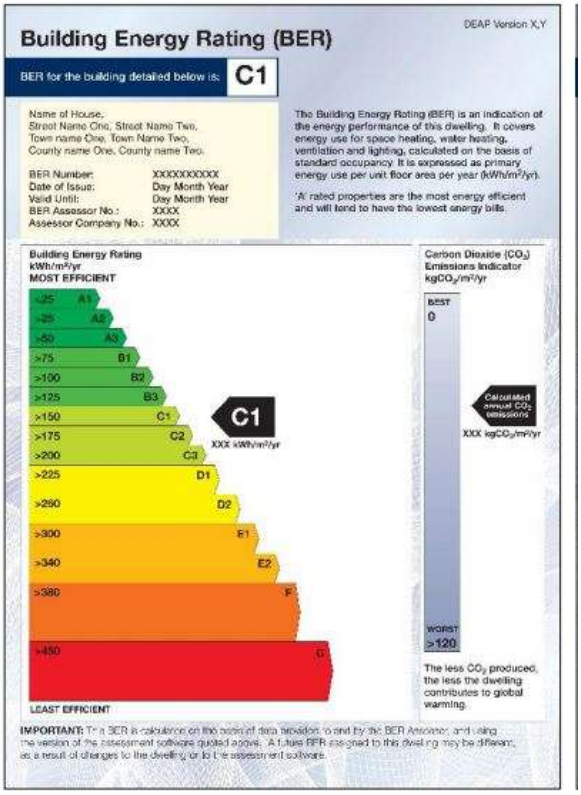


Figure 10: Ireland's Building Energy Rating (Source: Adene, 2013)

This will be transposed into Irish legislation and monitored through Building Energy Rating (BER) Methodology (Figure 5). The BER scale from A (best) to Z (worst) is based on primary energy use under standard conditions for space heating and cooling, ventilation, water heating, lighting, and associated pumps and fans. Each BER is also accompanied by an advisory report outlining a series of options and recommendations for improving the energy performance of a building. The standard will provide for further improvements to building fabric, enhanced levels of air tightness, improved thermal bridging details, as well as addressing the anticipated greater future deployment of improved ventilation strategies (DoECLG, 2014).

Figure 6 below illustrates the historical trends in the energy rating of new build Irish housing. It illustrates how achieving an A BER rating coincides with constructing a nearly zero energy building.

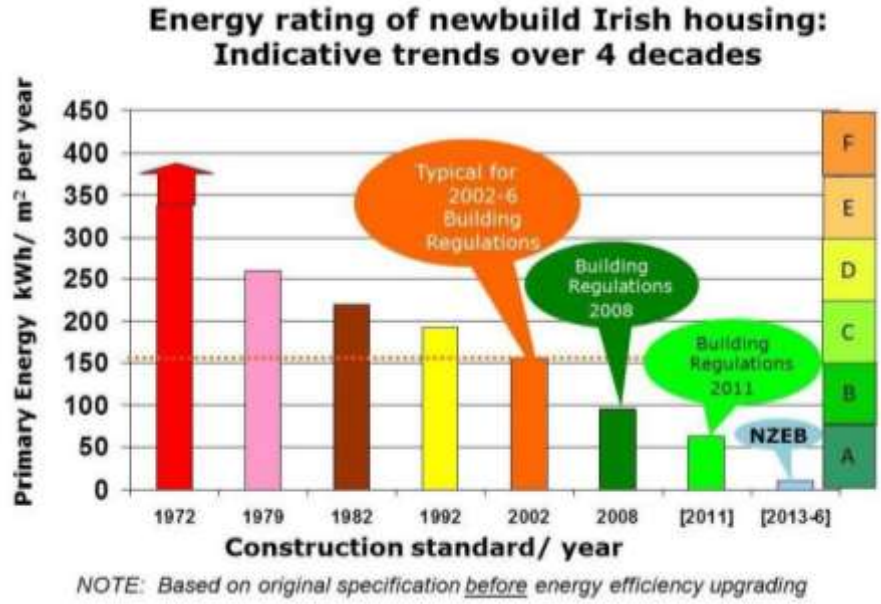


Figure 11: Long term progression of energy performance standards in newbuild dwellings in Ireland. Source: Adene, 2013.

3.3 COUNTY LEVEL

Dublin is divided into four administrative areas, Dublin City Council, Dun Laoghaire-Rathdown, South Dublin, and Fingal. Each county council has a separate planning authority which governs the area and decides on planning issues and proposals.

Figure 12: The four authorities in Dublin. Source: New Communities Partnership (2014)

3.3.1 DUBLIN CITY SUSTAINABLE ENERGY ACTION PLAN 2010-2020

Dublin City Council realizes that the current trend of energy consumption within the city is unsustainable and a clear and ambitious plan was needed both to halt and to reverse this trend of rising energy consumption. The ultimate aim of the SEAP is to have a positive impact on the environment through the reduction of CO^2 and other pollutants. The report examines sustainable energy actions both in terms of (a) their potential to reduce the cities carbon footprint and (b) the cost of the measures.

The following graph highlights the approaches that can be taken, the green indicating low cost effective measures of reducing emissions whilst the blue requires more costly investments e.g. new Windows and demolition of old houses. It follows that the economically most attractive measures are to the bottom-left of the chart, while the most expensive measures are at the top-right.

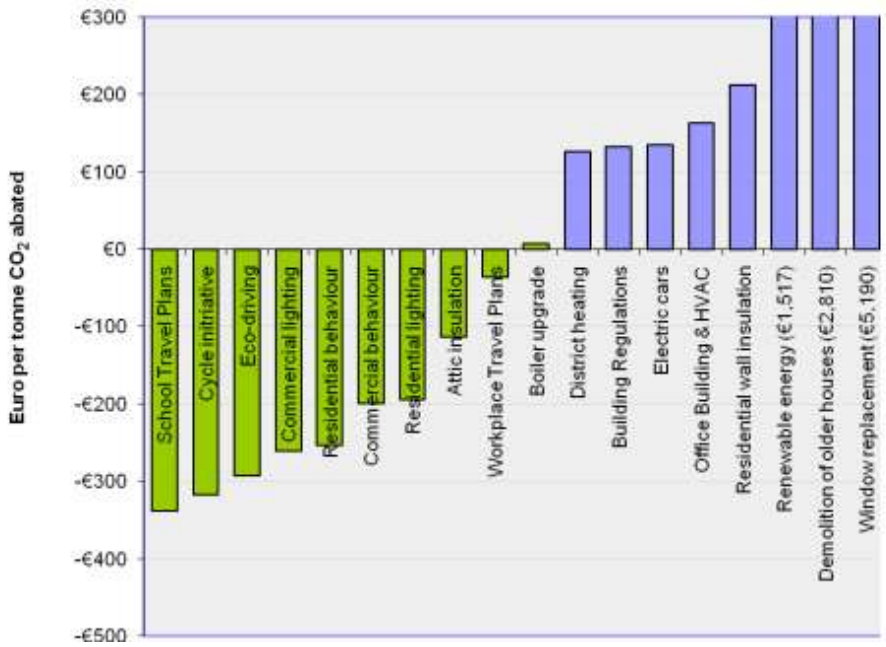


Figure 13: Carbon Abatement Costs (2010 – 2020). Source: DCC, 2010.

In relation to the efficiency measures and cost, the Dublin City SEAP states:

> *"It is relatively inexpensive to include extra insulation and more energy-efficient equipment at the design and construction stage of a building but much more costly to retrofit into existing buildings. For this reason Dublin City Council has, through a variation to the City Development Plan, specified high energy standards in all new residential and commercial building developments (DCC, 2010)."*

While a Draft Sustainable Energy Action Plan exists for South Dublin County, no Sustainable Energy Action Plans have been produced in draft form or otherwise for Counties Fingal and Dun Laoghaire Rathdown.

4 DEVELOPMENT OF NEW NEARLY ZERO ENERGY BUILDINGS INCORPORATING LOW CARBON TECHNOLOGIES

Currently available and proven technologies are estimated to achieve between 30% - 80% reductions in energy consumption on both new and existing buildings (Dalene, 2012). Therefore it is imperative that such technologies are integrated into potential new homes in Dublin and elsewhere, in order to ensure that Ireland gets as close as possible to its emissions reductions target by 2020.

Globally, buildings account for 40% of energy related Green House Gas Emissions (GHG) emissions. The majority of GHG emissions come from fossil fuel energy in the operations stage throughout the life span of the building. Upon completion of construction, the operation stage begins. GHG emissions from operations come from heating, cooling, and electrical uses (Dalene, 2011). These

are considered to be the "explicit" energy saving and carbon reducing works (Shaui and Li, 2009). Other GHG emissions come from transporting occupants to and from the building, how waste is handled and maintenance of the building (Dalene, 2012). These are the "implicit" works. Low carbon building technology should take into consideration both the "explicit" and the "implicit" low-carbon technology (Shaui and Li, 2009).

> *80-90% of GHG emissions of buildings are emitted in the operations stage during the life span of building, whilst 10-20% of GHG emissions are produced in the construction stage of the building (Dalene, 2012).*

Dalene's paper outlines a methodology for the construction of a building that produces net-zero energy. This methodology has the potential to be applied to new building stock in Dublin with the intention of meeting European standards. There are many definitions for zero energy buildings, however it can be considered that a building that produces equal or more energy than it consumes is a net-zero energy building (Dalene, 2012).

This is preferably achieved through on site, renewable resources. Typically, using heat sources from solar thermal and geothermal energy production systems together with renewable photovoltaic systems and wind generators, fossil fuel based energy is minimised. The building would normally remain attached to the electric grid with a net meter installed to measure the difference between electrical energy produced and electrical energy consumed over a period of time (Dalene, 2012).

Phase 1 of Dalene's methodology involves a carbon audit to determine the GHG emissions associated with the construction stage of the building. The process of this audit involves counterbalancing GHG emissions with carbon mitigation programs, which allows for a carbon neutral status to be achieved (Dalene, 2012). It is also essential to carry out a life cycle analysis (LCA) which accounts for GHG emissions during the buildings entire life cycle, from the gathering of raw materials to the disposal at the end of the buildings life. However, for the purposes of claiming a building is net-zero energy, the building needs to operate for one year while energy use is monitored. LEED, or Leadership in Energy and Environmental Design[15] protocols were also followed, which is an internationally recognised green building certification system. LEED awards points for certain criteria as set out below (Dalene, 2012):

- Innovation and design process
- Location and linkages
- Sustainable sites
- Water Efficiency
- Energy and atmosphere

[15] Leadership in Energy and Environmental Design: http://www.usgbc.org/leed

- Materials and resources
- Indoor environmental quality
- Awareness and education

If phase 1 of this methodology were to be followed when delivering the 37,581 new residential buildings in Dublin, an accurate representation of energy efficiency could be provided for the new building stock and high standards could be achieved under the European EPC and CPC.

Significantly, when integrating new building technologies, communication and collaboration needs to dramatically increase in order to achieve successful outcomes (Dalene, 2012). In other words, the successful delivery of any such project is dependent on effective stakeholder involvement. To this end, the American Institute of Architects developed a concept of integrating design known as integrated project delivery (IPD). IPD brings the design team, owner, contractor, and trade contractors together during the early stages of the design phase. This fosters collaboration, team-work, information sharing, shared risks, and shared rewards. Ultimately, the process ensures maximum efficiency and successful project delivery from all parties involved (Dalene, 2012; Winstanley, 2011). This is especially true, considering, the process creates a sense of ownership and pride during the design process for all parties, making it difficult to place blame on a single person or entity. Therefore, information is managed more efficiently both during design and construction, which creates a more pleasurable working environment (Figure 9) (Dalene, 2012; Winstanley, 2011). Such an approach would prove pivotal in the delivery of a new housing stock in Dublin. The Irish planning system is often criticised for its disconnect between what the markets want and what can actually be built. Developers will only build what markets can sustain, whilst planners need to assess how market needs can be provided. With collaboration between all stakeholders at the outset, conflicts between market demands and planning policy can be minimised and therefore, objectivity can be created at say pre-planning consultation stage, allowing for the adoption of a viable strategy for delivering the type of housing people desire, while also ensuring energy efficiency. Additionally, time and cost savings would be produced through the avoidance of any conditions retrospectively imposed by planning authorities; instead, these considerations would be dealt with at the outset of the proposed development.

Figure 14 Integrated Project Design Methodology. Source: Winstanley, 2011

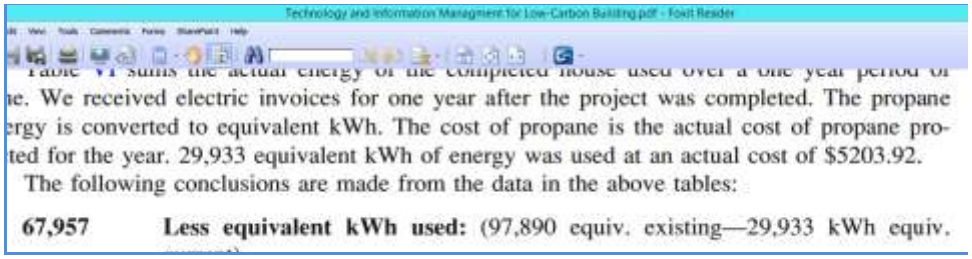
Contemporary engineering techniques are sufficiently advanced to accurately calculate and project energy efficiencies, production and consumption. This is significant given that weather is a variable in renewable energy production and consumption that cannot be controlled. However, weather's impact on energy consumption can be controlled by reducing energy loss in winter and solar heat gain in summer.

Essentially, how occupants operate building is a variable that cannot be controlled. In commercial buildings, the variable can be assigned to the buildings manager instead of the occupants, whilst in homes energy use habits among occupants are very personal and can vary greatly. Therefore, incorporating optimum design, engineering and green technologies for energy reduction, is highly dependent of how the occupants of these new buildings in Dublin use energy (Dalene, 2012). It is expected that the owners of green buildings make lifestyle changes through education and awareness. Although, certain changes can be enforced upon building occupants by restricting water faucets and using less water to flush a toilet, for example. Nonetheless, in most cases all that can be done, is install automated energy technologies which automatically turn off lights, air-conditioning, heating systems etc. (Dalene, 2012). The house in Dalene's paper was rated with a Home Energy Rating System (HERS)[16] Index with a score of 25. This indicates a projected 75% energy reduction from the HERS standard home. If this methodology were to be used for the new housing stock in Dublin, the BER rating system would be implemented at this point. Nevertheless, the actual energy reduction for this case study was 69.42%, which amounted to a 51.09% cost saving (Figure 10) (Dalene, 2012). Significantly, the pay-back period for the energy reducing technologies used is 15.7 years, if the energy saving usage continues on the same track as the first year and the energy costs remain the same (Dalene, 2012). Given that a mortgage within Dublin averages at around 30 years, the energy savings begin making a net profit after

[16] Home Energy Rating System: http://www.hersindex.com/

15 years or within half the life span of the house, although it is accepted that the lifespan of a house lasts longer.

> *"With currently available and proven technologies, reductions in energy consumption on both new and existing buildings are estimated to achieve 30%-80%. When the costs of implementing the energy reduction technologies are offset by energy savings, there is potential for a net profit over the lifespan of the building"* (Dalene, 2012, Pp. 11).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...e. We received electric invoices for one year after the project was completed. The propane ...ergy is converted to equivalent kWh. The cost of propane is the actual cost of propane pro- ...ted for the year. 29,933 equivalent kWh of energy was used at an actual cost of $5203.92.

The following conclusions are made from the data in the above tables:

67,957 **Less equivalent kWh used:** (97,890 equiv. existing—29,933 kWh equiv.

Figure 15 Energy and Cost Saving Results. Source: Dalene, 2012

The CO^2emissions analysis also proved positive. There was a reduction of 11.36 Metric Tonnes of fossil fuel based energy in the first year, this accounts to 43.82%. It is important to note, that the greatest impact in reducing CO^2emissions in building operations is achieved by electricity usage from the grid. An additional benefit of focusing on grid electricity for CO^2emissions is that it will also have the greatest impact on overall energy reduction (Dalene, 2012). Therefore, the focus should be on reducing electrical usage from the grid compared to other energy types as it will have the greatest impact over the lifespan of a building. It is stressed that there is a need for a paradigm change if there is to be a successful transition from fossil fuels to renewable forms of energies (Dalene, 2012).

5 EVALUATING PLANS, POLICY AND PRACTICE IN RESPECT OF NEW ENERGY EFFICIENCY HOMES

As has been outlined in this paper, there is a wealth of plans and policy in place in respect of energy efficiency in Dublin, and Ireland. Much of it is informed by the legislative instruments introduced by the EU. The Environmental Protection Agency recently stated that even in a best case scenario, with all measures under the National Energy Efficiency Action Plan (NEEAP) and other plans being implemented, Ireland will fail to meet its 2020 emissions targets. This could result in the country having to pay up to €300 million for emissions credits from other EU member states (Flynn, 2014). This suggests that either the policy in place to meet the EU targets has not been sufficient, or that there has been a failure to implement the measures contained within plans. Paradoxically, according to Dublin City Council's 2013 Sustainability Report, Dublin is on track to meet its 20% renewable energy target (Gorey, 2014).

The Energy Performance of Buildings Directive requires that all new buildings by 2020 be 'near zero-energy buildings'. There is serious risk of Ireland missing a considerable opportunity to increase energy efficiency in the built environment by not making it compulsory for the required 79,660 homes (37,581 in Dublin) to implement the newest efficiency technology to ensure they are 'Near Zero Energy'. By the time it is compulsory for all new buildings to be Near Zero Energy, Ireland could have missed the boat. It is encouraging to note however, that a draft standard for Nearly Zero Energy Buildings is due for publication by or before 2015 (DOECLG, 2012). This standard is likely to be passed into legislation between 2015 and 2020, but crucially, may only be applied on a voluntary basis.

Within Irelands second National Energy Efficiency Action Plan there is recognition that due to economic uncertainty it will affect the ability to meet its targets. Based on the estimates contained in the Plan, Ireland will surpass its 2016 target, assuming a full roll out of the measures contained therein (DCENR, 2013: pg 12). The government actually targeted a rate of energy savings larger than the EU target of 20% by 2020. These are ambitious targets, and must be admired, however as has been previously stated, Ireland is set to miss these aims. The commitment to create an implementation group to ensure that all actions contained in the National Energy Efficiency Plan are delivered will only be successful if the groups are given robust powers, with the ability to punish non complying parties. It remains to be seen what powers will be attributed to the group.

One of the successes of recent energy efficiency measures include the new building energy standards (in the Building Regulations) which have resulted in the reduction in the permitted primary energy usage for a typical new dwelling from 200kWh per m^2 (kilowatts per hour, per metre squared) to 90kWh per m^2 between houses built in 2002 and 2008. A reduction to 60kWh per m^2 is now the target. It is a policy of the NEEAP to develop a framework for achieving zero-energy housing by 2020. It is considered that an appropriate method can be established that reflects the individual attributes of Dublin. Chapter 4 of this report outlined the recommendations of this paper in respect of introducing what is felt is an appropriate efficient technological solution for housing in Dublin. The existing difficulties in installing energy efficiency measures primarily centre around market failures such as the upfront cost of measures, the length of time required for measures to pay back savings, and the ‘hassle’ involved in planning and carrying out work (DCENR, 2013 pg: 85). There remains a challenge in securing the financing and willpower to implement the low carbon housing solution outlined here.

Further successes within Dublin include the requirement that from 1st January 2008 all planning applications submitted to Dublin City Council include a statement, certifying that the proposed development conforms with the energy rating targets for Dublin City Council. The council has also supported the provision of Carbon Neutral Housing programmes within Dublin City, such as in Raleigh Square, Dublin 12, and York Street (DCC, 2010: 20). These examples of low energy housing are few and far between, however (DoEHLG, 2012). Local Authorities have a very important role to play in achieving energy targets. Local

Authorities can further contribute through the preparation of robust, co-ordinated and sustainable Renewable Energy Strategies. It is considered that further measures and responsibilities could be placed in the hands of planners in attempting to achieve further efficiency targets. These include a greater responsibility in enforcing energy standards in new build.

The NEEAP states that there is major responsibility on the private sector regarding energy efficiency and that it is not sufficient for local authorities to act alone in order to meet these challenges. The public and private sector will need to work with other bodies such as research institutions so that the challenge is comprehensively tackled. All sectors within the development process will need to play an active role in achieving efficiency targets. While business and technology are very important, the challenges of climate change cannot be met without the active participation of Dublin's local communities. The NEEAP describes how"the combination of behavioural changes and new technology can reverse the present upward trend in energy consumption, and associated CO^2 emission significantly towards meeting the Irish and EU target of a 20% reduction by 2020''.

Planned future energy policy documents in Ireland include the Climate Action and Low Carbon Development Bill, and the Low Carbon Roadmap to 2050. The Bill is set to include consideration of the impact of carbon mitigation policies on Ireland's competiveness and to ensure the adopted measures reflect the lowest cost options available (DoECLG, 2014). There exists a sizeable challenge in balancing the implementation of energy efficiency measures and in ensuring the recovery and sustenance of the Irish economy. According to the recent (April 2014) Scoping Report on the proposed Low Carbon Roadmap, Ireland is committed to implementing the EU Energy directives through 'aligning the Roadmaps policy tools with requirements of the directives' (DoECLG, 2014).

It is worth reiterating that while a Sustainable Energy Action Plan exists for the Dublin City Council area, no such plan is present for Counties Fingal or Dun Laoghaire Rathdown, while a draft plan is in place for South Dublin (the four counties together make up the Dublin region).

It is accepted that Ireland cannot meet its emissions targets of 20% by 2020, based on the current policy mix, and even in a best case scenario with all policy instruments being implemented. In addition, as a result of the observations and evaluations outlined here, it is considered that the current policy, plans and practice in place is not sufficient to deliver energy efficient technologies within potential new housing in Dublin and Ireland. Therefore, a goal of this paper was to provide recommendations to changes in policy and practice, in order to provide energy efficient homes in Dublin and Ireland in the coming years.

6 RECOMMENDATIONS

The predicted need of up to 79,660 houses in Ireland (and 37,581 in Dublin) by 2018, presents both an opportunity and a threat to the country's 2020 energy efficiency targets. Ensuring the latest in emissions reducing technology in potential development would provide a timely boost to meeting Ireland's emissions targets. As previously mentioned, a draft standard for dwellings in 2015, which will be Ireland's Nearly Zero Energy Buildings (NZEB) standard, is currently being developed for publication by or before 2015. This NZEB standard will be passed into legislation in the timeframe between 2015 and 2020 but may be applied on a voluntary basis once published (DoECLG, 2012). With this, there are current proposals to implement voluntary building standards regulation for apartment buildings, which include proposals such as increasing minimum floorspace. However, there is no incentive, financial or otherwise given to developers to adhere to these regulations. It is therefore recommended that the NZEB standard be made compulsory once published, considering the projected housing need is from now until 2018. Any implementation of compulsory legislation after this would be too late.

Nonetheless, it must be considered that there have been suggestions that the challenges of achieving low energy building standards are increasing as a result of the low level of construction taking place which is a consequence of the economic downturn. In particular, issues such as additional costs, creating capacity in construction skills and experience levels, as well as extended turnaround times from planning approval stage to completion stage are presenting tangible barriers in the construction sector (DoECLG, 2012).

The Department of the Environment, Community and Local Government (DoECLG) and the Sustainable Energy Authority of Ireland (SEAI) are responsible for maintaining and advancing progress towards achieving nearly zero energy buildings. The SEAI in conjunction with the Central Statistics Office (CSO) have agreed to geocode all registered BER's, through Geographic Information Systems (GIS). However, this should be taken further, making it compulsory for local authorities throughout Ireland to track carbon emission reductions spatially through the use of GIS and My Plan[17]. In this way, a centralised method for assessing BER's can be established and enforced, rather than the current disparate approach adopted by the SEAI and outside bodies. The benefit of this is that it will create a reliable database and establish an initial reference point for energy usage and consumption of newly built homes and thus, allow for well-founded enforcement procedures.

However, the authors of this paper are of the opinion that a national research centre for physical planning and construction research should be established for these purposes. Ireland possessed the equivalent through An Foras Forbartha, which was established by the government to carry out environmental research, training and information services, covering physical planning and development; building and construction; road construction, road traffic and road safety and water and sewage. Regrettably, it had to be discontinued due to economic

[17] My Plan tool: http://www.myplan.ie/viewer

constraints. With the establishment of a similar autonomous government body, reliable data could be created.

This is significant, as it will create a certified monitoring process and therefore, add certainty to investment of zero carbon homes. It would allow for data transparency and fraud prevention by limiting the need of external bodies and most importantly, provide quality assurance. First, planning authorities could use the data to create well founded enforcement practices. Second, developers and consumers could be assured that energy standards will be met, which in turn would qualify energy savings throughout the lifespan of a building. A certified monitoring process would also allow for a low risk introduction of financial instruments into energy saving initiatives, as well as create confidence in the reshaping of policy. Moreover, findings would also indicate when it would become necessary to adapt or alter such enforcement practices, recommendations, initiatives and policies.

> *Monitoring the implementation of recommendations is crucial to keep track on the actual improvements in building energy performance, especially in the building stock* (Adene, 2013, Pp. 17).

Significant considerations to audit, monitor and benchmark would be:

1. Investment Cost;
2. Energy savings and/or CO^2savings;
3. Payback Period;
4. Construction Methodologies; and
5. Changes in Energy Rating Systems

A further issue in this regard is the tradition of Irish people favouring semi-detached housing in sprawling, suburban locations. If future housing development is to follow in this vein, then our emissions target may prove unattainable. The challenge for planners, among others, is creating a paradigm change in living preferences in the Irish population, so that apartment living is deemed desirable, similar to many of our European counterparts. It is recognised that a balance needs to be struck between energy concerns, and design and desirability in new housing developments. Design is key, and creating desirable, well located (e.g proximate to public transport), closer together apartments and houses could be the crux on which we pass or fail our 2020 commitments.

It is important to note that behavioural need has changed. Our housing stock does not reflect the demographic facts. Within the period between 2014-2018, it is estimated that 57% of all households in the Dublin region will be for one and two person households, while three person households will account for a further 18%. The significance of this, is that three quarters of all households will be for three people or less (Housing Agency, 2014). This contradicts the traditional housing need in Ireland for a desire of family homes. This provides an opportunity for planners and the planning practice to create attractive higher density living units that are also energy efficient. However, it must be remembered that this new housing need is spatially specific and one size will not fit all. Therefore, planners will need to be creative and adopt a case by case methodology.

In keeping with the ethos of the 1963 legislation, planning operates in the interests of the common good and society as a whole and must take precedence over a developer-led or market-driven approach. It is crucial to always remember that markets change and therefore, planners should not plan for markets. Rather, planners should plan for communities and not for profit. Definitions of viable planning should focus on creating developments that have a lasting functional and cultural life within society, not something that can be built next week.

This lays down a challenge, not just for professional planners, but for all disciplines engaged in place making. How do we ensure that good quality, affordable, efficient, well designed houses are built and that place making remains at the forefront of the planning and housing agenda? Of course the availability of finance will dictate the viability of such recommendations. A possibility could be to follow the example set in Denmark, Germany, the Netherlands, and elsewhere, where housing is sometimes part owned/funded by councils. There exists potential for the development of a national investment bank, with the specific purpose to aid zero carbon construction. Savings made on energy costs from the development of energy efficient homes for example, could be used to pay back investment on capital, therefore creating incentive for such development. However, the research needed for the creation of such a model goes beyond the scope of this study.

Nonetheless, as previously described, it is suggested IPD methodology is adopted when bringing together various disciplines for development, as the process ensures maximum efficiency and successful project delivery from all parties involved (Dalene,2012; Winstanley, 2011). The process creates a sense of ownership and pride during the design process for all stakeholders and information is managed more efficiently both during design and construction (Dalene, 2012; Winstanley, 2011). Such an approach would prove pivotal in the delivery of a new housing stock in Dublin. With collaboration between all stakeholders at the outset, conflicts between market demands and planning policy can be minimised and therefore, objectivity can be created. This would allow for the adoption of a viable strategy for delivering the type of housing people desire, while also ensuring energy efficiency. Additionally, time and cost savings would be produced and limit the non-technological barriers for implementation, such as:

- Cost of extra materials & longer time on-site;
- Risk of legal proceedings against architects;
- Developers are not end-users (i.e. capital vs running costs); and
- Lack of existing examples (DCC, 2010: pg 26).

Essentially, behavioral changes will be required to ensure considerable decreases in the energy use of the built environment. It is not sufficient to build energy efficient homes, how occupants operate building is a variable that cannot be controlled. In homes, energy use habits among occupants are very personal and can vary greatly. Therefore, incorporating optimum design, engineering and green technologies for energy reduction, is highly dependent of how the occupants of these new buildings in Dublin use energy (Dalene, 2012). It is

expected that the owners of green buildings make lifestyle changes through education and awareness. Overall, it is recommend that the method of implementing building technologies in new homes, outlined in Chapter 4, be introduced in Dublin, and Ireland. Dalene's methodology has successfully shown that building net zero carbon homes is both economically and environmentally friendly. However, it should be noted that the methodology was implemented for the construction of one family unit. For this reason, it should be reassessed, adapted and made suitable for a higher density development that is required for Dublin and Ireland's new housing need of one and two person units.

It is argued that the method of building technology outlined in this paper is an appropriate measure to implement within potential new housing stock, and that it should be included within the National Energy Roadmap.

7 CONCLUSION

The recent EU directive on energy efficiency (2012/27/EU) was deemed necessary due to the European Commission's assessment that the Union is unlikely to reach its target of a 20% reduction in energy emissions by 2020 based on the current policy mix. Ireland meanwhile, was recently referred to the European Court of Justice for failing to meet emission reduction targets (Europa.Eu, 2014), while the Environmental Protection Agency confirmed that Ireland will miss its EU emissions targets of 20% within five years (Flynn, 2014).

It has been predicted that Dublin will require almost 37,581 homes by 2018. It remains to be seen how much emphasis will be placed on energy efficiency and related technologies when plans for the new homes begin (Housing Agency, 2014). The residential sector currently accounts for 27.1% of Ireland's overall energy use, while residential buildings account for the highest rate of CO^2 emissions in Dublin City at 32%. Improvement in the energy performance of residential buildings is therefore a critical success factor in reducing Ireland's overall energy demand (DoEHLG, 2012). With currently available and proven technologies, reductions in energy consumption on both new and existing buildings are estimated to achieve 30% - 80% (Dalene, 2012). Therefore it is imperative that such technologies are integrated into these potential homes, in order to ensure that Ireland gets as close as possible to meeting its 2020 emissions goals.

The paper outlined the existing policy relating to energy efficiency at various spatial levels from EU to National and local Irish level. The intention was to provide a clear indication of the existing framework within which initiatives to reduce emissions and increase energy efficiency operate.

Through evaluating the plans, policy and practice in respect of new energy efficient homes, it is argued that either the policy in place to meet EU targets has not been sufficient, or there has been a failure to implement measures contained within plans, due to the likelihood of Ireland missing its emissions targets. This is in spite of the assertion that Dublin City is on track to meet its targets (Gorey,

2014). It is likely that Ireland will miss an opportunity to maximise energy efficiency in new homes, due to the voluntary nature of existing and proposed standards, such as the NZEB standard due for publication next year. However, even with compulsory standards, there remains challenges regarding financing and willpower.

A number of recommendations have been made in order to achieve energy efficiency in the built environment, particularly with regard new housing. It is suggested that local authorities in Ireland track carbon emissions reductions spatially through the use of GIS and other tools, in order to establish a reference point for usage of newly built homes. The development of a national research centre for physical planning and construction research could take responsibility for this in order to create a certified monitoring process, to provide certainty to investment in zero carbon homes. It will be necessary to encourage people that more sustainable forms of housing are viable and desirable option. There exists an opportunity for planners to play a key role in the creation of attractive, higher density, energy efficient living units. An ongoing challenge will be ensuring good quality, affordable, efficient, well designed homes are built.

The paper discussed a transferrable example of achieving net zero energy in a new home, starting at initial development, throughout the building lifecycle, and suggests that such an approach is an appropriate method that can be implemented in Dublin. It emphasises how sustainable energy commitments and economic considerations can work in tandem to achieve a net profit over the life-span of a new home. It is suggested that an IPD methodology be adopted when bringing together various disciplines for new housing development, as the process ensures maximum efficiency and successful project delivery from all parties involved (Dalene, 2012; Winstanley, 2011). It is not sufficient just to build energy efficient homes; how occupants operate the building is variable that cannot be controlled. As a result behavioural changes must be strived for in end users. Significantly, it should not be ignored that new development can only add to carbon emissions. Therefore, new methods of adaptation and rehabilitation of the existing housing stock should also be assessed to meet the requirement of the new housing need. Although, the construction of new developments could be made rational and compelling if the developments themselves could go a step further then boasting an energy neutral status and actually generate energy for use on the Irish national grid.

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LIST OF ABBREVIATIONS

BER	Building Energy Rating
CPC	Carbon Performance Coefficient
CSO	Central Statistics Office Ireland
DCC	Dublin City Council
DCENR	Department of Community, Energy and Natural Resources
DCENR	Department of Community, Energy and Natural Resources (Ireland).
DEAP	Dublin Energy Action Plan
DECLG	Department of the Environment, Community and Local Government
DoECLG	Department of the Environment Community and Local Government (Ireland)
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Coefficient
ETS/non-ETS	EU Emissions Trading Scheme
EU	European union
GHG	Greenhouse Gases
GHS	Greener Homes Schemes
HERS	Home Energy Rating System
IPD	Integrated Project Delivery
kWh	Kilowatts per Hour
LCA	Life Cycle Analysis
LEED	Leadership in Energy and Environmental Design
NEEAP	National Energy Efficiency Action Plan
NZEB	Near Zero Energy Building
SCSI	Society of Chartered Surveyors Ireland
SEAI	Sustainable Energy Authority of Ireland
WHS	Warmer Homes Schemes

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Challenges in achieving sustainable energy goals in historical cities of the European Union: a reflexive debate about contemporary urban development and the purpose of planning

Agata Krause, Ioanna Katapidi, Eleni Malekkidou

ABSTRACT

The purpose of this paper is to prompt a debate about opportunities and challenges of sustainable development in historic districts. Taking into account the development of urban planning thought and with a special focus on energy-efficiency, we aim to evaluate how values embedded in energy efficiency policies shape the development of urban historic districts. In the paper, we stress that urban heritage sites are significant part of building stock and could contribute to sustainable development goals (EFFESUS 2011). Historical areas are also places of high value, but also vulnerability (Phelps et al. 2002; Lewis et al. 2013). We also claim that the European Union plays increasingly important role in establishing limits of available interpretations of sustainable development by defining breadth and depth of values and norms in the context of its policies.

We use reviews of selected policies of the European Union and its Member States with regard to energy efficiency in order to identify key areas of focus of policymakers and values they reproduce. The analysis leads to the arguments that (i) there is a void of policies on energy efficiency targeting at historical areas, in the context of EU; (ii) existing policies with regard to energy efficiency point to the role of public sector officials to guide progress towards sustainable development and that the process involves a range of challenges; (iii) the domination of scientific logics, while downplaying the role of lay and local knowledge, in the context of policies of the EU and its Member States.

Key words: planning theory, energy efficiency, sustainable development, historic cities

1 INTRODUCTION

Contemporary urban planning theory is not a homogenous field. It has been established that it represents *a collage of* multiple planning theories(Alexander 2012). The theories are grounded in various research traditions and seek to explain urban change from different perspectives, which often embed competing and contradicting ideas. They constitute urban planning as 'philosophy' rather than a set of rules (Taylor 1998). In this vein, our intention is not to deliver a comprehensive overview of these complex debates across various contexts (and regional differences involved), but to signpost two domains of values and positions that shape policies and practices in urban planning: (i) how public-private, state-market relationships define outcomes of urban planning (ii) philosophy of science, which includes reflections about the interplay between various scientific – technological values and environmental and societal values in the context of planning policy and practice. The two 'streams' of urban planning theories are intertwined and have been debated with regard to an alleged shift from modernism to postmodernism and/or structuralism to poststructuralism in urban studies (Madani-pour 1995; Hill 2000), which is a subject of a reflection below.

Urban planning has been considered a state domainin Western societies since the 1950s and 1960s(Taylor 1998). In line with Keynesism, this 'traditional' urban planning is based on the idea that market principles are wholly or partly unacceptable and that 'planning' is then to 'correct' market (Brindley et al. 2013).It has assumed the role of local authorities is to draw plans and give, or not, planning permission. It has also embedded structural positions towards 'rationality' of human beings and attributed a special role to a 'a planner' as a trained individual, a 'specialist', having superior powers in deciding about urban development(Albrechts 2004). In this vein, scholars interested in planning theory have also argued that the 'construction' of a planner as a technocrat has been embedded in redefinition of urban planning as a specialist, 'scientific' field (Rydin 2007). The latter, in turn, originates 'Enlightenment', which entailed the prevalence of scientific logics, knowledge claims in a certain period of time(Kuhn 1977). It involved trust in science and technology and ability to guide historical progress whereby "rationality" was equated with science' (Taylor 1998, p. 160), or that scientific outputs as they can 'speak truth to power (…) growth of scientific knowledge as the driving force of social progress and individual "pursuit of happiness' (Hoppe 1999).

Over recent three decades, scholars and policy makers have pointed to a shift from this 'traditional' understanding of urban planning towards more bottom-up approaches, broadly constituting a 'postmodern', 'poststructuralist' turn in planning (Rydin 2007; Directorate-General for Regional and Urban Policy 2013b). It manifested itself in the form of re-emergence of the notions of 'participatory planning', and 'urban partnerships' in policymaking and practice(Healey 1995; Healy et al. 1995; Brindley et al. 2013). In this context, 'new' values of urban planning, such as pluralism, complexity and diversity have been put into spotlight(Taylor 1998). It has been accompanied by decline of faith in development being acquainted with progress (Madani-pour 1995, p. 23) and

entailed that knowledge is held 'outside the planning organization and by groups other than professionally trained planners' and is associated with 'an epistemology of multiplicity' (Rydin 2007, p. 55). Also, the 'postmodernist approaches'have pointed out that a local plan embeds contradicting ideas and became a 'ground', where various (political) interests and preconceptions collide (Healy et al. 1995; Rydin 1998; Brindley et al. 2013).

The 'postmodern' or 'poststructuralist' turn in urban planning has been said to entail increasing interests of public actors in a market producing state outcomes and raise of prominence of market-oriented (entrepreneurialism and competitiveness) ideologies in Western European countries (Healy et al. 1995; Newman and Thornley 1996; Taylor 1998; Brindley et al. 2013). Strengthening of the role of the private sector in urban development has been associated with fiscal crisis (Graham 1995) and restructuring of urban economies (Harvey 1989). It has also allegedly also lead to 'hollowing out' the state (Jessop 2002). The arguments, claims about this alleged turn in urban planning, policy, theory and practice have been raised also in the context of discourses about sustainable development and reopened the debate about epistemologies, values and norms, and the purpose of planning (Rydin 2007).

The notion of 'sustainable development' has been of interests to policy makers, academics and planning practitioners over last 30 years. Recently, the focus on energy-efficiency has become one of the most significant elements of sustainable development policy and practice. Policymakers, in the quest of 'achieving' sustainability have promoted greater knowledge exchange across the borders (Dolowitz and Marsh 2000; Evans 2009; Benson and Jordan 2011). In this context, however, a range of scholars point to 'dangers' relating to uncritical thinking about policy development and implementation, which entails that the subject of the lessons learning represents dominating, in a particular time, 'logics' and 'definitions' of best practices(Owens et al. 2006). The issues, in turn, lead to a range of questions about the nature of contemporary urban development, for instance, whether people and places become alike (Relph and Charles 1976; Relph 2007), or if the European Union act as a convergence agent (Pallagst 2006). More importantly, however, it opens arrays of questions about the dialogue between different types of knowledge in the field of urban development (Fischer 2000), and 'glocalisation' and power dynamics in a local context (Swyngedouw 2004).

In order to unravel the influence of policies on values and norms in urban planning, the paper approaches these, complex by nature processes from within social 'constructionist' tradition. It entails that reality is a 'social construct' and that language plays active role in constituting the reality (Berger and Luckmann 1966). Our theoretical approach also involves ideas that power relations work in 'overt' and 'covert' ways, especially that possible interpretations of social phenomena are bounded by criteria used for 'structuration', 'ordering' of a discourse (Foucault and Gordon 1980). In our paper, the theoretical approach is used to study of a range of secondary data sources with regard to policies of the European Union on energy efficiency and the way they are implemented within Member States,

based on predefined focus on the notions of philosophy of science and the roles of public and private sectors in urban development.

1.1 ROLE OF THE EUROPEAN UNION IN DEFINING ENERGY EFFICIENCY GOALS

The European Union has played an important role in establishing values and raising awareness in many aspects relating to urban planning. It has played strong regulatory role in such policy areas as Environmental Directives, spatial policies (Trans European Networks), cohesion policy and Structural Fund (Directorate-General for Regional Policy and Cohesion 1997). At the same time, it has, however, provided considerable 'space' for national governments to adopt to 'new measures' and has attempted to capture differences between the urban planning systems, create umbrella for planning initiatives (Newman and Thornley 1996).

Eco-efficiency goals have been part of mainstream policy of the European Union in various areas, especially in the European Union Sustainable Development Strategy developed by the European Council in Göteborg (European Commission 2001), Renewed Sustainable Development Strategy (2006), or in relation with Climate Change (European Commission 2005). The focus on sustainable development, including energy efficiency, has become even more apparent in the light of economic crisis, which has been considered as one of the most significant economic one and has lead one of the most considerable slowdowns across Europe in the last fifty years (Directorate-General for Regional and Urban Policy 2013a).

There is also growing interests in the potential and challenges of delivering eco-energy goals in historic cities as there is at least one historic district in almost every European city*'with more than 1000 historic cities in 30 countries inscribed in The European Association of Historic Towns and Regions while "historic urban buildings consume 4% of all energy and are responsible for 3% of CO2 emission'(EFFESUS 2011, p. 6).* The idea that urban heritage can play a major role towards energy efficiencyis further enhanced by the fact that '*one third of European buildings were built before 1945, while about half of these are of historic value'*(Ministry of the Interior and the Kingdom relations 2010, p. 5).

With regard to advantages of preindustrial historical cities and districts in implementing eco-energy goals, scholars stress that they were built with concern for the sanitation and ventilation of buildings and by taking into account the environmental conditions of the specific area (Beatley 1999; Rodwell 2008). In addition the archetypal pre-industrial cities are claimed to present certain advantages with regards to urban design, for instance, (i) clearly defined and compact form small scale, proximity and walking as main modes of mobility;(ii) contextual homogeneity, for instance, similar structure; (iii) architectural homogeneity constructed by the use of a limited range of local materials which comply with the natural environment; (iv) uniformity in size construction and use, providing the opportunity to generic solutions to have the widest application (EFFESUS 2011). In addition restoration of urban heritage offers an advantage

over new constructions as it "avoids the high energy and carbon emission consumption caused by the process of constructing new buildings and demolishing old buildings (Yates 2006). Knowing this, the question arises: how the goals of energy efficiency are approached in policies of the European Union and its member states?

2 KEY ISSUES IN THE EU POLICIES WITH REGARD TO ENERGY EFFICIENCY

In this section we attempt to raise general key issues in achieving energy efficiency in historic cities and districts. These issues are categorized in four main categories as presented below.

2.1 SCOPE AND SCALE

Overall, the issue of energy efficiency in historic cities has been indirectly addressed by a number of projects and programs focusing on urban regeneration and revitalisation rather than on specified European Policies. It is only few policies which address eco-energy in relation to historical areas in spatial planning directly. An example is the European Spatial Development Perspective (European Commission 1999) in which urban heritage subcategory was included in the plan of '20-20-20'. Specific policies of the European Union regarding energy efficiency in general, however, has focused on three main areas: i) the upgrading of existing buildings and structures in order to decrease energy consumption; ii) the attention to new buildings in order to build according to higher standards of thermal quality; and (iii) occupants behaviour so as to promote the rational use of energy (Bourdic and Salat 2012; Lewis et al. 2013).

Upgrading energy efficiency standards has been broadly addressed in the Energy Performance of Buildings Directive, such as EPBD, 2002/91/EC, 2010/31/ EU, 2012/27/EU(European Commission 2014a). The policies concern particularly individual buildings and structures. They also entail a 'requirement for the Member States to establish a long-term strategy for mobilising investment in refurbishing residential and commercial buildings stock' (Barbu et al. 2013, p. 8). Interestingly, in the context of the Energy Performance for Buildings Directive(European Commission 2014a), public sector is called to set best practices '*by renovating 3% of buildings owned and occupied by the central governments and by including energy efficiency considerations in public procurement so as to purchase energy efficient buildings, products and services*'.

The EU has also undertaken considerable effort regarding energy efficiency in constructing building standards. One of the fourth working groups of the European Committee for standardization is currently working on the development of standards for Energy efficiency in historic buildings. It has been argued that '*standardization could help conservation professionals in their restoration and conservation work, ensuring at the same time the possibility for European experts to exchange information on test and analyses methods on Cultural Heritage*(Fassina 2012). EU members, such as UK, have also started to invested

in standardization (Cameron and Clark 2006). However, the application of the standards has been problematic, as it is bounded with different architectural typologies, types of historic districts and their condition, as well as geographic and climate criteria.

The EU has limited influence on the way its member states' policy implement energy efficiency directives and regulations. Each EU Member State embodies it in a different way and its implementation is bounded with national, regional and local policy arrangements and objectives. The review of national policies regarding energy efficiency in the EU countries has also identified that the processes of developing and implementing the policies are long lasting and usually involve delays. This is due to incompatibility issues between existing and new policy frameworks, raising concerns about the effectiveness of public administration. The situation is further intensified due to the dilemma that often exists between new investment in energy efficiency or preservation of old structures (Economidou et al. 2011).

In conjunction with the above, urban heritage falls under specific rules and regulations regarding interventions, aiming at the maintenance of their structure and architectural integrity. On the other hand new developments regarding energy efficiency are often incompatible with those (Bourdic and Salat 2012; EFFESUS 2014). The national policies also focus mainly on individual buildings and omit a district scale, which is surprising provided that targeting at an area as a whole rather than only at individual structures can significantly contribute to more desirable energy performances:

> '*[W]hile it is tempting to focus energy efficient solutions on prestige historic buildings (castles, churches and mansions) due to their high public visibility, the biggest impact from limited resources can only be obtained by focusing on the largest number of common historic buildings in Europe, those in residential occupation, representing 75% of the built heritage*'(EFFESUS 2011, p. 6).

Urbact report on energy efficiency goals in policy in EU Member States identified however that the implementation of the Energy directive at a local level is bounded with a range of issues(Lewis et al. 2013). These concern, for instance, the issue of finding a balance between energy efficiency goals and other sustainability priorities. The report states: *'a local authority may be interested in the trade-offs and relative timing of deploying local renewables versus the greening of the national electricity grid. An appropriate decision support tool should provide guidance as to which local energy technologies are cost-effective given other developments in the energy system'*(Lewis et al. 2013, pp. 13-14).

In a scale of a particular project, on the other hand, fundamental issues in successful implementation turned out to be the use of building energy codes, through which all relevant to energy requirements are integrated during the design phase of a new building or retrofit phase of an existing one. The European Performance of Buildings Directive attempted to introduce to all Member States a common general framework including building energy codes based on a 'whole

building approach"(ENTRANZE 2012, p. 13). In this context, however, concerns over, for instance, an appropriate level of enforcement compliance, were raised.

2.2 FINANCIAL ISSUES

The Buildings Performance Institute Europe, based on a country-by-country review of buildings' energy performance which was undertaken in 2013, identified that the lack of financial sources was ranked among the most important issues in implementing eco-efficiency solutions in the European Union (Economidou et al. 2011).

The Urbact report on energy efficiency (Lewis et al. 2013) points out that the EU promotes diversifying funding sources at various levels. It stresses that the private sector support is of crucial importance as owners of properties of historic importance often cannot afford refurbishing and retrofitting them: '[*p]olicies instituted by municipal authorities should comprise integrated packages of measures (...) as it is not enough for technical solutions to be available if no one can afford them*'(Lewis et al. 2013, p. 14). Similarly, the EU stresses that the governments of Member States should make considerable effort in engaging private sector: member countries are responsible for setting up a strategy for triggering investment in the refurbishment of old buildings, while setting up obligatory measures in order to achieve the "*cumulative end-use energy savings target of 1.5% of annual energy sales to final consumers…pushing energy supply companies (ESCOs) to become integrated energy service providers instead of simply energy suppliers*"(Lewis et al. 2013, p. 13). The EU has also strongly supported the ideas of public-private partnerships, however did not indicate how the partnerships should look like and be delivered.

It is important to note, however, that the role of private sector in financing eco-energy change depends on market conditions, especially existence of demand for a certain kind of solutions. As the latter is difficult to encourage due to the high cost of investment, it has been acknowledged that a more central intervention is often useful in encouraging the creation and supply of technological innovations regarding energy efficiency. Potential pathways to improve the situation were identified within a research project funded by the EU. In particular, the outcomes of the EFFESUS project entail that the contribution of Small and Medium Enterprises may trigger the interest of the market actors in investing in energy efficiency. In addition, the findings of the Intelligent Energy Europe programme as released by European Union stresses the importance of building capacity, especially with regards to skills and information sharing between various stakeholders (European Commission 2014b).

Finally, the EU policies often stress the importance of dissemination of knowledge regarding funding opportunities. They do so in order to encourage wider participation in the costs of deep renovation or retrofit. Also, the EU has created a range of new financial tools and mechanisms aiming to incentivize private sector investments in energy efficiency. They include, for instance, Energy Performance Contracting (EPC), energy services agreements, national or/and municipal loan

programmes, energy utility obligations, mortgage-backed financing, preferential taxes or mortgage rates, utility on-bill financing, such as PAYS (pay as you save), revolving guarantee funds, green banks and climate funds(Lewis et al. 2013).

2.3 AWARENESS, INFORMATION AND REASSURANCE

The EU policies regarding energy efficiency stress that an important aspect in promoting and achieving energy sustainability is stakeholders' awareness and knowledge of the different dimensions of the subject.

Based on country-by-country review of energy efficiency policies in the EU, the BPIE identified that there is a number of factors, which make investors hesitate to invest in energy efficiency. Locals and owners of properties with historic significance, although they are willing to retrofit their buildings do not proceed due to the lack of information about incentives and funding opportunities; occupants with high rates of energy consumption lack information regarding the advantages of its reduction and; local authorities did not invest in energy efficiency projects although European mechanisms and measures have been in place. The BPIE report points out that '*alternative investments are in many cases preferred to energy saving measures due to the lack of awareness, interest or in fact, 'attractiveness' of energy efficiency as an investment option*'(Economidou et al. 2011, p. 12).

In this vein, the lack of information and awareness hinder the choice of energy efficiency solutions, stressing the need for knowledge and information dissemination across different groups of people. There are several past and present examples of initiatives and projects in EU level that aim to fill this gap. For example, BUILD UP Skills is an initiative which aims to boost continuing or further education and training of craftsmen and other on-site construction workers and systems installers in the building industry(Lewis et al. 2013).

It is also important to note that education regarding finance source can help to control and decrease the risk linked to investments in energy efficiency. In addition it may further trigger energy community specialists to appreciate more efficiently the risk assessment and decision making frameworks of the financial community in order to create a solid model to retrofit existing buildings.

2.4 NEW TECHNOLOGIES AND TACIT KNOWLEDGE

Energy efficiency in the build environment involves new technologies as it was already mentioned. However there is limited work concerning the adaptation of these new technologies in the context of urban heritage places (Effesus, 2012). Indeed at a national level, although the majority of countries established the first certification regarding energy efficiency for new buildings, certification in the cases of renovating *"existing public buildings were usually left for later implementation*" (Lewis et al. 2013, p. 13).On the other hand, historical cities embody potentials with regards to energy efficiency as reflected on their form as mentioned earlier (see 1.1) providing a tacit knowledge which can further

enhance the implementation of energy efficiency solutions, despite conservation constraints.

It is also important to note that the European Union has recently indicated an interest in combining conservation and energy efficient retrofit. It funds a project, which helps decision making around environmental issues in the context of historic urban districts taking into account local practices - 'Decision Support System' (EFFESUS 2014). Another project supported by the EU is CLUE. It explores best practices in planning and implementation of systems, solutions and technologies for climate neutral urban districts as well as methods for measuring, monitoring, reporting, verifying and assessing climate mitigating efforts. Likewise, the Long life project (2007-2013) seeks to improve methods and construction, to develop, adapt and implement innovative or new technologies and practices for buildings and to coordinate building procedures among the participating countries(Co2olBricks 2013). In view of the above, facilitating and improving the adaptation of new technologies in the historic urban core while also taking advantage of the tacit knowledge that historical cities provide in relation to energy efficiency, constitutes an area of concern and further research on the field.

3 DISCUSSION

The purpose of this paper is to better understand the way policy initiatives in the context of the European Union with regard to energy efficiency shape contemporary urban development. In order to enrich our understanding of the issue, the paper pointed to the development of planning thought with regard to two intertwined set of debates: the one about state-market relationship and the one about philosophy of science in urban planning, and attempted to position selected policy initiatives within the framework. The analysis lead to the arguments that (i) there is a void of policies on energy efficiency targeting at historical areas, in the context of EU; (ii) existing policies with regard to energy efficiency point to the role of public sector officials to guide progress towards sustainable development and that the process involves a range of challenges; (iii) the domination of scientific logics, while downplaying the role of lay and local knowledges, in the context of policies of the EU and its Member States.

The outcomes of the research suggest that the EU policies and the policies of its Members States are focused on energy efficiency issues at the building level, technical measures, new technologies and interventions in individual buildings, and involve a void of historical areas as a separate category, at a district and neighbourhood level. They imply that the role of private sector in the context of energy efficiency in the field of urban planning is to follow goals and objectives establish by the EU and national governments. At the same time, however, the insights into policy initiatives revealed that EU brings about different strategies that national governments (public sector) should deploy in order to encourage private sector entrepreneurialism, facilitate the mobilization of capital in the energy-efficiency market (through e.g. raising awareness, information) and proposing certain financial schemes for individuals willing to take part in eco-change (Economidou et al. 2011).

This positive from an outset strategy may however also imply extreme version of 'enabling a market', whereby negotiations between supply and demand may outshadow concerns over the incorporation of local communities in planning process and effectively lead to social exclusion (Swyngedouw et al. 2002). There are premises to think that due to financial, economic constraints certain groups in society can be excluded from potential benefits from delivering and implementing energy efficiency solutions in urban areas. These, in turn, also lead to deliberations about urban planning as a 'modernist project', which lost its legitimacy as capitalism orders social relationships and leads to social inequalities (Harvey 1989; Madani-pour 1995).

The review of energy efficiency policies of the EU and the way they are applied in Member States recalls 'modernist' beliefs that key factors underpinning human progress relate to the use of technology, science and economics. It reveals the importance of technical, scientific, experts' knowledge in delivering sustainable development. It stresses the domination of 'standarised' approaches to urban planning in terms of energy efficiency. It also suggests that in the policies local knowledges are approached instrumentally, as, for instance, the development of specialist skills at the local level is designed to meet global standards of decrease in energy consumption rather than to enable local strategies to deal with the issue to enter a 'global arena'. One could also note that the values of 'science' emerging in the context of the policies may be contradicting the EU's ideas about 'Good Governance', which entail greater efforts towards 'openness and participation, accountability, effective coherence, efficiency (proportionality) and greater sensitivity to the immediate context that is promised by subsidiarity' (Kemp et al. 2005, p. 18).

These findings also seem to contract contemporary conceptions of urban heritage. It rather feedbacks to 'old' conceptions of heritage 'preservation', which were based on the idea of sterile protection of the 'object' as defined and suggested by experts based on technical matters (Burke 1976; Rodwell 2008). Whereas, current approaches to urban heritage stress the contribution of lay people's perception of urban heritage, communities view on what is that needs to be preserved (Pendlebury 2008; Ashworth 2012).That being said, the matters of celebrating 'diversity' of people's perceptions inevitably involve balancing often conflictual perspectives and values mediated in the processes of interaction between various stakeholders. It could concern the matters of preserving historical and architectural integrity of urban heritage sites versus delivering technological and technical innovation, which was already proven to be the case in the context of energy efficiency.

Although the paper entails a number of limitations, as it does not review national policies, it cannot address the peculiarities of adopting and applying energy efficiency policies within a particular context, it points to the importance to reconsider relationships between environment, democracy and scientific expertise in the context of policymaking. The research findings feedback to arguments about 'remodelling' contemporary policymaking into a more 'deliberative', 'reflective' mode is one of key challenges of our times (Fischer 2000; Rydin 2007), and that the focus on scientific interpretations can be

considerered as 'potentially exclusive, suppressive, technocratic and ultimately undemocratic' (Hoppe 1999, p. 202). Also, in spite of the fact that dealing with pluralist epistemologies in planning can be particularly problematic also in practice, especially in the context of planning proceedings (Healey 1995; Rydin 2007), this, however, does not and should not prevent policymakers from greater reflexiveness of their practices and reflectiveness towards social and spatial context of energy efficiency initiatives and programmes in a context of historical areas.

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Steps towards Energy Efficiency on Klauzál square

How to rehabilitate old housing buildings in a sustainable manner

Anna Bajomi, Beata Imre , Melinda Mihaly, Helena Polomik

ABSTRACT

Energy efficiency in housing has a crucial importance; the household sector consumes around one third of final energy consumption (EEA) but this is also an area which offers plenty of opportunities for significant improvement.

Europe is facing serious challenges on the level of energy efficiency which mainly appears as a result of the ageing housing stock with low environmental standards. This situation can only be solved with an integrated approach where physical renovation is accompanied with the active involvement of various stakeholders. To prove this point this research will examine a specific area of intervention. A typical affordable housing neighbourhood has been selected from the heart of Budapest, Klauzál square in order to demonstrate the planners' real challenges in a rehabilitation housing district which aims to increase energy efficiency. In Europe the highest level of energy savings can be achieved in the housing sector through the refurbishment of ageing buildings. In course of this work we will examine how implementable this aforementioned statement is in the reality. The purpose of this research is to discover the challenges of intervention and to offer a possible solution.

The study is built on data-collection and analysis (both primary and secondary), desk research on best-practices, interviews with experts, inhabitants and site visits. Based on these the work outlines how the most harmonious living can be achieved which is sustainable from environmental, social but also economic aspect.

Key words: rehabilitation, energy, urban planning, sustainability

1 SIGNIFICANT ENERGY SAVING POTENTIAL IN THE EUROPEAN HOUSING STOCK

Consumerism and the lack of energy efficiency led to the fact that today Europe's energy consumption is outstandingly high. The three main energy consumer sectors are the transport, households and industry. In 2012 the ratio of transport's energy consumption was 31.8%, the households represented 26.2% while the industry 25.6% (Eurostat). Therefore it can be stated that in comparison with other sectors **the households' energy consumption is one of the most significant** which over the time has shown a stagnating tendency (Figure 1).

And the picture throughout Europe varies (Figure 2); it is not evident that more developed countries with more developed technological and financial potential would be more energy efficient. This makes the whole European continent face a major challenge.

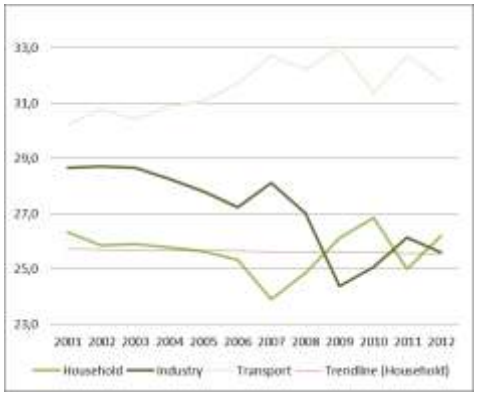

Figure 1. Ratio of energy consumption by sector

Source: own compilation, Eurostat

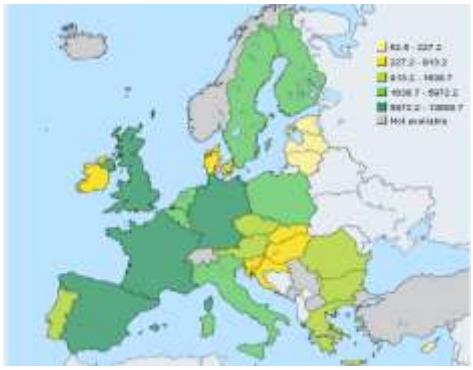

Figure 2. Electricity consumption of households (1000 tonnes of oil equivalent), 2012

Source: Eurostat

In order to alleviate the negative effects of high energy consumption in 2009 the EU accepted the EU 2020 Strategy which formulates the following targets in relation with the climate change and energy sustainability that need to be reached by 2020 (European Commission):

- Greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990;
- 20% of energy from renewables;
- 20% increase in energy efficiency.

In 2011 in its Energy Efficiency Plan the European Commission formulated that **the most significant energy saving potential can be found in the buildings** (European Commission, 2011).Today the buildings themselves are in charge of 40% of the total energy consumption. In 2011 the Buildings Performance Institute Europe prepared a very complex research (BPIE, 2011) on the energy

performance of buildings. They had estimated that there is cca. 25 billion m2 of useful floor space in the EU27, Switzerland and Norway out of which half can be found in North and Western Europe, 36% in Southern Europe while 14% in Central and Eastern Europe. One third (36%) of the residential buildings (which represent 75% of the total stock) are apartments.

An interesting fact that the study highlighted was that the general tendency is to seek larger floor spaces over time. For the moment in the area of examination the standard size of apartment floor space is 20 m2 per capita. In the more developed Western and Northern European countries it is 36 m2. It is very important to realise that with the growing population and their increasing needs Europe is to face further challenges as regards of energy consumption; preparation is therefore of a crucial importance.

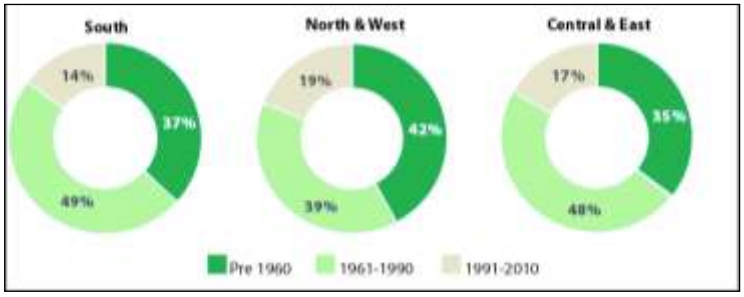

Figure 3. Age categorisation of housing stock in Europe

Source: BPIE survey

As it can be seen in Central and Eastern Europe where our area of examination can be found almost half of the buildings were built in the period between 1961 and 1990, and a significant part, over one third of the buildings even before (Figure 3). This is very challenging from the energy efficiency's point of view as their condition is the most problematic (TES Energy Façade).

Some studies claim that EU goals set up for 2050 in the field of energy efficiency can only be reached if the buildings built from now on to 2050 are completely energy efficient and a significant part of the current stock gets retrofitted (Lončar-Vicković, 2012). The task is not easy given the fact that ratio of historical buildings is also very significant.

The following case study was prepared as part of the EU-funded IDEAL EPBD project. The work investigated energy savings that could be made in the existing building stock of nine European countries (Bulgaria, the Czech Republic, Denmark, Finland, Germany, Latvia, the Netherlands, Portugal and the UK).

The results of the study show that implementing ***energy efficiency measures in existing housing stock could save 10% of current heating consumption by 2020 and 20% by 2030****. Planning authorities can play a major role by providing support and unbiased information to all stakeholders involved in the renovations. The researchers analysed the inventory of housing stock, previous and potential rates of renovations to improve energy savings and the range and costs of energy efficiency measures in each country.*

Source:http://ec.europa.eu/environment/integration/research/newsalert/pdf/38si5.pdf

The general analysis of European housing stock above clearly shows that there are two directions for intervention. From one hand physical development, technical improvement is inevitable however there is also floor for awareness raising of inhabitants so that they can learn why and what should be done. In the followings a specific model will be presented with this purpose.

2 INTERVENTIONS ARE UNAVOIDABLE BUT ON WHAT EXTENT?

This chapter presents the findings of the research which was based on document analysis, best practices and field examination (bothprimary and secondary data was used). A significant energy saving potential is lying in the European housing sector. The aim of this study was to examine how this can be applied and also to explore a wide range of improvement possibilities which can be implemented in case of the action area. With this work we are aiming to present different tools which can be used by project owners and decision makers to create successful retrofitting schemes. We attempt to examine whether it is possible to realise energy efficiency measures in case of an old, historical buildings in economically difficult environment. From the assessment of the action area we concluded that the involvement of stakeholders and the setting up of a viable business model are among the key success factors.

We examined fifteen practices on retrofitting mainly from the EU and North-America. In selecting the projects, we had the following considerations:

- Location: in the downtown area of relatively big cities, mainly European ones;
- Old brick buildings constructed before 1950 (with special attention to those which are historical and at least partially protected);
- Main function is housing (with special attention to public housing units);
- Each project should have energy efficiency elements;
- Projects target at least one whole building but preferably a small area which includes more.

Based on the analysed examples **the following conclusions are drawn**:

Historical and old buildings have their unique cultural value which makes it **difficult to implement energy efficiency related measures**. Before a building qualifies for energy efficiency refurbishment, its cultural value and possible measures have to be precisely defined with the help of cultural heritage experts, architects and engineers in order to implement the right measures. This classification gives the basis for the decision on which building components can be refurbished in order to save energy and on which component should be preserved in its original condition. Therefore **energy efficiency measures in such cases require cooperation and an interdisciplinary approach**.

Old houses actually **have good initial energy performance features** such as thick walls, local building materials etc. (Lončar-Vicković, 2012). Until the end of the 40s' and 50s' mainly at urban regions, small-size solid bricks were predominant, with a wooden or steel concrete slab and without insulation. The typical wall width was a multiple of the small size brick. In line with this, the most resource efficient approach we found suggests renewing the original elements. For example one of the most relevant energy performance factors in these old buildings are the windows and doors. According to the mainstream approach it is compulsory to replace old windows and doors for the sake of energy efficiency. Some of the analysed best practices (English Heritage, 2012) prove this view is incorrect; **in many cases the reconditioning of old windows and doors is enough** to achieve a desirable heat transfer value and if reconditioning is possible, it is the cheapest and most environmental friendly way of improvements.

More data is needed because it is still hard to find solid data when a decision has to be made. Before choosing the right refurbishment project the energy performance needs to be assessed on the old housing buildings so that the energy savings of the different possible refurbishments can be compared. These calculations help us to decide with which measure could be the most energy saved.

In the following table we attempted to compare the energy efficiency investments of the examined best practices according to their complexity.

	Insulation	Roof insulation	Basement or floor insulation	Windows, doors (replacement or reconditioning)	New heating system	Renewables	Cost	ROI*year*
Shallow	X	X		X			$	2-3
Complete	X	X	X	X	X		$$$	10+
Deep	X	X	X	X	X	X	$$$$$	15+

Table 1. Classification of energy efficiency refurbishments according to their complexity. *Source: own compilation*

Examined practices can be classified into three categories depending on the complexity of the refurbishment (Table 1). **Shallow type** of renovation is the cheapest and easiest minimum effort which can be made for energy saving. This type of refurbishment mainly focuses on the improvement of the insulation therefore costs are significantly lower compared to the other two categories. **Complete renovation** includes a modernised heating system which increases the costs and the stakeholders are more significantly affected. The fact that in these buildings in many cases each flat uses an individual heating system (mainly convectors or radiators which should be replaced), makes its implementation a lot

more difficult. **Deep renovation** approach applies when not only the complete energy system is being renewed, but also fossil fuel consumers are being replaced at least partially by renewable energy (in most cases combination of photovoltaic and solar panels or geothermal).

3 KLAUZAL SQUARE; WHERE OLD AND NEW LIVE TOGETHER

Klauzál square has been selected as the area of our examination for more reasons. This square was small enough for us to personally assess it within the framework of a field study. (Interviews were conducted with its inhabitants and its buildings had been assessed.) The square illustrates perfectly the average challenges regarding to the ageing housing stock in Budapest.

Short history of Klauzál square. The action area for our case study is Klauzál square which is located in the inner part of the 7th district known as the Jewish district. The square gave home to a theatre which was destroyed by a fire in 1874. The square has been reconstructed and the buildings were finished in 1897. Instead of the theatre a market hall was placed on the square with 3 new public housing units. In these times the square was connected to the public transport by a tram.

In 1919 a playground was established. During the World War II it was the only cemetery in the Jewish ghetto. In 1969 a unique playground was designed on the square which had sledding hills, two ball game courts and many other new exciting toys. In 1997 the square was rehabilitated by the mayor's office with the involvement of a major urban horticulture organisation. Some of the elements of the original concept have been kept such as the small hill which was partially redesigned as a grandstand. Since this last renovation the state of the public square has been deteriorated which applies – on a greater extent – to the surrounding housing buildings.

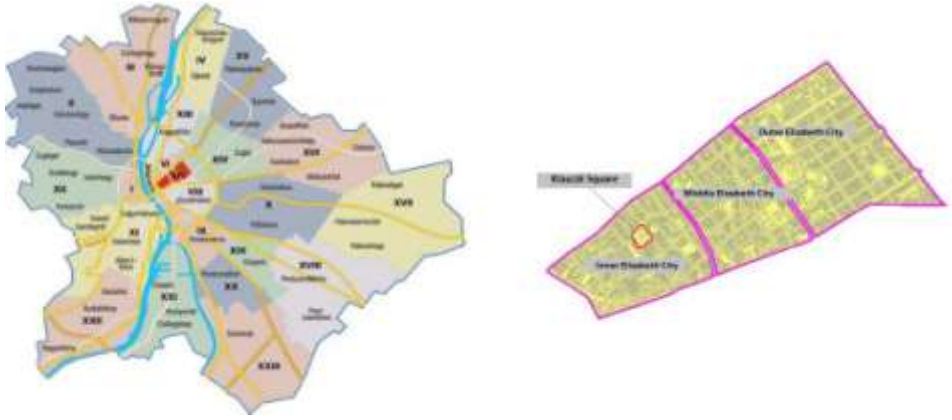

Figure 4. Location of Klauzál square

Location. Klauzál square is located in the inner part of the 7th district (Elizabeth City) (Figure 4). The structure of inner Elizabeth City has been formed 200 years ago. The eclectic, nouveau art and classicist monuments, protected buildings

represent high architectural value and make inner Elizabeth City the most valuable part of the 7th district.

Housing situation. There are 16 buildings and 318 inhabited flats (Table 2) on Klauzál square. Two buildings are listed buildings and are under the protection of historic buildings. All the flats are individually heated with convectors and less often with radiators. Most of the flats have 1, 1.5 or 2 rooms, bigger apartments are rare.

	Inhabited flats	**Floors**	**Flat/floor**	**Protection** *(historical b.)*	**Decade of building**
1.	14	3	3,5	no	built before 1940's
2.	16	2	5,3	no	built before 1940's
3.	22	4	4,4	no	built before 1940's
4.	18	5	3,8	no	90's (before empty)
5.	22	2	7,1	no	built before 1940's
6.	21	3	5,2	no	built before 1940's
7.	9	3	2,2	yes	built before 1940's
8.	(N/A)	3	(N/A)	no	built before 1940's
9.	26	3	6,5	no	built before 1940's
10.	26	2	8,6	no	1894-96
11.	13	3	4,3	no	1894-96
12.	10	1	5	no	1894-96
13.	25	2	8,3	yes	built before 1940's
14.	22	3	4,4	no	built before 1940's
15.	31	3	7,75	no	built before 1940's
16.	43	4	8,6	no	built before 1940's

Table 2. Inventory of buildings on Klauzál square

Source: own compilation

To put the housing situation of the square in a context we collected some information about the main characteristics of the 7th district's housing situation. In 7th district 99% of the dwellings were built before 1945 (67% before 1900, so more the 100 years ago, and 32.5% between 1900 and 1945). Only 18% of the dwellings are with all amenities and 16% have low comfort level: many of the houses have important deficiencies and the problems are rooted in the last hundred years. One of the main causes is the lack of maintenance: since the World War II for decades there have not been significant renovations. - During our interviews local people of Klauzál square complained about the same. - Difficulties are even more important concerning the renovation of the protected buildings which are part of the cultural heritage. From 2003 private sector has been renewing the frontages of municipality owned buildings in the district, in return they got the possibility for new construction with good condition. As a result between 2004 and 2009 the number of newly built apartment increased, however in Klauzál square only one new building stands which was built during the 90's.

Generally the new buildings' appearance is not fitting very well in the historical surroundings and this applies to Klauzál square as well.

Inhabitants. From the second half of the 19th century this part of Elizabeth City was mainly inhabited by Jewish people. As former part of Teresa City (6th district, separation in 1910) this part of the 7th district is connected to the world heritage area of Budapest.

Inner Elizabeth City is now inhabited by 17000 people. Despite the positive migration rate, the population of the district is decreasing: 58221 inhabitants in 2003 and 55404 in 2012. The ratio of retired, elderly people and single people who do not have a regular income is outstanding in this part of the district. Although the ratio of young population (age 0-18) is decreasing in the 7th district (2003: 14.5%, 2012: 11.3%), inner Elisabeth City is probably more attractive for the students and young professionals (18-35) because of the large scale of cultural and entertaining possibilities. The students and young professionals are quite active socially; most of the social programmes (common cooking and food distribution, popularisation of vegetarian cuisine) are started and operated by them. In Elisabeth City the number of registered job-seekers has doubled in the last 10 years: 822 in 2003 and 1758 in 2014 and yet the unemployment rate is about the average of Budapest. Klauzál square and its neighbourhood are facing a high risk of turning into a slum.

Functions. Inner Elizabeth City contributes to the cultural, commercial, educational, religious, administrative and touristic functions of greater Elizabeth City and Budapest while it is also a residential area. Klauzál square is mainly a residential area, but has recreational and touristic functions too.

Ownership structure. From 2003 to 2013 the number of public housing units in the 7th district decreased by 16% but their ratio (8.2%) is still higher than the national average (2.7%) or the ratio in the capital (5.1%). Therefore in light of data shortage, the same ratio as in the district (ca. 8%) can be estimated for the action area too(Integrated Urban Strategy, 2008,HCSO).

Energy performance. There is no proper information concerning the energy performance of the buildings in Hungary. Our basic source of information is the survey data of a national research made in the framework of Negajoul project of Energiaklub (Climate Policy Institute). The energy consumption of brick apartment houses is 213-344 khw/year/m2 – G & H category at the energy labelling (labels: A – I, panel houses are the best and family houses are the worst). As in our district the houses are old brick houses built before 1945, they have probably higher consumption than the average. According to the survey of Energiaklub only 26% of „non-panel" block of apartments had replacement of windows, 27% have a modernised heating system, and only 22% had no external isolation (which is the most negative indicator compared to the other types of houses: panel and family houses).

Klauzalia project; a social innovation?

The biggest social initiative in the area is Klauzalia project which was initiated by KÉK (Hungarian Contemporary Architecture Centre). The project's main goal is to renew the Square based on local values and systematically collected local knowledge. The project emphasises the importance of inhabitants', local entrepreneurs' and NGOs' involvement to each step of the planning process (from the programming till the implementation). It is important that the government supports such initiatives in order to realise coherent organic rehabilitation project meeting the local stakeholders' needs. In this vision the role of local stakeholders is to fulfil this given public space with content and take part in its operation and maintenance with the involvement of their resources (broadly interpreted). Klauzalia is doing lobby activities, facilitating participative planning process in order to collect inputs for a coherent rehabilitation plan. While Klauzalia is great for achieving community development it does not have a significant influence on the energy efficiency.

4 PROPOSAL ON INCREASING ENERGY EFFICIENCY AND SAVINGS ON KLAUZAL SQUARE

4.1 A POSSIBLE REFURBISHMENT SCHEME

In Klauzál square there are only two buildings which are under historical protection which makes refurbishment easier since regulations are not hindering its implementation. As significant part of the inhabitants is either elderly people or young students there is no sufficient amount of will to invest in long term energy saving reconditioning. This makes it extremely difficult to define an applicable scheme. Researches show that most of the households are not capable of financing bigger improvements although the return on investment is ensured in long term. This obviously narrows down the number of potential projects and emphasises that **state intervention is necessary** in to urge the reconditioning of energy inefficient buildings.

Taking the needs and economic condition of the inhabitants into consideration we found that **even shallow type of renovation can be challenging in this area**. **It is necessary** from the implementation's point of view **to include a national strategic framework**, **good incentives** for the stakeholders, and **suitable financial model** for the inhabitants which makes the investment possible without huge initial contribution.

Description of possible elements
Before installing any type of insulation the brick masonry, the real heat transmission values and the water content of the walls need to be analysed. On this basis, simulation and calculation can be done in order to select the right measures to increase energy efficiency.

a. Internal insulation, external insulation (only at the inner yard), roof and basement

The most common practice in Hungary is to use 5-8 cm thick insulation despite the 12 cm thick suits the best to the climatic conditions. In long term the 20 cm thick is the most optimal from the environmental point of view because this saves the most energy. The costs are in line with the needed resource of the selected insulation type; however interestingly the energy savings increase with a smaller pace than the growing insulation thickness. While the first 10 cm decrease the heating costs to 50%, the second 10 cm also reduce costs to half but it is only the 25% of the total initial costs. Still it is worth considering the thicker insulation since extra expenditure appears only through materials, but the rest remains the same (estimated budget increase 20%). A high quality insulation system serves its users for 25-30 year and during this period cost saving can be continuously realised (about 100 EUR per heating season).External insulation is the most favourable when internal insulation is possible but it has its restrictions due to the appearance of damp-stains.

b. Windows, doors

30-50% of the total energy loss is coming from heat loss associated with air flow through the building's small openings and cracks in its structure. The rate of natural ventilation (infiltration and exfiltration) depends on several factors such as; wind strength and direction. This means that refurbishment of old buildings should start with solving the reconditioning of windows. The secondary benefits are noise reduction which is quite important in this neighbourhood, because this part of the district has enormous number of visitors during the evenings.**The complete renovation of windows is only suggested if it is coupled with external insulation otherwise it leads to appearance of dawn-stains.**It is also important to note that well insulated windows and doors are not allowed together with gas heaters which are very common in the action area. The related regulations do not allow gas heater with open-fire (gas convector), since it has high risk of releasing carbon-monoxide.

c. Heating system

On Klauzál square in most of the buildings individual heating units are used, in each flat separately. Installation of a central heating system is an expensive element of the energy efficiency improvements. Heat radiation has many advantages for the preservation of the historical buildings because it lowers the number of moisture and condensation problems arise. Although installation of central heating unit is costly since it includes not only the new machines, pipeline distribution, individual metering system but also it increases the installation labour demand. As far as we see the central heating unit is the biggest obstacle in these houses because the buildings' current infrastructure – resulting from inhabitants using individual heating units – increases significantly the need of manual labour. **The inhabitants do not have high amount of savings or long term interest in taking credit which can hinder even smaller scale investments.**

d. Renewable energy elements

The use of energy efficiency is below the average of other refurbishment practices. As a result of our analyses **the installation of renewable energy on current price level seems to be impossible.** On average prices the installation of renewable elements would double the costs of a simple refurbishment;

therefore under the current circumstances their implementation seems to be impossible even though we would highly recommend its concept's integration in future plans in a way that it saves costs of later adaptation.

Other tools for immediate energy saving

As a fast and easy solution on the double windows heat mirror film and on the walls heat mirror foils can be installed. This small intervention does not require changes in the physical structure of the building in order to decrease heat loss and hence improve energy efficiency. It would be beneficial to see a pilot project which uses only such low-tech solutions combined with awareness raising of inhabitants to the importance of energy efficiency to maximise savings. We have not found any examples where such measures and their efficiency would have been measured.

Soft (behavioural) elements

The "Reduce your bills" project of Energiaklub[18], aimed to reduce the energy bills of low-income households by direct personal advising and by the implementation of some simple tools for energy savings. During the project so called energy advisers gave personalised tips for energy-saving possibilities (e.g. where to put the fridge, reduce the temperature or use longer curtains) for each flat which participated in the project. They also gave a low-budget package of tools which can help to reduce energy consumption (sealing strips, thermometer, heat mirror foil, etc.) and taught its correct application to the project partners. As a result the households' average savings were 35 euros (755 kwh/year). The experimental (pilot) project's results can provide a great example for local governments and organisations working in the social sector.

On the basis and in line with Klauzalia project other community strengthening programmes could be implemented such as neighbourhood educational programmes on energy saving techniques and energy saving competitions between the buildings located on the square. These incentives could help to apply the acquired knowledge.

4.2 ENERGY SERVICE COMPANY; A DRIVER OF CHANGE

As aforementioned 80% of the flats in the 7th district are one- or two-room flats with low comfort. The same can be stated about Klauzál square while the density of the flats is high in this area too. Most of the buildings on Klauzál square have not been refurbished for a long time. It was not a priority, and there were no financial resources for this either. After and also as a result of the beginning in the ownership change (privatisation) taking place at the end of 1980s further significant deterioration could be observed and the condition of these houses has been continued to deteriorate as the owners do not have the sufficient financial resources for the refurbishments. There are more buildings on Klauzál square where not just the technical architecture is in bad condition, but the risk of plaster-crumble is also high. Taking the condition of the buildings and the social

[18] www.csekkcsokkento.hu, https://secure.berliner-netzwerke.de/media/file/472.EC_LINC_Brochure_web.pdfDownloaded: 01/06/2014

background of the homeowners into consideration a special financing concept needs to be implemented. With the financial refurbishment support of the municipality or by applying for EU tenders an **Energy Service Company** (ESCO) could be a key stakeholder in rising energy saving in the Klauzál square.

An Energy Service Company is an organisation delivering the service of shifting the investment budget of energy savings projects to operational costs through upfront investment by a third party and pay-back through savings on the energy bill (de Groote, EUKN - 2013, p31).

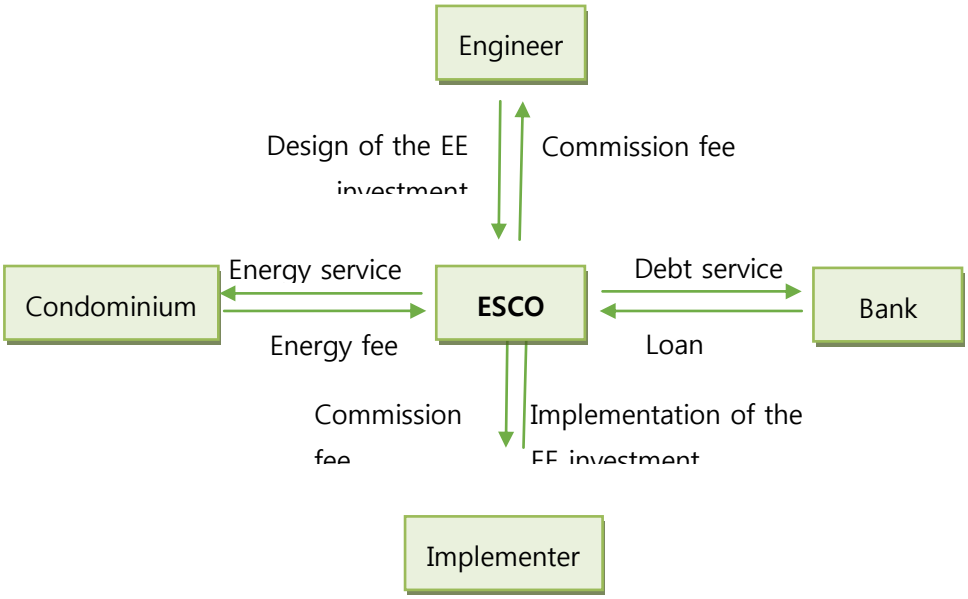

Figure 5. A proposed business model for the prospective ESCO

Source: own compilation

The concept of Energy Service Companies was introduced in Hungary in 1990. ESCOs played an important role in street lighting modernisation, as these investments had low investment costs and short payback time (three years). Hungarian ESCOs also had added value in the indoor lighting and heating system modernisation of public buildings and also in modernising district heating with a focus on the block of flats.

A possible Energy Service Company could connect homeowners (condominiums) with engineers, implementers, and banks. If the homeowners made a decision to take part in an energy efficiency investment programme the engineers would assess the buildings' energy performance and would set up different scenarios for the building retrofit. It could include the renovation or replacement of doors

and windows, the replacement of boilers, insulation, cooling systems and lighting. This ESCO would take full responsibility for the project, meaning that it would cover all aspects of the project from the beginning to the end: preliminary energy audits, detailed design and engineering, business case analysis, installation, commissioning, performance measurement and verification.

The legal framework of the business would be provided by an EPC (Energy Performance Contract). EPC is a contractual arrangement of an energy efficiency improvement measure, where investments are paid for in relation to a contractually agreed level of energy efficiency improvement (de Groote, EUKN - 2013, p33). The contracting parties would be the condominiums and the ESCO.

Therefore the future ESCO would have four key stakeholders (Figure 5), the condominiums who order the energy service, the banks who provide loans for the energy efficient investment, the engineers, who assess the buildings and design the energy efficient investment and the implementers, who implement the energy efficient investment.

Name or Group	Role
Inhabitants	Main costumers
Local shop owners	Potential costumers
Real estate investors	Partners in financing the energy efficiency driven refurbishment
Self-government of 7th district	In reality only interested in renovation public spaces; Aim is to achieve partnership for more shaping policy to generate energy efficiency related investments; Being role model with EE refurbishment of public building and public housing units (costumer for ESCO)
Mayor's office/ city government	Shaping policy to generate energy efficiency related investments; Being role model with EE refurbishment
Government	Shaping policy to generate energy efficiency related investments; Proposing calls (grants) for historical building refurbishment; Convert the government supported utility cost reduction system to a real effective energy saving incentive
NGO's (e.g. Klauzalia)	Engage inhabitants for change, involvement for public reconciliation
Banks	Special financial products for EE refurbishment loan (working already with panel buildings); strategic partners for ESC's
Energy Service Company	Company which sees business case in energy saving investments; drives and implements the change; Strong lobby for policy makers; cooperation with key stakeholders
Utility companies	Potential conflict of interest, different lobby interests (lower energy bills mean less income)
Joint	Opinion leader for the groups of inhabitants;

representatives

Table 4. Key stakeholders of the prospective ESCO

Source: Own edition

The homeowners from the condominiums would pay a so called energy fee for the ESCO. This energy fee would be as much as they save on their energy bills due to the energy saving investment. As the energy performance of their condominium would be thoroughly assessed by the engineers via an energy audit it would be possible to assure that they would pay the same amount (lower energy bills and energy fee) as they paid before for energy.

In the table above (Table 4) we have collected and analysed the key stakeholders of the prospective ESCO.

5 CONCLUSION

Extremely high energy consumption can be detected across the European Union; although this can be identified mainly in three sectors (transport, housing and industry). **The EU considers that the biggest energy saving potential can be found in ageing buildings.** In Central and Eastern Europe these are the majority. Our area of examination, Klauzál square perfectly represents this average stock of housing buildings in the sense of their physical quality, however **when trying to identify and build a project on this theoretical potential several challenges have been observed.**

Significant part of the local inhabitants is a pensioner or student among whom the **fluctuation is high** therefore **engaging them in long term energy saving project is difficult**. The NGOs have also weak results in involving inhabitants but they could play significant role in future.

In this very typical housing area of Budapest **major physical obstacles** has also appeared. In order to draw the right conclusion these do have to be enlisted:

Insulation externally is not possible on the facade due to the historical character and loss of cultural value. **The internal insulation causes many inconveniences to the inhabitants** (loss of surface, moulding). Different elements of intervention have to be applied at the same time (or in a logical order which keeps the possibility open for further interventions) unless problems will rise. It is also important to note that since the area is a rehabilitation area all kinds of interventions (especially esthetical) have to be in harmony with potential future energy saving actions. **One intervention generates another**; changing the windows, fixing insulation obligates these apartment owners to change their heating system as well. It then becomes such a major project that **two sorts of actions need to be guaranteed:**

Saving more energy can be reached by **making the inhabitants more sensible for the environmental issues and by teaching them energy saving practices**. This obviously does not solve the physical problem that occurs but prepares them for the future when the physical environment will be fixed. When the physical environment will be already refurbished with the right behaviour the inhabitants will be able to realise the maximum benefits possible.

For physical improvement (if financially possible) **we recommend a centrally coordinated approach**. It is important to have a functioning national and municipal legal and planning framework for achieving the EU2020 energy saving objectives. These need to define the clear aims, the right steps of implementation to stimulate the cooperative action of different stakeholders.

As the needed intervention is major **in the examined area one possible solution can be offered by the Energy Service Companies**. These have the knowledge and connections to implement the energy saving improvement. Their main advantage is that the inhabitants do not have face extra costs. While the inhabitants pay the same exact amount of money for energy these companies gain their profit through the difference achieved with the energy saving (*win-win situation*). These companies can be nicely profitable due to the principle of scale of economy which is present in many phases of their work (e.g. procurement, loans with better conditions, better lobby power). Finally these companies can play a significant role in collecting the currently hardly achievable or sometimes even completely missing data (from basic energy performance data to higher level assumptions).

As a conclusion even though there is potential in these building this study highlights that it is very challenging to exploit this potential and to improve the buildings quality in this area of examination (even though it is very typical in its region); it requires both behavioural and financial competence. Therefore the recommendation of this work is to redefine this general approach; **the potentials should be territorially tailored so that the possible goals can be realistically reached.**

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New sustainable strategies of Rome's historic district

Chiara Fantin, Antonio Gatta, Sofia Perdikidou

ABSTRACT

As for the city of Rome, our Group intends to submit a proposal of retrofit on a neighbourhood scale, considering this scale as less evasive than the entire city and, in the same way, more interesting and effective than individual urban units. By using two indices related to the increased consumption of energy, namely population density and building density, an area of study has been identified: it is part of the regional plan called "historical urban settlements."

This aspect makes historic buildings' retrofit a very interesting question to ponder on, since these buildings are often under restriction and deserve special attention. The proposal therefore aims to give a response to the immense Rome's historic building stock, by comparing two scenarios of possible interventions: energy retrofit with the best available technology and energy retrofit with the best allowed technology.

Where is allowed, will be made a considerable lowering of the primary energy demand by making improvements to the building envelope through the realization of a ventilated roof, radiant floor system, use of skylights in the pitched roof the construction of a photovoltaic system on flat roof and pitched roof and, eventually, building a plant for the recovery of grey water and rainwater.

Through the analysis and planning of the most energy-intensive fields, such as buildings, transport and public lighting, the holistic approach can be an excellent key factor for creating models of sustainable cities in terms of energy, which can be neutral in energy consumption and in climate-altering emissions, such as CO2.

Regarding the funding of the proposed interventions, the expected sources of funding shall consider the forms of access to financial resources, including leasing, ESCO, and project financing. It also proposes the activation of participatory processes. This process will be implemented through questionnaires, meetings, and forums with stakeholders.

Key words: urban planning, neighbourhood scale, historic buildings' retrofit.

1 INTRODUCTION

The Historic buildings are the trademark of numerous European cities: historic quarters give uniqueness to our cities, they are a living symbol of Europe's rich cultural heritage and reflect society's identity. Yet, this is also an area where the high level of energy inefficiency is contributing to a large percentage of greenhouse gas emissions. With climate change posing a real and urgent threat, it is necessary to guide an improved approach to all refurbishment actions in historic buildings.

The document seeks to evaluate for the city of Rome, a proposal of retrofit on a neighborhood scale, considering this scale as less evasive than the entire city and, in the same way, more interesting and effective than individual urban units. By using two indices related to the increased consumption of energy, namely population density and building density, an area of study has been identified: it is part of the regional plan called "historical urban settlements." This aspect makes historic buildings' retrofit a very interesting question to ponder on, since these buildings are often under restriction and deserve special attention.

The proposal therefore aims to give a response to the immense Rome's historic building stock, by comparing two scenarios of possible interventions: energy retrofit with the best available technology and energy retrofit with the best allowed technology. Where possible, a considerable lowering of the primary energy demand will be made, by carrying out improvements to the building envelope through the realization of a ventilated roof, a radiant floor system, the use of skylights in the pitched roof the construction of a photovoltaic system on flat roof and pitched roof and, eventually, the building of a plant for the recovery of gray water and rainwater.

1.1 THE NATIONAL ENERGY PLANNING CONTEXT

Italy has placed the promotion of energy efficiency among the priorities of its national energy policy, which combines the pursuit of security of energy supply, reducing energy costs for businesses and citizens, the promotion of technological chains innovative and environmental protection, including in relation to the reduction of greenhouse gas emissions.

The National Action Plan for Energy Efficiency, in accordance with Directive 2006/32/EC, identified a series of guidelines that the Italian Government has sought to attain to achieve the objectives of improving energy efficiency and services energy. In parallel, the National Action Plan for Renewable Energy, issued by the Ministry of Economic Development and the Ministry of Environment, as a result of Directive 2009/28/EC transposed by Legislative Decree 28/2011, provides further guidance for energy efficiency, as a prerequisite for the achievement of objectives in the field of renewable energy and reduction of CO2, thus prompting to evaluate the implementation of Directive 2006/32/EC in a strategic context outside the extent of their sector. In the preparation of National Action Plan for Energy Efficiency 2011 both the programmatic elements as well

as those introduced by Legislative Decree punctual 28/2011 and the related implementing legislation enacted were duly considered. In fact, the reduction in gross final consumption of energy in 2020, achieved through programs and measures to improve energy efficiency, will facilitate the achievement of the objective of efficient energy production from renewable sources.

The National Action Plan for Energy Efficiency 2011 lays the foundations for the establishment of strategic planning of measures and reporting on all savings, not only in terms of final energy. There is also the provincial or regional energy plans relating to the use of renewable energy, as indicated by the Law 10/1991, must contain:

- Energy balance identifying basins territorial energy, namely those basins are, by their characteristics, size, user requirements, the availability of renewable energy sources, energy savings achievable and pre-existence of other energy carriers, the most suitable areas for the purpose of feasibility actions of rational use of energy and use of renewable energy sources;
- The location and construction of district heating plants;
- Identification of financial resources for the construction of new plants for energy production;
- The allocation of financial resources, in order of priority relative and absolute percentage of saved energy for energy saving measures;
- The formulation of objectives as priorities for action;
- Procedures for the identification and localization of installations for the production of up to 10 MW of electrical energy.

In addition to energy rationalization, the Regional Energy Plan has as its general objective the reduction of environmental pollution in the territory, with particular reference to the resolutions adopted at the Kyoto Conference in December 1997, and the subsequent actions of the European Union.

The Regional Territorial Plans are supported by specific municipal energy plans made by the municipalities with populations of more than fifty thousand inhabitants, included in their Local Strategic Plan.

At the urban scale, the Energy Plan should be integrated with other planning tools, meeting all Local Strategic Plan. Planning at the urban scale, in order to rationalize the use of energy and reduce consumption in the organization of civil and industrial settlements must move from a structure of users online (an organization of energy flows in which each user draws power from a single source, using the part they need and dispersing the rest) to a frame number, or a system where the energy is used to cascade from individual users (each function takes heat to temperature that is optimal, but starting from a single source).

Spatial planning and sectorial identifies those urban areas and establishments where you record the highest levels of energy consumption and where the greater the potential related to the use of cogeneration, district heating and cooling. The Provincial Government, through the Territorial Coordination Plan, states:

- Urban areas of priority intervention (maximum demand / energy requirements, the maximum level of emissions);
- The municipalities where it is more effective to take action on public and private building, and in what proportion;
- The municipalities where it is more effective to intervene with policies of district heating, and in what proportion.

One of the key elements - in terms of results achieved by scheduling and planning - which will leave the PTC and the tables are the Concentration thresholds Reduction (three and / or five years) the levels of demand and output is with these indirect indicators you can quantify the level of effectiveness and efficiency of urban energy policies.

1.2 ENERGY PLANNING IN ROME AND RETROFIT IN HISTORICAL BUILDING

The need to put in place actions to reduce emissions of greenhouse gases has led Roma Capital to contribute to the path towards energy and environmental sustainability by signing the Covenant of Mayors in Brussels of European cities is pledging to prepare a Sustainable Energy Action Plan (SEAP), which indicate the concrete measures and policies that should be implemented to achieve the targets for reducing greenhouse gases. The general strategy is based on a precise model of energy policy and governance. The goal of reducing greenhouse gas emissions by Roma Capital necessarily have to be translated into concrete policy choice. The SEAP therefore represents a real commitment to a strategic plan and operational sustainability and energy savings.

The Master Plan includes four main lines of action: 1) Renewable energy; 2) Construction positive energy; 3) Hydrogen for residential and transport; 4) Smart grids and electric mobility. At the base of these pillars lies a fifth line of action constituted by "energy efficiency, which is an indispensable condition for the development of any other development strategy. All the actions foreseen in the SEAP are to be framed in the basic concept of a network model, the distributed generation of “energy and the smart grid. The main actions envisaged include, among the others, in summary:

- The construction industry is a sector that is particularly energy-intensive.
- The actions planned are aimed at both new construction and the existing building, particularly for new construction measures taken they should be aimed at increasing the number of buildings with higher performance than the existing national or regional level, while as for the existing

buildings some interventions have been identified, and they have to be applied in different sub- sectors concerned (public and private residential, school building, tertiary);

- The setting of a mobility system that promotes all inside of urban area the improvement of accessibility by alternative modes of transport, favoring the TPL surface and underground, bicycle and pedestrian mode and the enhancement of journeys taken along river; special attention will be given to the implementation of energy infrastructure in line with the Sustainable mobility Plan for Roma Capital, with explicit reference to electric mobility and to a model of the transition to the hydrogen mobility and mixtures thereof;

- The use of renewable energy sources that reduce dependence on traditional non-renewable energy sources such as fossil fuels and to implement a policy of effective reduction of greenhouse gas emissions. In this sense it is necessary to implement local energy policies that emphasize the specific characteristics of the area, such as a good insolation, a lie of the land that allows the construction of small hydro power plants and an adequate availability of wind in coastal areas, making these policies a key element of public administration;

- A system of spatial planning modern and updated, through the development of a synergy (conceptual and temporal) between plans and programs and the inclusion of environmental criteria and energy in the process of preparation of planning instruments and sector;

- A green purchasing policy (*Green Public Procurement)*;

- The production of electricity on a local basis as a key policy of diversification of energy sources and environmental sustainability. The wind, solar, biomass, small hydroelectric plants, cogeneration and regeneration can be the keys to a policy of local generation of electricity, which combined with an optimization of the uses and an energy saving policy extended to different areas of consumption, will lead to a limited dependence on large power plants with consequent immediate positive effects on greenhouse gas emissions;

- The setting processes of raising, training and participation with finding opportunities to exchange ideas, the development of the initiatives, the project of training courses, etc.., oriented as content and method, the principle of sustainability and education at the correct consumption habits.

In reference to the religious buildings of historical value, the changes and additions to the Municipal Building Regulations (February 2011), regarding the standards for energy efficiency, the use of renewable sources of energy and water saving, were considered. The Building Regulations contain a greater integration in the field of environmental protection through the writing of specific

annexes relating to the issues of the use of alternative energies, the rationalization of energy consumption, water saving, sound insulation, energy savings calculations of the buildings.

In public and private buildings during the new installation of heating systems or renovation of existing thermal plants, with respect to the entire building unit, the installation of thermal energy production must be designed and constructed so as to cover at least 50 % of the annual requirement of primary energy demand for the production of hot water with the use of renewable energy sources. This limit is reduced to 20% for buildings located in the historic part of the city a UNESCO World Heritage Site - as well as clearly identified in Regional Territorial Plans adopted by the Lazio Region. They are always subject to the limits provided by the constraints related to cultural, environmental and landscape.

2 TERRITORIAL AND SOCIAL DESCRIPTION

2.1 CHOICE AND ANALYSIS OF THE NEIGHBORHOOD

Given the urban fabric of Rome and its extension, we should use a scale of clear and effective survey. Using data from the 2011 general population census, it is possible to determine indexes that are synonymous with high energy consumption. The indices used are the population density and building density, which can be interpreted as high energy flows in terms of primary energy demand. Through these measures it is possible to identify the settlement contexts that present major indexes.

After a comparative analysis between the various areas of the City of Rome, the zone called “Monti” is individuated as the area with the highest values. This area has a lot of unique features such as the presence of the Vatican State at its core, different types of buildings according to the period of construction, two underground train stations and limited green spaces, due to the presence of a strong urban tissue.

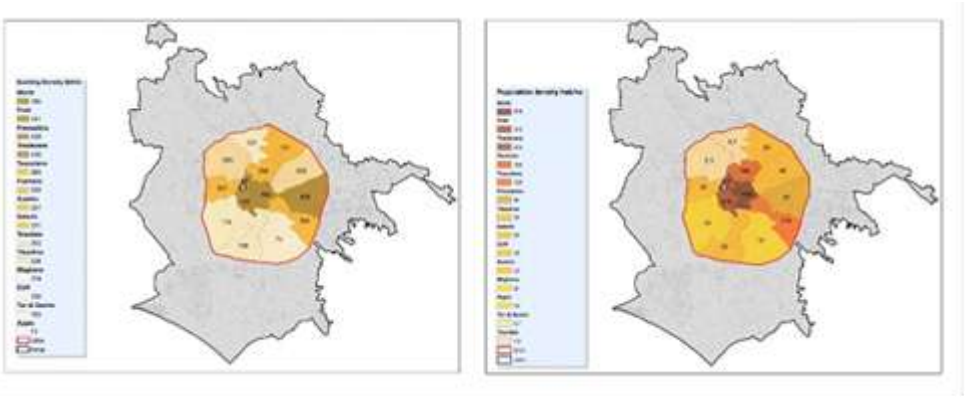

Fig 2. The population density

The first municipality, Monti, includes the entire historic center and most of the monuments, archaeological sites and cultural spaces and exhibitions of the City of Rome. This has encouraged the tourist vocation of the area in which they have developed most of the tourist accommodations in the city. Given the presence of institutional settings, most of the activities related to the political and administrative life are concentrated in this area. In this 1,430 hectares and inhabit about 132,000 people, 4.6% of the entire population of the city of Rome, with a density of 92.2 inhabitants per hectare. This number of the total population does not consider the enormous daily flows of people who visit the district for various reasons and for tourism. In fact, the historic center continues to maintain the characteristics of elective attraction for the enjoyment of cultural activities, entertainment and other services. The population has remained fairly stable over the last decade, except for a growth in the past two years, mainly thanks to the growth in the number of foreign citizens. The composition consists primarily of many single parents, followed by elderly and many couples. In this context, the presence of the immigrant component is often a place in the activities of family support. With the continuous evolution of the social and productive tissue, the territory requires constant interventions aimed at preserving the social and cultural identity while protecting the share of residential and commercial tissue, as craftsmanship still exists. To determine which area to develop further the demand for primary energy in the Monti district, we used once again the ISTAT 2001. The parameters used are the population density and building density.

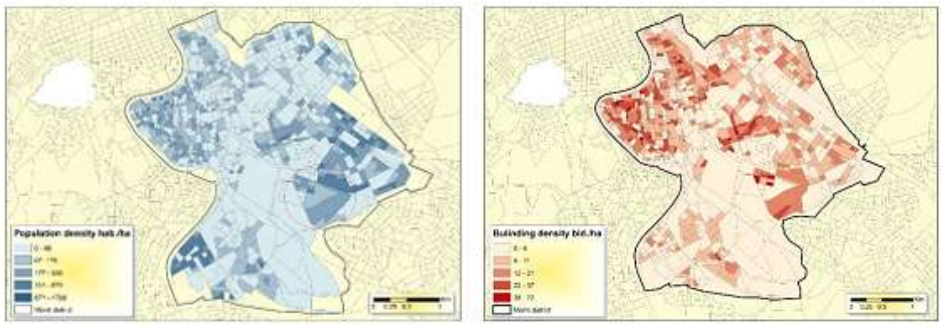

Fig 3. The building density

Comparing the two cards and using the two indices of comparison, high and constant values emerge in the circled building's block. Therefore, it will be necessary to analyze the area of the district in detail. The survey area has a population of 3864 permanent residents with an average density of 73.2 inhab. / Ha with component of foreign residents (267) which is 6.9%. As for the buildings, they are about 210, of which 158 (75.2%) residential buildings, 20 (9.52%) office buildings, hotels, services, and 32 (15%) used as religious buildings and hospitals.

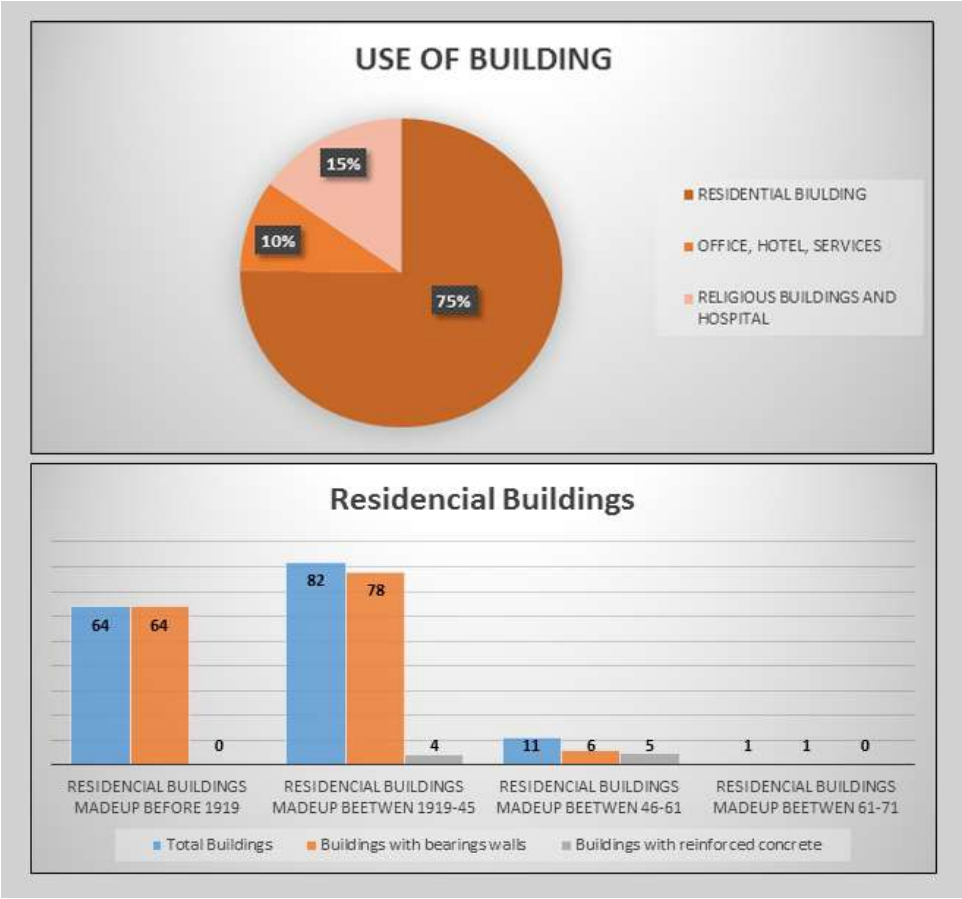

Fig 4. The use and the age of the buildings

The residential buildings were analyzed according to the techniques of construction and are due to the age of the building. The survey shows that 93% of the total load-bearing masonry is built, the remaining 7% of the reinforced concrete. In addition, most of the buildings were built before 1945 which is the element that characterizes the entire historic fabric of the real estate area.

2.2 EVALUATION OF ENERGY CONSUMPTIONS BY SECTOR AND BASELINE CO² EMISSIONS

In reference to energy consumption, out of 2321 total housing, 47 % (1092) has central heating and 20.4% (474) are empty dwellings. The analysis has considered the different types of buildings and energy consumptions depending on the intended use assigned to the housing and the time in which it was built; consistent with the percentage of buildings of historical and architectural value, many buildings in which it denotes a lack of quality housing, particularly buildings dating back to the 60s.

The analysis has continued with the estimation of the energy consumption of the neighborhood for areas such as the consumption of electricity for domestic use (kWh / inhabitant and m3/inhab), the level of light present in the study area (light points / inhabitants) and the rate of motorization (number of cars / 1,000 inhabitants). Specifically, the data that the environmental indicators show ISTAT provide a final consumption of electricity of 1458 kWh / capita / year.

Therefore sizing the data on the area of study can include an estimate of consumption. The value of electricity consumption per capita is multiplied by the inhabitants of the area. You get an estimate of consumption for the year 2011 1458 kWh / year x 3864 = 5,633,712 inhabitants KWh / year

The same deduction can be taken with consumption relative to natural gas; values indicate a consumption of 309 m3 per capita in 2011. The figure should be multiplied by the inhabitants of the area of study: 309 m3 x 3864 = 1,193,976 inhabitants cubic meters/year

For consumption by the same unit of measurement should be converted 1,193,976 m3 x 10.5 = 11.93976 million kWh / year. The network of public lighting area is divided into three types of light sources: the first type has a metal bracket of about 10 m with armor provided by HPS lamps (high pressure sodium) with a power of 250 W. The second type has metal supports of about 7 m with armor equipped with HPS lamps with a power of 150 W. Finally, there are, especially in the major intersections and squares, a metal that supports 4 lamps of 400 w. The poles that hold up to 250 W of armor are placed in the main streets defined high slip where you have an abundant and constant lighting for road safety. In the local roads, however, are willing lower stakes with a reduced intensity of light. In the figure the arrangement of street poles.

In relation to public lighting, 91 points are light bulbs that have High Pressure Sodium (SAP) 30 109 of which have a nominal power of 250 W, 163 have a power of 150 W and 400 W 36 At our latitudes is necessary consider a total number of hours that the night lighting ensures visibility road. It is equal to 4200 hours / year.

Fig 5. Analysis of the street lighting

The amount of electrical energy consumed in a year in the study area is the following: 9 (400W x4) + 163 * 150 * 109 W + 250 W = 66100 W * h year 4200 = 277 620 kWh / year.

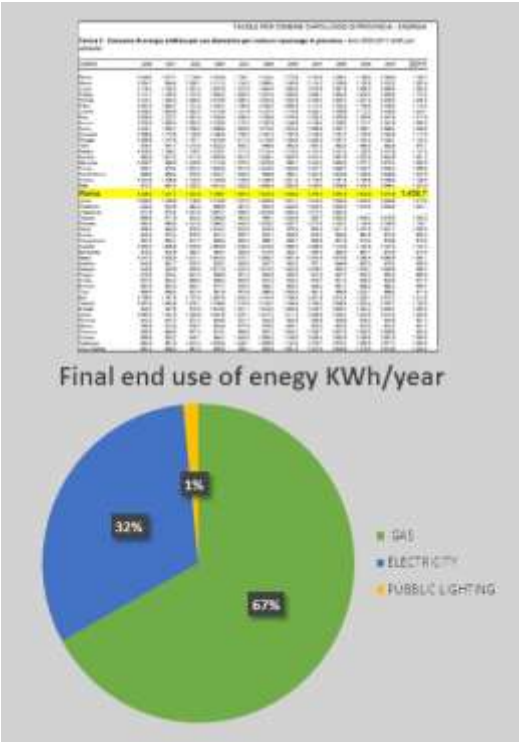

Fig 6. Energy consumption

2.3 PUBLIC PARTICIPATION IN THE DECISION-MAKING PROCESS

"Participation is an essential condition for sustainable development of the city, as the people themselves with their behavior can become the protagonists of a new model of development." (SEAP, 2011, p.60)

In line with the requirements of the European Community, the actions proposed in the "Public information, awareness and stakeholder involvement" in the SEAP, intend to develop the dialogue with citizens and stakeholders, as a methodology for the taking of public decisions. The goal is to bring the municipal administration to citizens to respond in a timely, appropriate and specific way to the needs of local communities, to improve transparency, accessibility, responsiveness and dialogue towards the citizens and authority, and to direct the system to local public and private principles of accountability, transparency and subsidiarity.

For the awareness building of citizen, the Sustainable Energy Action Plan proposes the creation of an interactive process and of course the use of social networks, and also provides the creation of a campaign with testimonials from spreading through the media and the opening of an office for the information to the citizens of the energy aspects. The group intends to concentrate on the mapping of stakeholders who have shown very interested, but who have had no influence on the process. The subjects selected for the administration of the questionnaires are: residents, business owner and city users of the district.

Nowadays in Italy there is a tense atmosphere and complete distrust for any type of project proposed so the method of administration of the questionnaire is mainly based on personal interviews because it allows us to interact with the citizen and feel the mood of interviewee and understand the possible degree of participation within the process. The important part of the questionnaire examines the perception on the part of the interviewees of the value of the historical heritage of the buildings subject to retrofit, the opinion regarding possible actions designed and an opinion with respect to actions proposed by SEAP.

The results show a lack of knowledge by most of the respondents belonging to all age groups taken into account as for, the issues of energy efficiency and the energy rating of buildings. Older people are not interested in knowing the actions feasible in their own homes or in own building; whereas young people and adults have shown particular interest once explained the advantage that can bring any intervention of energy efficiency in terms of reduction of expenditure and consumption. The majority of respondents in the bands from 18 to 30 and from 30 to 65, are conducive to the realization of redevelopment energy in historic buildings provided that their architectural appearance will not be modified. In reference to the SEAP and proposals relating to the activation of telematics and the opening of an office for the information to the citizen of the energy aspects, the responses were quite similar for all respondents. None of the citizens are aware of the existence of the energy plan for the opening of an office information once again the general opinion is to the contrary because, as previously mentioned, people have a certain impatience with the government and non-

believe in its efficiency. The activation of telematics and the use of social networks seem to have a possible positive response in young people aged 18 to 30.

In this regard, the group proposes a tool capable of bringing citizens closer to the theme of energy conservation. It is a return map of energy consumption with buildings more energy- efficient and the most clearly marked and freely accessible by anyone to make cross-checks, to organize energy policies and evaluate the results or simply to trigger mechanisms of imitation of virtuous energy savings.

The data for the consumption of utilities of electricity and gas have long been in the possession of local authorities; comparing the total consumption of each building with the surface of the property, you can get the energy rating of dwellings in the area. You can then create a system for monitoring energy consumption data using the area who have no personal reference, however, because they refer to the property as a whole and to each building by associating a color corresponding to the energy level of classification assigned.

It needs to be kept in mind that a property may have a low energy consumption when uninhabited because in this case it is sufficient to check whether there are residents; but this is a good starting point for the representation of the situation of the territory, especially to start sharing at various levels what is the meaning of energy classification, how it compares to the annual consumption, how you can save money and the incidence it can have on saving the environment. It is useful to create a culture of sharing and a virtuous model.

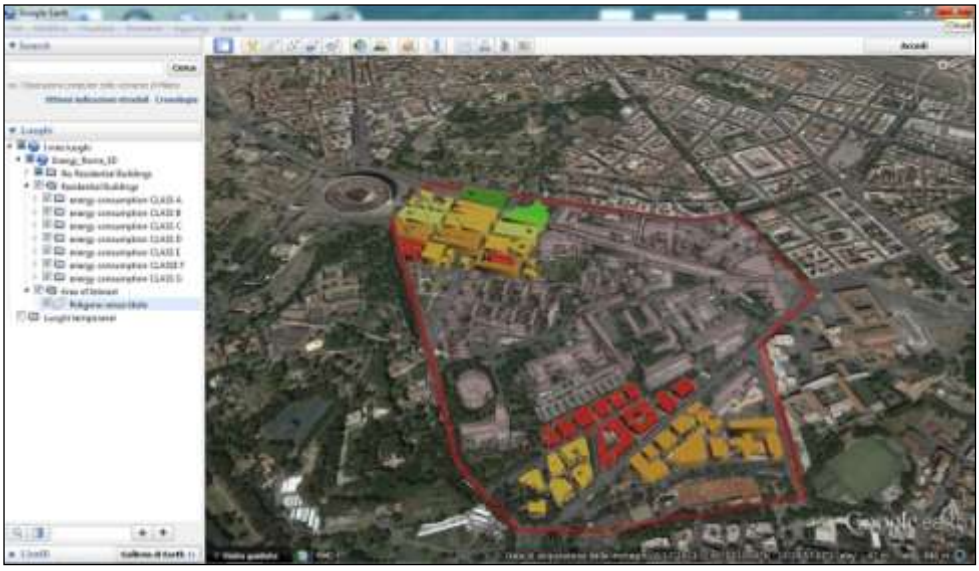

Fig 7. Map of energy consumption

3 DISCUSSION OF POTENTIAL SCENARIOS

Analyzing the land use we saw instantly that the most of the area consists of hospitals. Moreover there are residential buildings that there are built in the eightieth and nineteenth centuries and they have 5 to 6 floors. At the end there is a lack of green spaces.

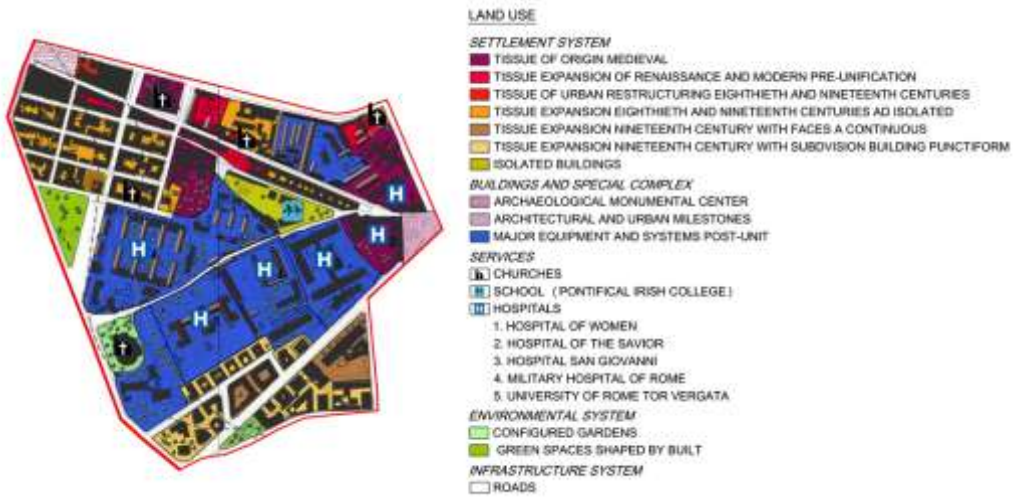

Fig 8. Land use

The analysis start with a climate data base. The maximum temperature is 31°C at the month of August and the minimum temperature is 2°C at the month of January. The relative humidity is always high seeing that the area is located near the Tiber River. Closing the average wind speed is 3,4 m/s with direction north-east in the winter and 3,5 m/s with direction south-west in the summer. At the later stage, the analysis envisage the shading with the software Ecotect. In the winter we chose the month of December from 8 in the morning until 15 in the afternoon. While in the summer we chose the month of June from 9 in the morning until 16 in the afternoon.

Fig 9. Analysis of the shading

We also did the analysis of the air temperature, specific humidity and wind speed for both winter and in summer with the software Envimet.

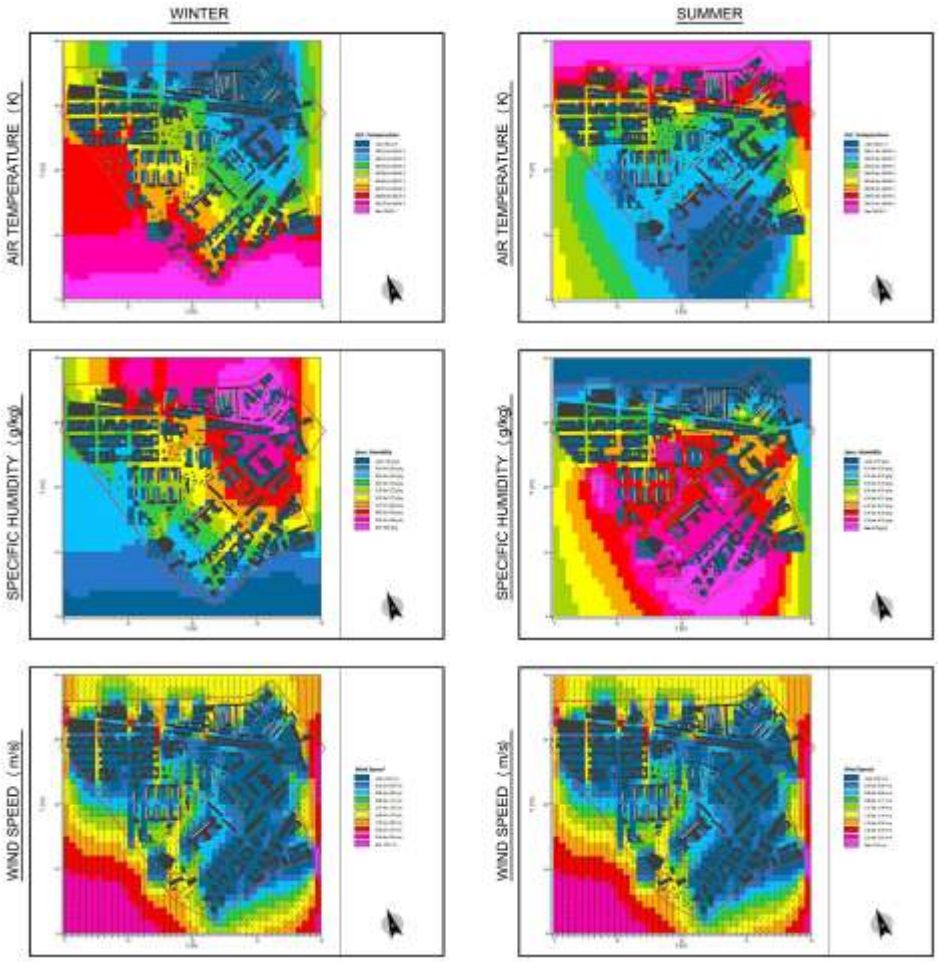

Fig 10.Analysis of the air temperature, specific humidity and wind speed

Modifying technical specifications for the construction or rehabilitation of buildings to take account of other potential effects of climate change and retrofitting existing buildings to make them more resilient to adverse weather conditions and natural disasters.

First of all we divided the area into three zones: The residential (A), the offices, college and hospitals (B) and the religious zone (C). We also acted under two scenarios. The first one is without constraints of the law and the second one is the most realistic based on the law. So based on the zone and the scenery we have considered the following strategies to resolve the problems of temperature and humidity.

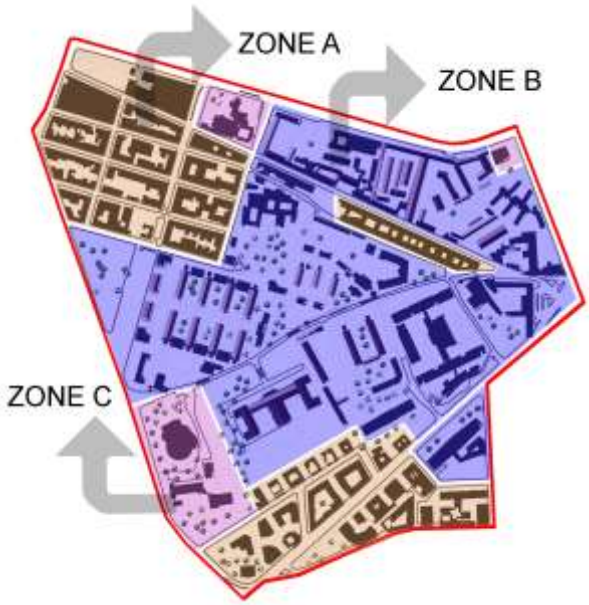

Fig 11. The individuation of the three zones

There are two types of strategies: the use of the passive system and the use of the active system.

The recovery or even the ordinary and extraordinary maintenance of the historical buildings (zone C) must include all steps necessary to implement the conditions of sustainability and biocompatibility, as well as comfort and health of the environments. For this reason it is suggested to adopt technology systems shortly invasive, made with the logic of "minimal impact" oriented the use of renewable energy sources and the maintenance of traditional appliances. You should prefer to use bio-sustainable building materials and finishes, provenance local and belonging to the local building tradition, according to the fundamental principle of "minimal impact" on the existing. You should prefer, as much as possible, the use of recycled or recoverable. Interventions need to contemplate, among other things, the rehabilitation of energy performance of the building envelope, with solutions should increase the thermal inertia of the enclosures with natural materials and biocompatible. All work must provide for the recovery of techniques, existing structures and components in order to collect rainwater. At last it is possible to produce energy with the gel PV, a liquid material composed of amorphous silicon, to which is applied a procedure in order to make semiconductor nanotechnological. The idea is to go to fill the space between the double glazing of the windows. Solar energy is captured and absorbed by small electrical terminals installed in the windows and then be poured into the network.

3.1 ACTIVE SYSTEM: SOLAR THERMAL ACTIVE

The "active" system means is that some component inside requires power, either a battery or an external voltage source. At the zones A and B the actions are the same. In the first scenery we considered the use of a heat pump, a radiant floor,

the recovery of gray water and rainwater, the photovoltaic installation and the use of the LED lighting. In the second scenery we considered the use of a heat pump, a radiant floor, the recovery of gray water and rainwater and the use of the LED lighting.

The actions proposed include:

1) Increasing the autonomy of buildings in terms of water and energy supply, so as to better withstand disruption in the provision of collective services, through a radiant floor system. Increase of the thickness of their 18cm floor to enter the pipe and slide the heating fluid;

2) Re-use water: Firstly harvesting rainwater and secondly, by using so called grey water from showers, baths and basins. Both sources can provide water to flush toilets, and possibly to use in the washing machine and on the garden. The benefit of grey water systems is, of course, that you know own home will regularly produce it - rainfall is less reliable. You can cut down your mains water use by around third by flushing the toilet with rain or grey water;

3) Take advantage of the sunshine through the photovoltaic installation to produce electricity from renewable source, using solar thermal active through the construction of a photovoltaic system on the flat roof and pitched roof;

4) The replacement of the fluorescent lamps with the LED lamps will improve the electrical efficiency and the heat dissipation.

3.1 PASSIVE SYSTEM: RETROFITTING

The "passive" system means that no components inside need to be powered. In the first scenery we considered the retrofit witch is the ventilated roof or the green roof, replacement of the fixtures, the use of the solar screens shades, the thermal plaster and the greenhouse solar system. Meanwhile in the second scenery we also considered the retrofit without the greenhouse solar system.

The actions proposed include:

1) Reduction of the thermal dispersion through the internal insulation and optimization of thermal insulation through the replacement of existing aquifers and the realization of a ventilated roof;

2) The replacement of the fixtures will optimize the heat insulation. The new array will be in aluminum frames with thermal break and double glazing that will reduce heat loss;

3) The installation of the solar screens shades, outside of the windows will control heat and light, allowing a lower percentage of both;

4) The use of thermal plaster on the walls have unrivalled thermal and acoustic properties that is both hard wearing and flexible which is ideal for both internal and external applications. When applied either internally or externally, creates a seamless thermal barrier which eliminates any risk of cold bridging within the structure;

5) Capture the heat through the greenhouse solar for helping the natural heating in the time of winter and the natural cooling in the time of summer;

6) At last we considered for the implant, the replacement of the traditional valves with thermostatic valves or sensors of the presence, owing to the existence of the empty dwellings in order to not consume unnecessary energy.

4 CONCLUSION

The choice of the group to concentrate the analysis to a neighborhood scale in preference to the urban scale, allows you to focus on well-defined interventions. The real risk you run, in fact, in the case where the government intend to implement plans and projects to promote energy saving, is the difficulty in raising funds for large-scale projects. The scale of the neighborhood, however, helps the decision maker to exercise a more reliable feedback on the time spent on specific activities, in particular to increase the effectiveness and efficiency of the plans. All this creates a better monitoring phase. Our main purpose is to create a plan that the people could use as guideline for the interventions of the historical buildings of Rome.

A key aspect to consider is the activation of the financial resources necessary for the realization of the project, through the activation of networks and mobilizing public and private actors both inside and outside of the territory concerned. The ability to intercept funding is essential for every single city and may, in most cases, through the launch of partnerships with other entities.

The European fund ELENA offers to the public entities of the various institutional levels, the necessary assistance to develop investment programs and projects in the field of sustainable energy. The funds are used to cover 90 % of the costs of technical assistance necessary to prepare, implement and fund energy projects, trying to overcome in this way the problems related to a lack of know-how and lack of capacity to implement large-scale initiatives by local authorities. Technical assistance may in fact be used for different types of intervention: such as energy efficiency and retrofits in buildings (public and private), public lighting, renewable energy, district heating plants, development of Smart Grid, energy issues related to transportation. Currently the obligations imposed by the Stability Pact Italian make complex access to this and other European funds, wasting the opportunities really convenient. The financial instruments considered for the project, provide for public subject of White Certificates (Energy Efficiency Certificates) certifying the energy savings. Certificates shall be issued in an amount equal to the primary energy saved, or a TEE each toe (ton of oil equivalent) saved.

For private entities is expected to contract proposal with an Energy Service Company (ESCO). The contractual model that is slowly spreading as prevalent in Italy, called "Energy Performance Contracting" provides that the ESCO is paid on the basis of the savings actually achieved by the private client in front of the intervention. The investment is redeemed and paid for with the savings achieved (a portion of which is shared immediately with the customer) for a predetermined period of time, usually between 5 and 10 years, after which the savings is to the advantage customer. Both the ESCO and small and medium-sized industries that carry out energy efficiency measures have the ability to finance themselves by issuing Mini Bond.

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Urban planning: the mirror of society

Manuela Sarcià, Mario Agatino Reale, Ilaria Alessandra, Dario Salerno

ABSTRACT

Nowadays one of the most important global planning problems is to link the urban planning to sustainable development. In the last years the issue of sustainability has been implemented through several methods and key elements.

Infact cities and citizens have an important role to play in the reduction of CO_2 emissions and the fight against climate change.

The focus point of our proposal is to develop a real partecipated way of planning processes, starting from a local urban organization including society.

The first step is informing and bringing up citizens about energy costs, prices and technical aspects connected to the feasibility of producing energy, using alternative sources. The second step includes citizens' need of being informed and actively involved in planning development processes. After these two phases a new way of public land use could come out with graphics, projects, partnerships etc. And the third step focuses on the Municipality as the main actor, which could transfer citizens some areas, such as services, fringe, abandoned and disuses industrial ones and so on. Such areas could include the creation of multifunctional spaces which will produce "green" Energy in order to save it.

In the meantime these spaces will become meeting and sharing point not only fisically but even virtually. All this actions will promote urban regeneration interventions. Thanks to these kind of areas each community could feel as a real active part of its neighborhood.

Moreover inside those areas it could be possible to create: waste separation areas, playgrounds, urban organic gardening, green areas, "mini wind farms" in order to promote an efficient use of public urban areas.

Key words: Urban planning**,** Smart City, Siracusa, Sustainable development, Public Participation, Energy Efficiency.

1 INTRODUCTION

The increase in population density due to urbanization, which has characterized regional transformations in western countries from the beginning of the Industrial Revolution until the second half of the Twentieth Century, appears to be strictly linked with increasing energy consumption.

The European Union on 9 March 2007 adopted a ground-breaking action plan entitled “An Energy Policy for Europe”.

This action plan foresees the responsibility of all the EU member states to reduce emissions of greenhouse gases harmful to the climate by 20 per cent by 2020; to reduce energy consumption by 20 per cent by 2020; to phase in 20 per cent renewable energy in the European energy mix by 2020.

Cities are responsible, directly and indirectly (through products and services used by citizens) for more than fifty percent of greenhouse gas emissions originating from the energy consumption of human activities.

The EU commitment to reduce emissions will be achieved only if local stakeholders, citizens and representative groups share these aims and take an active part. Local and regional authorities, as administrators closest to citizens, must coordinate actions and give a good example.

The use of renewable energy sources is essential both for industrialized countries and for developing ones. In the short term the former need greater sustainability in the use of resources, a reduction in the emission of greenhouse gases and air pollution, diversification of the energy market and reliable energy supplies.

For the latter, renewable energy sources represent a real opportunity for sustainable development and access to energy in remote areas. Energy efficiency policy, renewable energy projects and other measures in the energy field can be introduced in various sectors of local government.

Traditional energy sources (fossil fuels) should be combined with, if not completely replaced by, sources of alternative energy, such as wind, biomass, solar, geothermal, hydroelectric etc. The production-consumption cycle should be designed to reduce to a minimum the production of domestic waste and garbage in general.

Products should be designed to guarantee appropriate storage at the end of their life cycle. Waste should be collected for recycling and sent for processing which enables the raw materials to be put back into a new production cycle.

In all cases, the product-waste cycle should ensure the minimum environmental impact. The environment cannot be considered a source of danger or a resource to dissipate, but as a resource to be responsibly managed.

2 SUSTAINABLE CITIES: GENERAL PRINCIPLES

The general principle of the sustainable city is sustainable development. The origin and the use of the term *sustainable development* is quite recent, it comes from the document edited by the World Commission on Environment and Development (WCED) which also includes an International definition of *sustainable development*: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

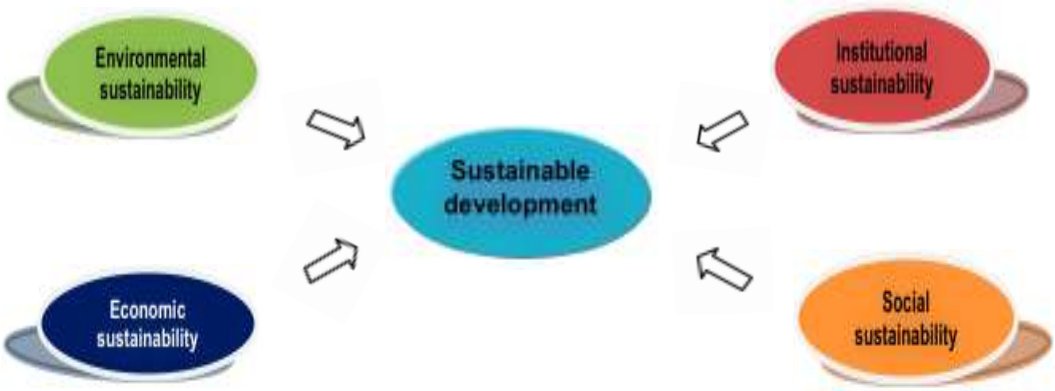

Figure 1 – Sustainable development elements

On the basis of that definition it is possible to enumerate four fundamental elements of sustainability: environment, institutions, society and economy. Cities are the only models of high-density human coexistence, and experience demonstrates that low density is incompatible with our lifestyle, which is so artificial.

It is in this perspective that we have the concept of the sustainable city, to be better defined in terms of cost - benefit analysis. Recently a new terminology associated with the sustainable, so-called “smart city”, has emerged.

Our project begins from a logic of communication and social participation which is able to satisfy population expectation based on sustainable development philosophy.

Smart cities in fact are able to combine both technology, development and population participation. According to the Spanish economist Gildo Seisdedos Dominguez, the smart city concept is based on efficiency, which is in turn based on integrated management, with ICT (Information and Communication Technology) and active participation of the citizens. All those things imply a new way of governance with the authentic involvement of citizens in public policy.

From the urban point of view the smart city is a set of urban planning strategies aiming at optimization and innovation of public services, so as to link a city’s infrastructures to the human resources, both intellectual and social, of those who

live in it, using new communication, mobility and environmental energy efficiency technologies, to improve the quality of life and to satisfy citizens', corporate and institutional needs.

3 HOW TO LINK URBAN PLANNING TO ENERGY EFFICIENCY

The project aims to involve citizens in order to inform them about economic and administrative aspects connected with public energy production.

Our intent is to reach this purpose through several actions:

- Information portal on the Municipality website;
- "Environmental footprint" platform;
- Awareness campaigns for students (involving Schools and University);
- Vocational training courses for municipal employees and young freelancers;
- Urban centers as info point and advice service (employees and young planners);
- Incentives and subsidies to sustainable green projects and virtuous behaviors;
- Roundtables/meetings with stakeholders, local administration and local community representative groups.

The knowledge of energy consumption data could motivate citizens to make progress in saving energy and developing the use of new energy sources. The publicadministration should take into account citizens' participation in order to improve their public spirit and sustainable development; besides the project includes incentives and subsidies to create sustainable energy production sites on public land.

A good example to consider would be Porvoo city on the south coast of Finland, where the administration decided to set up a major sustainability project in which a high efficiency energy development will house approximately 6,000 people.

The starting point was a pilot project for Skaftkarr residential area, in the city suburbs. The plans produced as a result of cooperation between Sitra (electricity supply company) and the city of Porvoo prove that thanks to shrewd energy planning it is possible to obtain a considerable saving in both energy and financial resources as well as a significant reduction of green house gas emissions. Various solutions were proposed to minimize consumption and emission. Houses with real time monitoring systems for energy consumption where, by means of online forums and blogs, users can exchange information and develop shared strategies to limit consumption.

As regards heating, annual requirement in the Skaftkarr area approximately 20 GWh, a solar plant is being designed.

When it is built, the entire area could have heating guaranteed for the whole year with no emissions. Regarding transport, Skaftkarr is encouraging people to use bicycles and walk; the local council believes that the removal of a number of obstacles to pedestrians should motivate people to get around on foot.

Figure 2 – Source: http://www.skaftkarr.fi/en

Porvoo's philosophy is that sustainability is a question of a sharing - culture which must involve the whole community. For this reason the pilot project in Skaftkarr includes a program to make citizens aware of the issues involved and the setting up of an energy information desk where, among other things, citizens can request a free device to calculate domestic energy consumption.

The purpose that we have in common with Skaftkarr project is to save energy by making invisible energy use more visible.

4 LOCAL URBAN ORGANIZATION AND COMMUNITY PARTICIPATION

In order to increase the level of agreement regarding the regeneration of public spaces, with the aim of ensuring proper management of urban spaces, the project envisages the involvement of the local community right from the design process.

The participation of the local community in the process of planning could contribute to the building of a strong sense of belonging and of a common vision, or a common project, for the transformation and the development of an urban area, in terms of responsibility and cooperation. Participatory planning prepares for greater public support of the adopted decisions.

Participatory practice should encourage citizens to get to know and explore the city, should facilitate self- promoted changes and transformations, even using the great educational potential of the natural and cultural context.

Looking at authentic models of citizens' participation, able to facilitate the protection of diffuse interests, it is possible to program city and territory development, whose quality is shared by all. The cooperation of citizens in the planning process is one of the necessary conditions for the supply of services, products, features and performances in the city, all responding to real needs.

The contribution of participatory planning can be extremely profitable if it concerns the environment in which people live their daily experience of citizens: the district, the neighborhood, the village, etc.

They are the real experts on what works and does not work in the territorial organization, on the resources available and on things to improve; they have expectations and ideas to make the area in which they live more livable, attractive, and competitive.

The most delicate and difficult aspect of participatory planning is the identification of good rules to organize the discussion, claryfing that there are no general rules applicable to all contexts, but the method of discussion must be defined on a case by case basis.

Among the tools of guided interaction that facilitate dialogue and promote cooperation in the search for solutions which allow you to produce concrete results towards the urban transformation of public spaces, we have considered:

- In the first phase of the participatory process, "active listening" to citizens and stakeholders, which is essential to look at reality in a "polyphonic" way, listening to all voices in order to enhance the vision of the problem and strategies to face it.

It is particularly important to listen to local people, investigating in advance who are the ones with whom to interact, to define an appropriate communication strategy, able to communicate with citizens. In order to put into practice "active listening" we must go and consult the people directly, such as through the distribution of information material in homes or directly to people in community centers, or through the "walking neighborhood" or activating some reference points on site.

In particular, the "walking neighborhood" is a tool that allows technicians and residents to share information that is specific to their field.

Technicians' work primarily on paper and data, allowing them to see the many aspects that other citizens don't know about. But there are many other aspects that the residents know about and that the technicians are not able to grasp.

The approach consists of one or more walks in the neighbourhood; during which small groups of residents (from 10 to30) lead technicians in a reconnaissance of the area.

During the walks, people exchange comments, questions, compliments and aspirations, in a free and relaxed gathering of impressions, excerpts of the history of the neighborhood, problems, experiences, memories.

The walk is also an opportunity to speak to passers-by intriguing and inviting them to provide additional information, to express opinions and perhaps to join the groupthat walks. The walk usually ends up in a place of meeting, where people find refreshments and where they can continue the conversation, exchanging other impressions and recording the final reflections.

- Inthe final step of the participatory process, the "design laboratory", which involves small groups of people, selected to represent both view points of citizens and technicians, and thanks to whom it is possible to develop, even through the useof hands-on materials, easily understandable and share able hypotheses of modification of urban space. Some design laboratories would be implemented by involving children and young people of middle schools and high schools, developing methods of participatory planning as “planning for real” or “action planning”, in which the design manipulation, with its concrete character and expression, could be of great support for discussion and debate.

From the participatory planning flows build shared visions between who is deputy institutionally to develop policy proposals for the city’s territory and those who actually use it, as well as the economic and cultural potential players.

Thanks to the participatory planning it is possible to build a picture of the neighbourhood that could be consistent with the expectations of residents and city users.

We believe that through the involvement of citizens and stakeholders in the process of participatory planning for the design of the experimental area and thanks to the project that will ensue, it could be possible to stimulate the spontaneous participation of other citizens and stakeholders in other neighbourhoods of the city.

The implementation of the participation will produce an increase in the consciousness of the importance of the participation in the planning process that determine the future development of the city.

5 CONVERTING UNSUSTAINABLE PUBLIC AND PRIVATE LAND TO SUSTAINABLE GREEN ENERGY PRODUCTION PLANTS

The project foresees cooperation among the local council, citizens and young planners, who could be employed for the realization of the project. Lots of public sites could be implemented to set up facilities, useful for children, young people and families but also for tourists. Moreover this project could save these places from decay and abandon.

This project proposes the granting, free of charge, of these areas to companies, organizations or associations (even for a limited number of years like 25, 50 or 100 years), who would realize within these sites a series of plants that would enable them to produce "green energy", which would be supplied free to the local council.

In this way the council, for the mere cost of the land grant, would benefit free of charge of all the energy necessary for public lighting and other municipal needs.

Inside these areas it also becomes important to create facilities that are accessible and functional for the citizen. In fact, this is about urban areas. If administrations only build areas of energy production, the result will be the creation of areas inaccessible to citizens and break up the urban territory.

Given that there are different ways to produce clean energy (wind, solar, geothermal etc) in practice it would be desirable to assess how these forms of production can be integrated with the delivery of services for the citizen.

Those who receive the land free of charge would also supply these services. As it is easily understood, the realization of these actions has inevitably a cost.

For this reason an appropriate solution is to make services available within these areas for a fee. So, those who manage the space in which it will be offered, for example the sports center, will keep all the profits that the asset produces.

Also we clarify that, having created structures capable of producing energy, the dealer will supply all the energy required by the municipality free of charge, and in exchange will be free to sell what remains to citizens, through charging stations.

It seem clear that such projects represent a benefit for everyone:

- For the administration: which merely granted free sites. It benefits from free energy, which is necessary for street lighting or to supply public transport;
- For stakeholders: they would have the opportunity to realize their projects without any charge for the site upon which they build facilities;
- For citizens: they would live in a greener city, with many services and the possibility of reducing council taxes.

6 BASIC ELEMENTS OF PROJECT AREAS

At this stage in the proceedings we can only speculate as to what services it is possible to achieve in these areas.

The elements that are present in every area are:

Energy production

The way in which energy will be produced within these areas is subject to the activities that will be carried out there and also the geographical position. Therefore, we may choose the installation of mini/micro wind turbines for the areas with most wind and where the noise of such installations will cause fewer disturbances. It is possible to opt for photovoltaic systems (panels, stained glass, tiles, etc.) where there is an increased exposure to sunlight or the site faces in a favorable direction and the installation guarantees a higher yield.

Paving, *"pavegen"* type, where there is a greater turnout and transit of people, both for interior and exterior spaces.

The installation of geothermal and solar panels will be considered where we need the access to hot water or to heated spaces.

Seeing that most energy production is subject to special conditions, we must also provide for the realization of energy storage in order to exploit the energy stored in the temporary absence of the sources that enable production (wind, sun etc.).

"Recycling areas"

An area where it is possible for citizens to dispose of garbage in different containers, resulting in a revenue from its sale which in turn would encourage everybody to recycle. This credit may be a bonus that could be deducted from either municipal charges or used for the payment of services rendered by the municipality (bus tickets, parking pass etc.).

Water point

Installations to distribute mineral and sparkling water. Water distribution network, certified by rigorous periodic inspections by the public health authorities and laboratory tests.

Charging stations

These electricity outlets (from the production of renewable energy sources) would be available to citizens who want to recharge vehicles, such as cars, bicycles etc.

The installation of these columns would give citizens easy access to the energy they need and consequently encourage the use of such resources.

Green areas

Then in each of these areas it would be necessary to build facilities accessible to everybody and which would enable the latter to make good use of the site. Moreover trees, plants and green paths help to absorb carbon dioxide and reduce heat in summer.

Urban gardens

Small plots of land granted to individual citizens or groups of them on which, upon payment of a fee, they could grow small plants and vegetables.

Parking with bike sharing

Parking areas, where people can find electric bikes available to the citizen. In fact, leaving their cars in the parking lot, they can decide to continue by bike or even by bus.

Other urban elements
Playgrounds for children; Daycare center; Centers for senior citizens; Sports facilities; Leisure Centers and Exhibition Spaces.

7 EXPERIMENTAL PHASE

At this point it is important to consider how and where realizing these projects. The starting point of the idea is Siracusa and its urban area. Siracusa is a historic city in Sicily, in 2005 the city is listed by UNESCO as a World Heritage Site. In the central area the city itself has a population of around 125,000 inhabitants (ISTAT 2009).

The town-planning scheme of Siracusa defines in its documents rules and procedures to build in the Siracusa territory. The town-planning scheme includes, in its technical rules for each homogeneous zone, at the article n. 62 based on D.M. 1444/1968 building parameters.

The Ministerial Decree 2nd April 1968, n.1444 establishes limits of building density, of height, of distance among buildings and maximum relationships among spaces destined to residential and productive settlements and public spaces or reserved to community activities, green areas or parking areas.

The 3rd article defines the minimum quantity of square meters 18 for public spaces for inhabitant, distributed as follows:

- 9 square meters of green areas equipped as sports and play zone.
- 4,5 square meters of public school areas.
- 2,5 square meters of parking areas.
- 2 square meters of public space for churches, hospitals, public services.

This minimum quantity is different depending on homogeneous territorial zones (Z.T.O.).

The area selected for our experimental phase is classified as “C”, it means that it must be ensured completely the minimum quantity of facilities (Art.3).

Let us take as an example a site destined by town planners to be a community area. The experimental area is about 46,446 square meters and has a 1,251 meters perimeter.

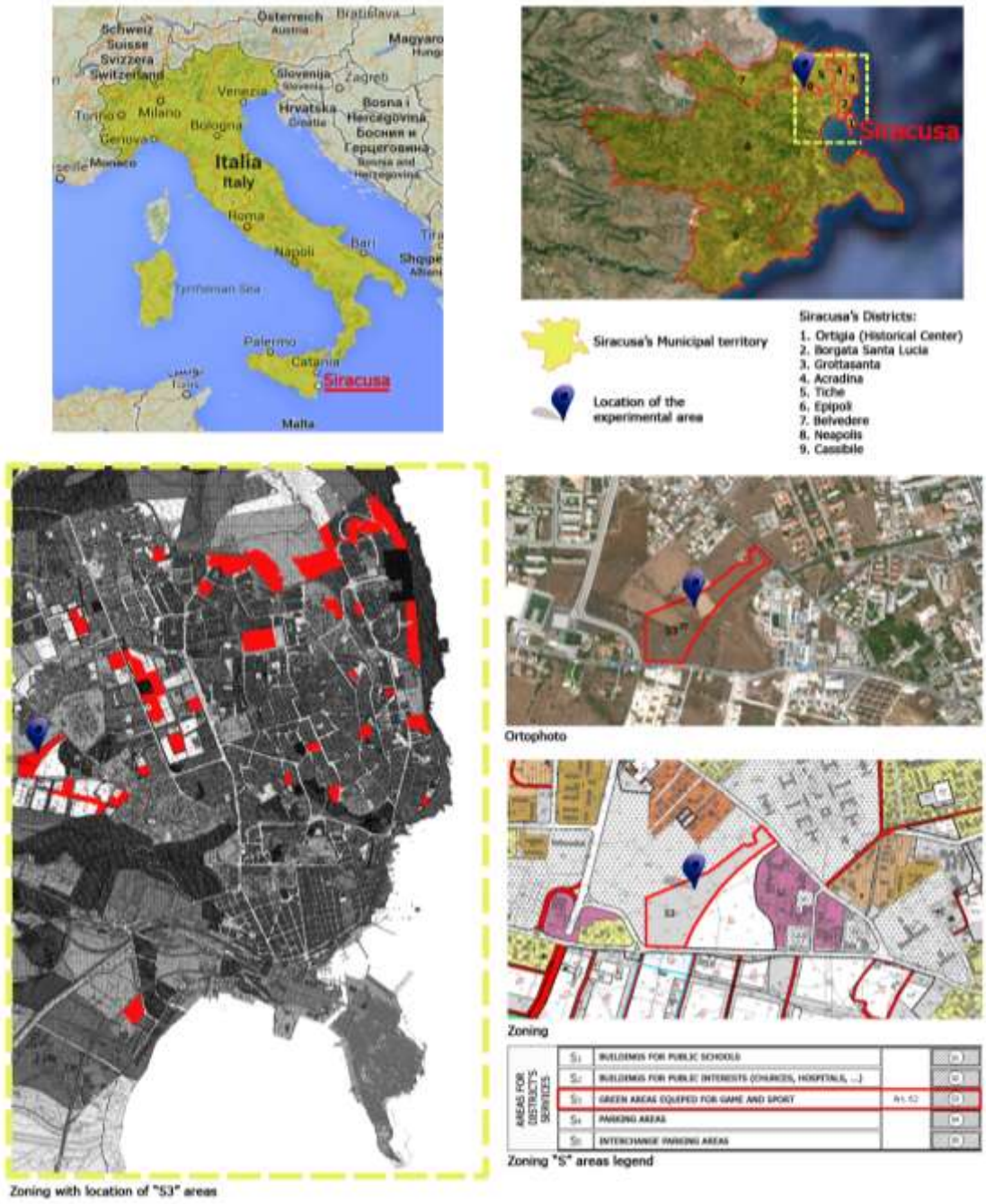

Figure 3 - Plant of Siracusa area and its zoning

The main objective is to create a pilot experience to have data and information about short and long-term costs and benefits, in order to improve and create a virtuous network of this kind of areas.

Local governance could improve urban energy efficiency and promote similar actions in other parts of the city, beginning from marginal areas encouraging local inhabitants participation and improving social cohesion.

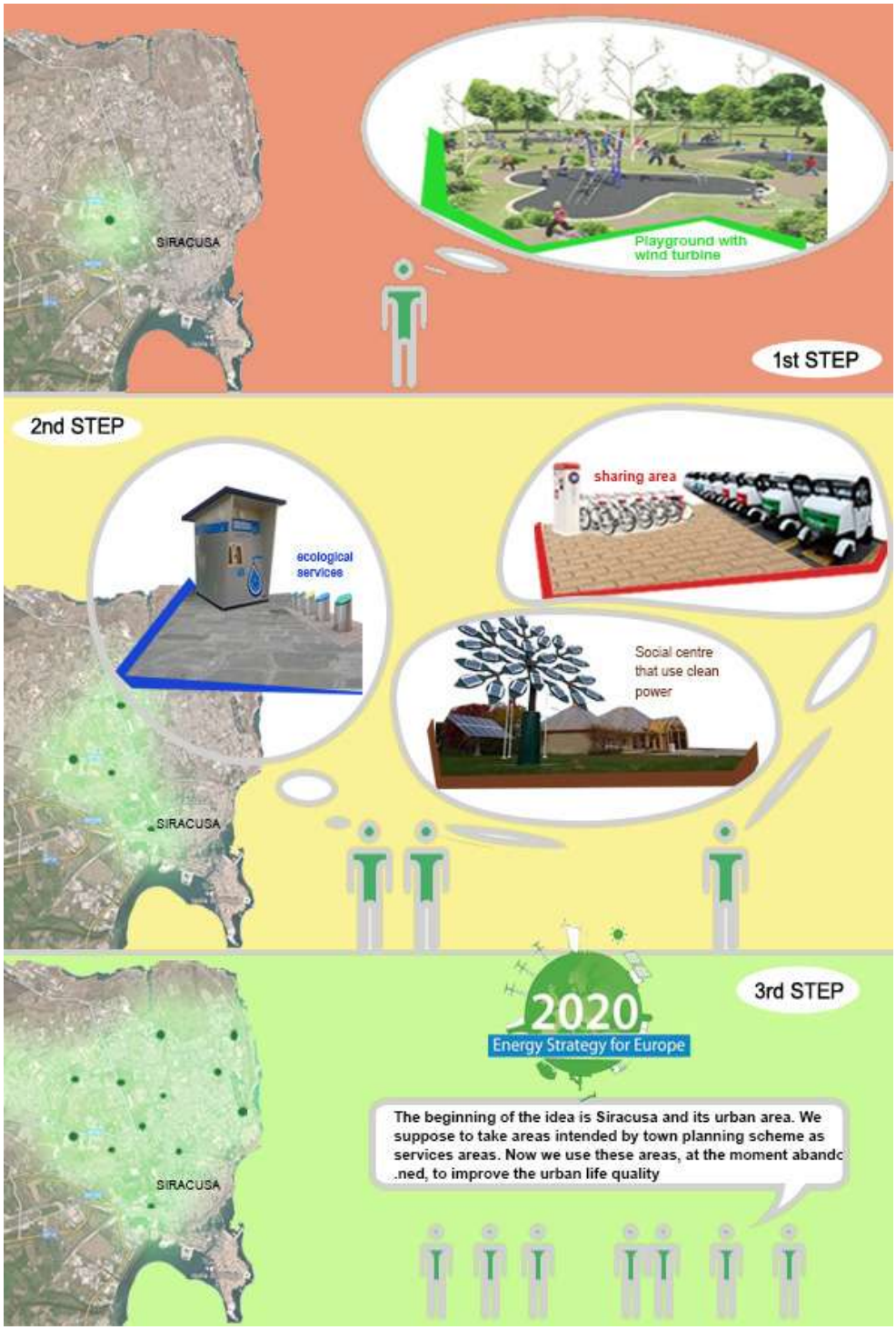

Figure 4 – Project steps

8 CONCLUSIONS

During the workshop we shared ideas among colleagues of the group "Model of urbanization, eco-town, housing density & transport and technologies", finding similar issues relating to different territorial realities. Different approaches are been used to search solutions, but we achieved shared conclusions.

The comparison showed, first, that the pursuit of a model for sustainable urban development is necessary for an integrated approach, that includes social, environmental, technical, political / administrative, economic aspects.

The development policies, in the medium and long term, need to be financially supported by both the public and the private sector. In particular, as regards the public sector requires an early engagement on energy production and on energy cycle.

Local authorities should exploit all their powers to the fullest extent in terms of forward planning and development management.

It's also essential to encourage public participation through the use of e-tools to diffuse information and facilitate communication.

Relating to the participation of citizens is also important that local authorities are committed to involve the social deprived neighborhoods.

Figure 5 –Plant of Siracusa and Implementation of proposal

As results of the experimental phase of our proposal citizens should encourage local administrators to develop “green” facilities all over the municipal territory, saving energy and respecting the environment, also in order to attract private investments.

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Energy Dependency at the Urban Scale and its Social Consequences

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ABSTRACT

The objective of the present research is to highlight the relation between energy consumption and citizens basic needs. It is aimed at showing the existing risk of social exclusion due to an unequal distribution of access to energy sources. Furthermore, urban and built environment shortfalls make the *support* unable to satisfy aspects related to the citizens welfare.

The social and functional specialization process of the different metropolitan pieces and the transformation of the physical structures and land uses have generated an increase in transport needs and, consequently, in energy dependency. Within the building scale, fuel poverty has dramatically risen triggered by the energy prices increase. All this reflects the way the city and the housing stock were designed from the old perspective of fossil fuels abundance and how it has generated a strong energy dependency.

The current scenario of increasing energy prices and decreasing citizens income exacerbates this dependency and shows the urgent need to seek a solution that rethinks and restructures the *support.* Ecological, economic and social problems are already visible and they will presumably become more acute in a context of urban and social polarization and sources shortage.

The urban and built *support* should be the one that guarantees the access to basic services at a reasonable transport cost and the one that ensures minimum habitability conditions at reasonable energy costs. This idea is in line with the 65/151 resolution of the United Nations General Assembly which understands that energy must be a sustainable good as well as achievable by the whole population.

This research presents an analysis of the social consequences that current situation of fuel fossil dependency is generating. These consequences involve all scales from the metropolitan to the building scale.

Key words: energy, fuel poverty, support, transport, leisure, dwellings

1 INTRODUCTION

1.1 RELEVANCE OF RESEARCH

According to current Europe 2020 context, the State Members are committed with the development of an inclusive economy with a strong emphasis on job creation on poverty reduction. Align with that objective and within the same strategy, the EU has undertaken to reduce greenhouse gas emissions by at least 20% compared to 1990 levels or by 30% if the conditions are right, increase the share of renewable energy in final energy consumption to 20%, and achieve a 20% increase in energy efficiency.

Therefore, there are different reasons for reducing energy consumption. Citizens, professionals and policy-makers are used to deal with some of them, such as environmental aspects (which include preserving natural resources and decreasing emissions) and economical reasons too (usually saving money or depreciating the refurbishment investments). But, in this research, a different approach was taken into account: the social implications of energy use, because there is a part of the developed countries population who is not able to afford the costs of the energy they need and they are even less able to afford the required changes to improve energy efficiency.

In addition to the current situation of fuel poverty, peak oil phenomena and fuel raising costs (Campbell & Laherrere 1998) are also relevant issues to assess, because the way cities work could not be the same without this kind of energy. It is very important to tackle the probable lack of this sort of power source. Nowadays, a large part of the planet's population located in urban and suburban areas is oil dependent, therefore a sudden rise of fuel prices could be a social disaster and, according to some studies (Sempere & Tello 2007) and, this rise will take place in a few years because peak oil.

1.2 AIMS AND OBJECTIVES OF THE STUDY

This paper explores the social consequences of energy dependency within the urban scale. For that purpose the next objectives are covered:

a) Identify the population needs that cause the energy dependency at diverse urban scales.

b) Explore the incidence of the energy dependency

c) Establish the social inequalities derived from the dependency.

2 SOCIAL EXCLUSION RELATED TO ENERGY USE

2.1 STATE OF THE ART

Urban planning, road layouts and different intensities and locations of land uses are the big items that have profound effects upon territorial final energy consumption. In this context, spatial segregation derives into the high-mobility lifestyle of our society. We waste not only a considerable time in everyday displacements but also a huge amount of energy on them.

For the last decades, metropolitan areas have been growing relying on the fossil fuel energy abundance (Fernández Durán 2011). As can be seen in the Figure 1 , the first map shows where the energy is produced and the second image shows where it is consumed. The third is the merge of the previous ones, showing that the metropolitan areas consume much more energy than what they produce. This is an understandable indicator about energy dependency in metropolitan areas

Main characteristics of those areas are low-density suburbs with a high specialized zonification (spatial segregation) which adds to the proliferation of car dependent communities. There are a lot of ecological, environmental, social and economic problems related to the growth of the metropolitan sprawl.

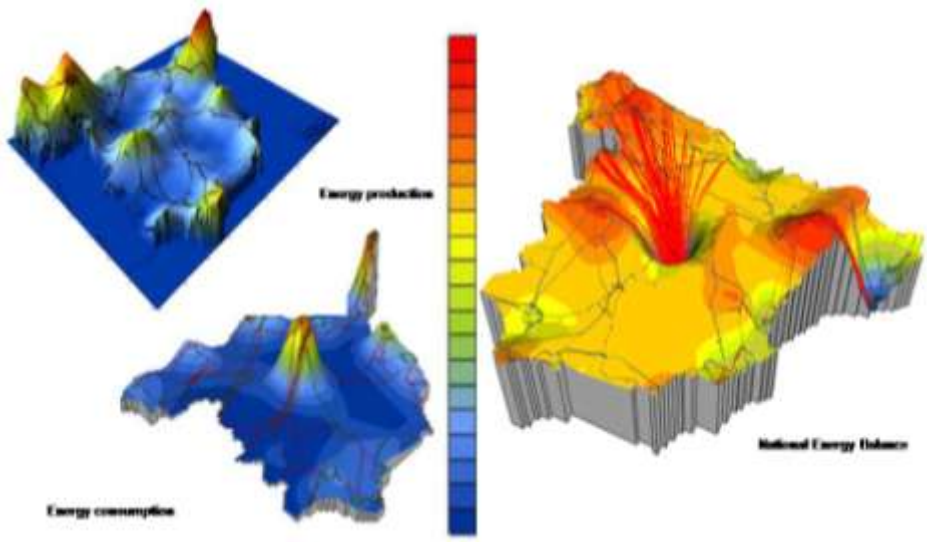


Figure 1. Energy production, energy consumption and national energy balance

The lack of mobility could be, by itself, a cause of social exclusion without being linked to other kind of deprivations. One of the most accepted definitions is the following:

> *It is the process by which people are prevented from participating in the economic, political and social life on the community because of reduced accessibility to opportunities, services and social networks, due in whole or part to insufficient mobility in a society and environment built around the assumption of high mobility.*
>
> *(Kenyon et al. 2002)*

Finally, the best known form of social exclusion related to energy up to date is fuel poverty which can be defined as the 'inability to afford adequate warmth in the home'. Yet to be officially defined by the EU, UK was the first state member inlaunching a Fuel Poverty Strategy in 2001 (Boardman 1991; Warm Homes and Energy Conservation Ac t 2000) in which a household was considered to be fuel poor if it is unable to have adequate energy services for the 10 per cent of its income (DECC 2010). Since that date some other methodologies have been developed for the rest of Europe based on households reported data in the European Household Living Conditions Survey (Healy & Clinch 2002). In Spain, fuel poverty has not been recognized but recent reports show a rate of 15% of Spanish households under fuel poverty threshold (Tirado & Herrero 2014).

3 MATERIALS AND METHODS

Our purpose is to show how energy dependence affects in different levels. For this purpose the document is structured in three distinctive scales: metropolitan, urban and neighbourhood/building. Depending on the scale, several indicators were analysed, explaining how each energy consumption scale affects to those socioeconomic indicators.

First of all mobility of the metropolitan Madrid scale is analysed. In this case the work was based on 2001 census data and income municipality level. Using the first data source, the analysis of the movement of one municipality to another was done. Similarly, a cross on indicators associated with mobility required for work based on the income of each of the municipalities of the metropolitan area carried out that year.

Given the importance of mobility-related shopping and leisure, in the fifth chapter is dedicated to this aspect. To do this, three very different peripheral towns were analysed. Although different from each other, they can be considered as a the representative model in their territorial context. For this the relation between dependence on private vehicle for shopping and leisure, and ratio commercial stores/ housing units in each was stated.

In a third step the neighbourhood scale and dwelling was studied. In this context the exploitation of Spanish Surveys for different levels were used. The main sources were the Family Budget Survey data and with the Household Living Conditions Survey data. Both data referring to 2011. To know what happens to the energy dependence in this scale, the 2001 data census and the Households and Environment Survey data from 2008 were also analysed.

4 FORCED MOBILITY IN THE METROPOLITAN AREA

4.1 FOSSIL FUEL DEPENDENCY IN MOBILITY RELATED TO WORKPLACE LOCATION IN MADRID METROPOLITAN AREA

The objective of the analysis at this first scale is to detect those towns located in the metropolitan area in which the mobility of car commuters poses a problem either because of its intensity or because related monetary costs are excessive regarding families income level. In most cases a high level of car commuter forced mobility in a town is not only a vulnerability indicator but also a symptom of a low urban complexity or a sign of lack of public transport service.

The metropolitan area was chosen given that almost every forced mobility displacement is made within this area. In the metropolitan and urban scales, the energy dependency is associated to transport and it must be highlighted that the 98% of the energy used for transport comes from oil. Therefore, there is a high risk for citizens to suffer from transport related vulnerability, because it relies on a specific sort of energy, the oil.

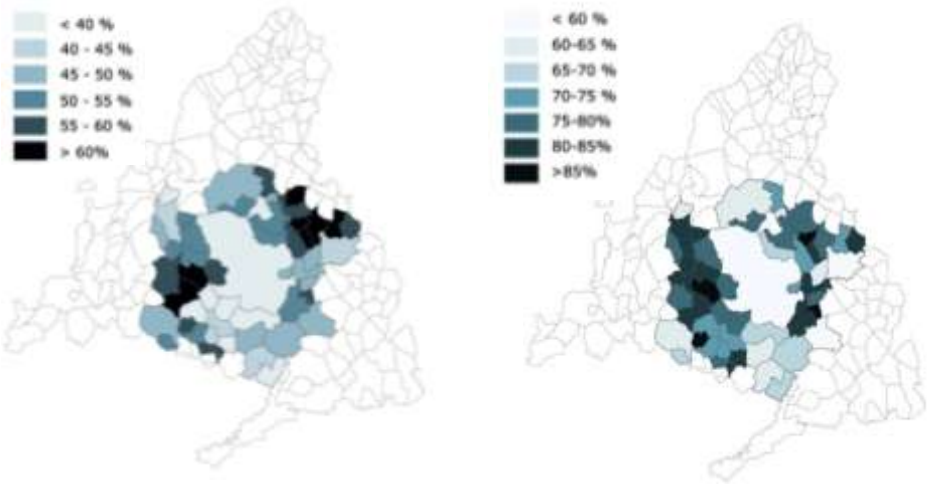


Figure 2. Forced mobility map: percentage of employed population over 16 years old, who uses private car for commuting. Self compilation (INE, 2001).
Figure 3. Forced mobility map: percentage of employed population over 16 years old, who are car commuters and work in other municipality Self compilation (INE 2001).

First approach to energy dependency was done in the metropolitan scale, where a general overview of the forced mobility situation was carried out. The study focused on employed population over 16 years old, who uses private car for commuting. Figure 2 shows the metropolitan area with the percentage of car commuters for each town. It can be stated that there is a high number of municipalities where the percentage is above 40% of the total commuters. Furthermore, a few towns reach almost the 70%.

As it can be noted from the Figure 3, in almost every municipality, at least half of car commuters travel to another municipality. This is an additional negative factor for their vulnerability situation, because they may not be able to change their mean of transport due to the long distance they must cover. The cases in which this percentage is above the 85% it can be considered the existence of a severe degree of the problem.

Another relevant factor analysed was journey duration. Car commuters who spend more than half an hour on travelling are more vulnerable because they need to consume more petrol and if they decided to change their mean of transport the journey would take a disproportionate amount of time. As it can be stated from Figure 2 and 3, there are some towns where, at least half of the car commuters spend more than half an hour.

4.2. URBAN AND SOCIAL CONSEQUENCES OF METROPOLITAN FORCED MOBILITY MODEL

Known the metropolitan mobility pattern, the income per capita level was analysed. The purpose of this analysis was to set up which municipalities were above or below the average income level of the Autonomous Region of Madrid. As shown in Figure 4, the majority of the municipalities located in the south and southeast have the lowest incomes within the metropolitan area. This map clearly reflects a historical socio-spatial segregation in this region, where the high income population is usually located in the north and the working class usually lives in the south.

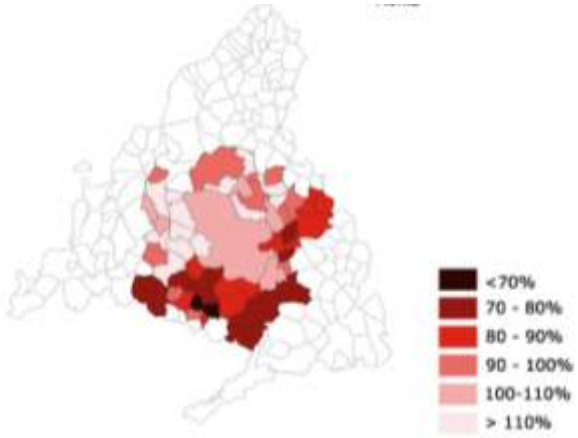


Figure 4. Income level map in relation to the regional average.

With both data, mobility patterns and income levels, the *energy vulnerability cross-indicator* was calculated as follows:

$$\text{Energy vulnerability cross-indicator} = \frac{\text{Municipality car commuter level}}{\text{Municipality income level}}$$

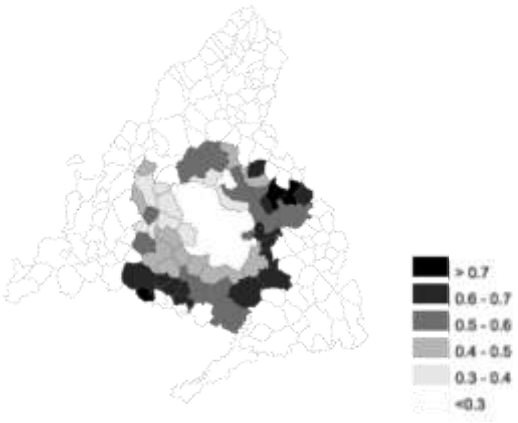


Figure 5. Energy vulnerability cross-indicator map. Self compilation

The higher the value of the numerator is (car commuter level) and the lower the value of the denominator is (income level), the higher the cross indicator will be (and, therefore, the energy vulnerability of the town analysed). The most affected municipalities are shown in figure 5.

There are a lot of municipalities with high energy vulnerability due to an elevated car commuting percentage and a low income level. This vulnerability could be worse in that cases where the journey time is longer than half an hour or the car commuters travel to another municipality. Once the most vulnerable towns have been highlighted the next step should be a most in deep study to unravel the reasons of this vulnerability. These towns must be the main target for urban regeneration and public transport policies.

5. INCITED MOBILITY BY THE METROPOLITAN MODEL: SHOPPING AND LEISURE

5.1. FOSSIL FUEL DEPENDENCY IN MOBILITY RELATED TO SHOPPING AND LEISURE IN MADRID METROPOLITAN AREA

In previous section, forced mobility derived from car commuting was analysed. This section deals with the mobility incited by the Metropolitan model to access shopping and leisure. This kind of mobility is more related to the different lifestyles and social relations found in the centre and in the peripheral towns of Metropolitan Areas.

The Metropolitan spread during the last decades has been based on the social segregation and the functional specialization between the different areas (Bassand, 2004; De Santiago, 2006). Related to shopping and leisure uses, this process has meant a shortage of commercial resources in most of new neighbourhoods and the concentration of trading activities in Metropolitan-scale malls, endorsed by good private transport accessibility conditions.

For this analysis, three peripheral towns of Madrid Metropolitan Area were selected: Alcalá de Henares (historical town which had an important industrial development in the 60s and 70s), Getafe (southern town whose urban development was strongly conditioned by the industrial growth since the 60s), and Las Rozas (residential town with suburban sprawl for high classes). The mobilityin these three towns was contrasted to the one in the central districts of Madrid Municipality.

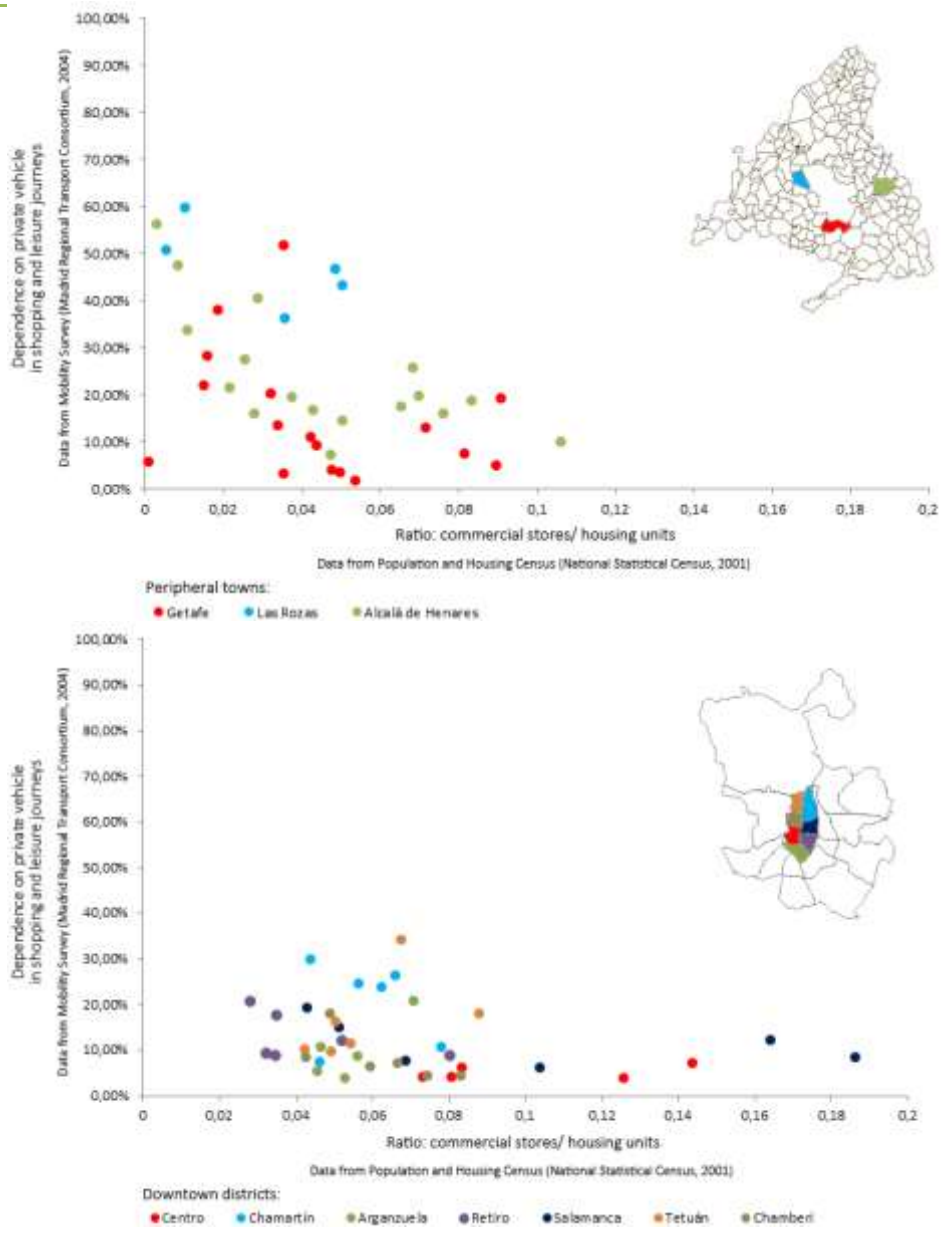


Figure 6 Relation between the dependence on private vehicle for shopping and leisure, and the commercial stores per housing units. Selected peripheral towns of Madrid Autonomous Region (up) and central districts of the city of Madrid (down). Self compilation

Figure 6 shows the relation between the ratio of commercial stores per housing units (axis X), and the dependence on private vehicle (axis Y), for different neighbourhoods in the three peripheral towns and in the central districts of Madrid. The first conclusion that can be inferred is that private vehicle dependency is considerably higher in the metropolitan periphery than in the downtown, proving that the metropolitan spread has been based on the universal access to private vehicle and on the abundance of fossil fuels.

The second conclusion is the existing relation between the urban support (balance between commercial stores and housing) and the dependence on private means of transport. The peripheral towns show a more direct and "canonical" relation between these data: The higher the number of commercial services are, the lower the private vehicle dependency is. This expectable relation is quite clear in peripheral towns, in which we find a wider variety of situations: from low commercial ratio and high dependency in Las Rozas, to the opposite case in most of neighborhoods of Alcalá and, specially, Getafe.

However, the neighborhoods in central districts of Madrid perform in a different way. Most of them are placed in the same area of the chart (Figure 5), with medium-high commercial ratio and low car dependency, with the only exception of commercial hubs of 'Centro' or 'Salamanca'. Madrid downtown presents a more balanced commercial structure, with enough facilities for shopping and leisure in all the neighbourhoods. This balanced urban support enables a lower dependence on private vehicle in all the neighbourhoods, either with higher or lower incomes. Thus, in the downtown the direct relation between commercial services and private vehicle dependence was not found as it was in the periphery.

5.2 URBAN AND SOCIAL CONSEQUENCES OF METROPOLITAN MODEL FOR SHOPPING AND LEISURE

Considering the previous results, it can be concluded that the urban structure of the traditional downtown allows a lower dependence on the private vehicle for accessing shopping and leisure and, consequently, a lower energy consumption. On the other side, the peripheral towns are related to a mobility model with a high dependence on private vehicle, even for these not-working activities.

The chart in Figure 6 reflects also the existence of a simplified and polarized model for accessing shopping and leisure in the periphery, in contrast with the balanced one in the downtown. The difference between the two metropolitan spaces is the urban support: The neighbourhoods in peripheral towns have been developed according to a commercial model based in malls, with a low presence of local stores and huge differences between diverse areas. In this model with large distances between the different uses, the access to energy and fossil fuels is the parameter which determines the accessibility (or not) to the different services. Consequently, in a future oil shortage scenario, the low income citizens will be the first who will not be able to access these primary services.

6 ENERGY CONSUMPTION IN DWELLINGS. THE NEIGHBOURHOOD SCALE

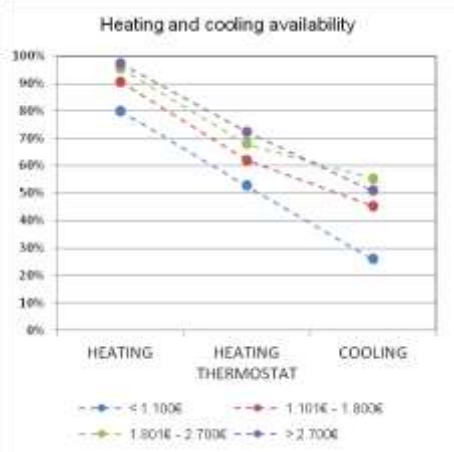
The strong energy dependency of Madrid households is reflected in the last Autonomous Region of Madrid Energy Report (Fenercom 2010) which makes the residential sector responsible for the 24% of the energy consumed within it.

Besides that, according to data from the project SECH-SPAHOUSEC (IDAE 2011), the 66% of this energy is used in air conditioning.

In line with this intensive household energy use, it should be questioned whether some inequalities in consumption can be found among families according to their economic situation.

First results obtained from data gathered in Family Budget Survey showed that the 13% of households of Autonomous region of Madrid, spent more than the 10% of their income in energy bills in 2011. Furthermore, for the same year, explored data from the EU-SILC, indicated that 2% of household declared being unable to pay to keep home adequately warm, 6% declared arrears in utility bills within last 12 months and 9% had leaking roof, damp walls or rotten windows in their dwellings.

The exploitation of data from the Household and Environment Survey, according to household income level, showed differences in housing facilities which are strongly related to the presence of fuel poverty. Regarding domestic facilities, the difference between higher and lower income households is almost the 20% for the presence of heating and reaches the 30% when it refers to cooling. Furthermore, the variance in the number of months in which households tend to turn on the heating was set out. Almost the 60% of high class households declared using the heating for three months while only the 35% of lower income families affirmed that.



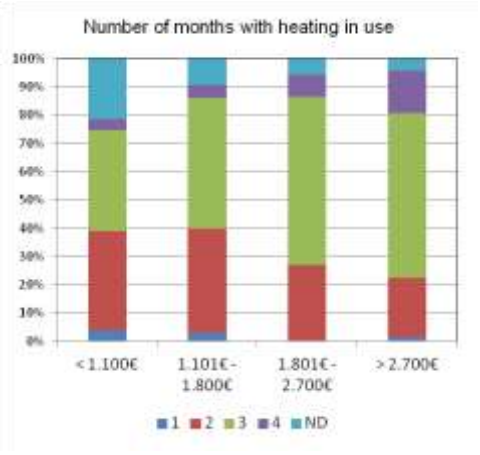


Figure 7. Heating and cooling availability according to household income level (percentage of households).

Figure 8. Number of months with heating in use depending on household income level (percentage of households)

Given these results, it could be argued that those households enjoy more efficient houses. For that reason, dwelling enclosure data was explored as well in order to

appraise dwellings thermal performance. Results for the existence of blinds, double glazing and windows with thermal break revealed differences among income levels with higher rates among higher incomes. Derived from this first housing analysis it can be stated that low income households are forced to spend more money in energy bills or, in case they cannot afford it, to suffer from living in cold and hot houses.

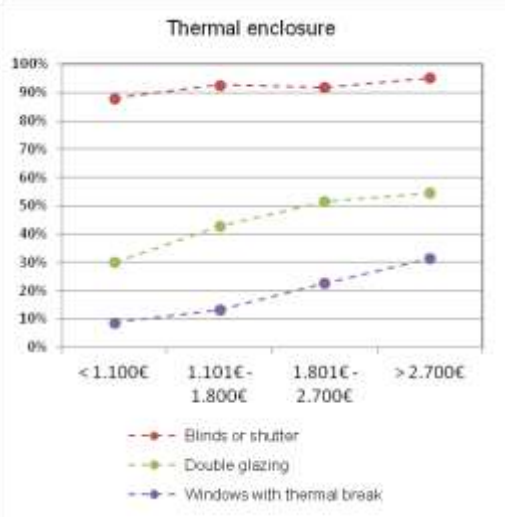


Figure 9. Presence of thermal efficiency measures in dwelling enclosures (household percentage)

Once the inequalities related to shelter were set up among different income groups for the Autonomous Region of Madrid, a neighbourhood was chosen as a case study in order to down the scale of study. The selected neighbourhood, San Cristóbal de Los Ángeles, located in the south of Madrid, is part of the *Vulnerable Neighbourhood Catalogue* (Hernández Aja 2011) and presumably shelters low income families.

Through the study of data relative to the housing stock from 2001 census, there were stated poor housing conditions among low class society. In line with data obtained from the Household and Environment Survey, the comparison between San Cristobal and Madrid mean values showed a lower heating and cooling availability. To add more, the use of electricity as heating energy source is pointedly higher in the neighbourhood which increase household vulnerability given constant arising of electricity costs. Regarding the quality of the buildings, a higher presence of old buildings was reported. That is a relevant item given that the majority of them were built before the first energy efficiency regulation in Spain, launched in 1979 (CT-79). At last, a higher percentage of buildings in poor conditions were accounted.

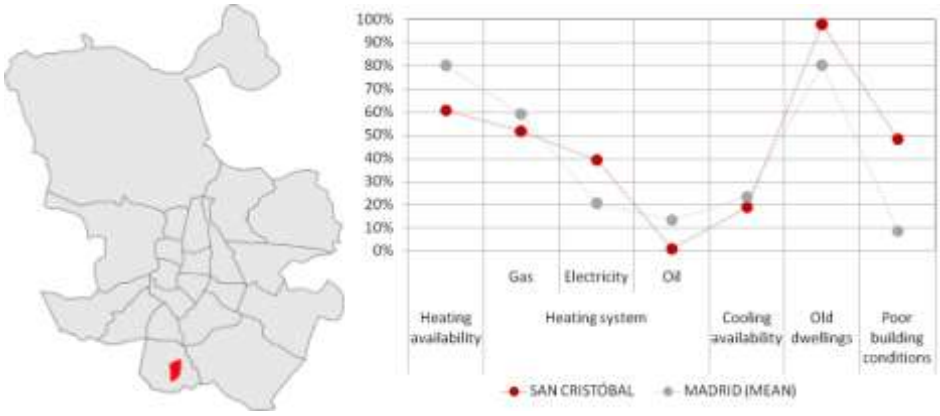


Figure 10. Location of San Cristóbal de los Ángeles within the city of Madrid and Figure11. Dwelling characteristics comparison between San Cristóbal neighbourhood and Madrid mean values

7 CONCLUSION

In increasingly unequal European cities (OECD 2014), in which the incomes and housing prices determine the residence of the lower–resources population and in which spatial segregation increases (Hernández Aja 2011), the most vulnerable people live in neighbourhoods with a low quality residential and urban support. In most cases the lack of access to basic goods, derived from the city location, has been solved with the displacement of people or resources, by using mechanical systems with high energy consumption. In the present crisis of fossil fuels, the energy dependency of cities affects therefore the people's quality of life. The configuration of the urban support, at all levels, forces that access to welfare and economic, social and politics life is mostly done through energy (Kenyon et al. 2002). Energy is a scarce commodity with high cost, to which not everyone has equal access. Given the lack of financial resources, a part of the population is forced to suffer from poor living conditions, either because they cannot afford the required amount of energy or because what they spend on it does not cover other needs.

As noted in the metropolitan area of Madrid, this relationship between energy dependency, caused by the urban and residential support configuration, and the residents lack of resources is given at all levels (metropolitan, urban and residential), and it can be worse if these situations occur simultaneously:

1) From the metropolitan level analysis of mobility, it can be pointed out that the housing development in the urban area of Madrid, derived from the real estate bubble, mainly depends on private transport and it has generated high levels of commuting mobility in municipalities within the metropolitan area. These forced journeys are covered with private transport, with high energy and economic costs, or with public transport, in those cases in which it is possible, with a significant investment of time and average cost. In a future scenario of fossil fuel depletion, this high energy

dependency places low income population in a situation of high vulnerability or even in social exclusion.

2) In the analysis of mobility incited to access shopping and leisure, we observe how the urban structure of the historic centre, characterized by a greater number of trades, grants a lower car dependency, while neighbourhoods in the periphery, with a lower percentage of trades have a greater energy dependency to access other services. This constraint, given the present energy and economic crisis, is an obstacle to the resident population with fewer resources in these municipalities to access these resources and services.

3) In the neighbourhood-buildings scale, it can be established that low income neighbourhoods live in less efficient buildings with a higher energy consumption. Those dwellings with deficiencies since its construction, have not been renovated with energy efficiency measures because of the cost of the intervention. This population with less resources, in these times of economic crisis and rising energy prices, has to choose between having worst living conditions, with higher health risks, or spending a major part of their income in energy.

	ANALYZED ASPECT	URBAN AND BUILDINGS CONDITIONS	POSIBILITIES	Q	E	€	V
METROPOLITAN SCALE	Urban planning: forced mobility	Short distances- good connection with work centres.	Private vehicle	▲Q	▲E	▲€	▼ V
			Public transport, walking, bicycle	▲Q	▼ E	▼ €	
		Long distances- bad connection with work centres. Forced mobility	Private vehicle	▲Q	▲ ▲E	▲▲ €	▲V
			Public transport (if it exists)	▼Q	▲E	▲€	
URBAN SCALE	*Urban structure:* Access to shopping and leisure	Urban structure with access to shopping and leisure	Move by private vehicle to access to shopping and leisure	▲Q	▲E	▲€	▼ V
			Don't move	▲Q	▼E	▼ €	
		Urban structure with a poor access to shopping and leisure	Move by private vehicle to access to shopping and leisure	▲Q	▲E	▲€	▲V
			Don't move	▼Q	▼E	▼ €	
NEIGHB	Buildings : energy performance	Good energy performance of the buildings	Use heating/ cooling	▲▲ Q	▲E	▲€	▼ V
			Don't use heating/ cooling	▲Q	▼E	▼ €	
		Bad energy performance of the buildings	Use heating/ cooling	▲Q	▲ ▲E	▲▲ €	▲V

NEIGHBOURHOOD SCALE			Don't use heating/ cooling	▼Q	▼E	▼€	

Leyend: Q: Quality of life (▲Q:higher;▼Q: lower); E: Energy consumption (▼E:lower; ▲E: higher); €: Cost (▼€:lower; ▲€: higher); V: Energy vulnerability (▼V:lower; ▲V: higher);

Figure 12. Synthesis table. Self compilation

This energy dependency that can be observed atall levels of the city and that constrains access to work, leisure and services has a profound effect upon thewelfare of citizens. Even though this situation is being tackled with new brand efficient technologies, these systems are generally expensive and not affordable for everyone. Despite that, the reconfiguration and improvement ofexistingurban support, through setting new centralities, a better organization andoperation of public transport, a urbansupportwith a greater varietyof uses andaccess to services, and improvementsinpassive energy performance of dwellings is an opportunity to meet the challenge of more egalitarian welfare society.

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Public Participation in City Design

Public Acceptance of Municipality's Energy Plan and The Project of District Heating in Šentrupert.

Mateja Klun, Gašper Okršlar, Maja Weisseisen

ABSTRACT

Today, close to two thirds of world population lives in cities or suburbanized areas. There, they are faced with numerous problems - such as overpopulation, lack of green areas, excessive and unsustainable use of cars, inadequate public transportation, etc. Furthermore, they are fighting global challenges, such as the economic crisis and climate change. To solve these challenges, cities will have to come up with better energy-efficient and energy-effective transportation solutions through the intelligent use of modern information and telecommunication technologies (ICT) (Kožman, 2012; Luna-Reyes et al., 2012; Vertelj Nared, 2014).

All of this can be achieved with better planning and active involvement of stakeholders in urban management and during the decision-making process. The use of modern ICT tools can improve participation in the city-making-process. That could help create sustainable, user-friendly cities that are based on mixed land use, walkable public spaces, and smart and well organized public transportation(The Aarhus Convention, 2002).

Our goal in the project is to explore the forms and possibilities of interactive public participation (such as e-Democracy) (E-uprava, 2014), different interactive web tools and other kinds of presentations of actual projects and communication with a public audience.

We will perform a case study on the importance of public awareness and information dissemination when designing cities in a smarter way. We will also explore if it is possible to improve living conditions in cities with public participation and promoting involvement of community.

1 INTRODUCTION

One of the basic rights and responsibilities of every individual is participation in spatial planning. Public participation in spatial development directly influences the attitude of stakeholders and increases the quality and rationality of land use. It has a positive effect on the identity of the individual in the community. The right to participate leads to development of common needs and solutions in the community.

(Ministry of Infrastructure and Spatial Planning of the Republic of Slovenia to all the municipalities in Guidlines to Municipalites for Earlier Inclusion of Public in The Process of Spatial Planning, 2011) (MzIP, 2011)

2 OBJECTIVES

In our case study we used the most appropriate out of several different web tools for gathering public opinion on certain topics. Our selection of web-based tools was based on accessibility, simplicity, user friendliness and versatility.

We are aware that certain population groups do not know how to use these tools or they simply do not want to use them due to of lack of trust. However, we believe that the majority of the population, which is interested in participating, does have the knowledge and skills to use web-based tools. Since e-literacy is an important part of everyday life and people tend to learn new skills every day (via workshops, seminars, brochures, lectures…), we can expect that the number of people who will not be able to express their opinion or suggestions is small.

Slovenia has a population of just over 2 million, which is not concentrated in large cities, but is scattered all over the country. Overall, the population density is approximately 100 inhabitants/km2. Relatively small number of citizens, results in formation of smaller settlements, rather than just one or two major cities. Therefore our study focuses on smaller municipal centers (SI-Stat, 2013).

We believe, that in the current processes of spatial planning in Slovenia, people are not included in the decision-making process early enough, although the involvement of the stakeholders in guaranteed by the law (Spatial Planning Act, 2007). Usually the planners prepare the spatial plan, and then release it to the public and only then collect public opinion. Consequences of late inclusion of citizens in spatial planning often result in reluctance to new solutions. These reluctances could be avoided by including public opinion and suggestions in early stages of the decision-making processes and planning. If we ensure that public suggestions are included in planning early enough, people will not feel reluctant to changes, but will instead embrace them (MzIP, 2011).

Most households in Slovenia get their energy for heating from individual furnaces, using different types of resources (oil, biomass, gas…). Problems of individual furnaces are:

- Incomplete combustion,
- Release of a large amount of particles,
- Outdated systems,
- Large number of pollution sources,
- Smog,
- Lack of maintenance,
- Large sums of money needed for replacement,
- Low energy efficiency (MKO, 2014).

In several municipalities, change from individual furnaces to district heating has proven as an appropriate decision towards improving energy consumption. The main reasons are:

- Complete combustion,
- High energy efficiency,
- Easy to use for customers,
- Only one pollution source,
- Low amount of released pollutants (Domjan, 2009).

Our research is focused on a case study because we would like to help the municipality in gathering public opinion and ensure that spatial solutions will be well accepted by local people and their wishes and suggestions will be maximally considered. By analyzing a case, we would like to set an example for other municipalities and encourage them to use e-tools in similar cases. We have deducted that our research would bring more benefits to real life stakeholders.

For the case study, we have chosen the Municipality of Šentrupert in southeast statistical region, which has already made the first steps towards improving energy efficiency.

The Municipality of Šentrupert confirmed its Local Energetic Plan in the year of 2009 in which energy consumption and long-term solutions were established. They have a strong vision of preserving natural heritage and becoming self-sufficient. The basic goals of the vision are long-term development of the region, usage of renewable sources of energy, informing all stakeholders about energy consumption and development of the infrastructure, and to be energetically independent with reliable infrastructure. For this purpose they have been approved expendable financial support from EU. The first step toward energy efficiency was a low-energy and low-carbon wooden kindergarten (Figure 1), which was built in 2010. Building consumes only 30 kWh per square meter per year (that means only 3 liters of oil per square meter per year of living space) (Občina Šentrupert, 2014; Remida, 2014).

The main goal of the project is to connect all public facilities in the infrastructure for district heating, and in the year 2013 a woodchip boiler room was constructed at largest state prison Dob (biggest energy consumption complex in the municipality), which is situated near the Šentrupert municipality center (Občina Šentrupert, 2014; Remida, 2014).

Fig 1. The kindergarten was also awarded as an energy sufficient building by the readers of Finance magazine in year 2011 (Source: www.sentrupert.si)

Our hypotheses are:

- Inhabitants are not included in decision making process early enough.
- Inhabitants are not familiarized enough with energy plans of the municipality.
- Due to large availability of EU funding for environmentally friendlier ways of producing energy, a lot of citizens have recently renewed their heating systems. These individuals will not be interested in becoming clients of the planned district heating system.
- Citizens do not want to live near a biomass power plant (NIMBY effect).

3 COMPARISON OF TOOLS

When deciding an appropriate technique for our survey, we considered advantages and disadvantages of several different tools in the aspect of costs, targeting, feedback etc.

METHOD	ADVANTAGES (+)	DISADVANTAGES (-)
CONVENTIONAL TOOLS		
LOCAL NEWSPAPER	Cheapest of all conventional tools, easy targeting (reaches every household)	Limited circle of readers, no feedback (no opinions), impersonal approach

MAIL NOTICE	Relatively cheap, easy targeting, reaches every individual	Environmentally questionable, lack of feedback, impersonal approach
LECTURES	Personal approach, more informative than mail notice, possible adaptations of lectures, Q&A session	Price, low attendance, lack of dialogue (one-sided communication), only one or two occasions (not everybody can attend), only really interested people come to lectures
PUBLIC PRESENTATION	Duration (usually 30 days), two sided communication, accessible to everyone, variant solutions	Presentation of finished plan or strategy, cost,narrow window for modifications
WORKSHOPS	Interchange of opinions, variant solution	Costs, limited number of participants, attendance
WEB TOOLS		
OFFICAL WEBSITE OF THE MUNICIPALITY	First place to look when searching for municipality's information	Low number of regular visitors, no feedback
E DEMOCRACY	No need for going to municipality or administration unit, individual can submit suggestions on any published theme (considering planned law changes)	Used mostly for administration processes, not for gathering public opinion
MOBILE APPLICATIONS	Suitable for gathering suggestions (with photos), easy and intuitive to use	Mostly used by younger population, person must be really interested for improving his/hers environment, suitable for gathering suggestions, not for opinion
QUESTIONNAIRE	Versatility, easy to make, detailed, wide audience, easy to analyze	No dialog, lack of interest for completing questionnaires, problematic dissemination

Table 1: Public participation tools comparison (advantages and disadvantages) (Kožman, 2012; Mandelj, 2011; Nabatchi, 2012; Vertelj Nared, 2014)

The Statistical Office of the Republic of Slovenia (SI-STAT) reports that in the first quarter of 2013, slightly fewer than 1,240,000 persons (entire Slovenia approx. 2 million inhabitants) or 74 % of persons of ages 10 to 74 used the Internet. The

majority of these persons (95 %) used the Internet at least once a week (SI-Stat, 2013).

Individuals of ages 10 to 74 years used the Internet in the first quarter of 2013 mostly for sending or receiving e-mails (64 %) and for reading online news, newspapers or news magazines (57%) (SI-Stat, 2013).

Browsing for different information on the Internet is also widespread; 54 % of persons used the Internet for searching for information about goods and services, 48 % for searching for health-related information and 33 % for searching for information about education, training or course offers(SI-Stat, 2013).

41 % of persons participated in social networks and 27 % of persons used the Internet for video calls via webcam over the Internet(SI-Stat, 2013).

In the first quarter of 2013, 34 % of users used the Internet for selling of goods or services, 31 % for Internet banking and 24 % for ordering or buying goods or services.

Considering the collected data, we believe that the fastest and most appropriate way of collecting public opinion will be a web-based questionnaire. The decision for using a web tool is based on the fact that processing data is easier and environmentally friendly. In addition, answers are already in digital, not paper form, which saves time and money. Also, there is no need for participants to mail their answers or to go to a specific location to submit their answers.

Lectures and workshops were taken into account, but considering the short time frame available for gathering public opinion and relatively high costs, combined with possible low attendance, we have decided, that web based questionnaire will be most appropriate for our case study.

4 METHODOLOGY

The questionnaire was designed in a way that participants can express their opinion about two different aspects:

- Prospect of district heating in their municipality and
- Their involvement in decision making process (not only in specific case, but overall state in the municipality).

The questionnaire was made in the Google Drive application Form (https://docs.google.com/forms) and was divided into 5 stages. After completing each stage, the participant was able to see the content of the next section and could start filling out the questionnaire.

The first section focused on the participant's personal information such as sex, age, place of origin, education and field of work.

In section two the main theme was the participant's current heating system (energy source, year of installment), their intentions about replacement, and their interest in becoming a client in a district heating system.

Section three consisted of only two questions regarding the knowledge about the municipality's vision in the field of energy usage.

Section four was divided into two parts. In the first part, we placed the summary of municipality's energy plan. After the summary, participants were able to fill out the questions about their role in realization of municipality's energy plan, their involvement in the process of designing the municipality's plans, their willingness to attend the presentation of the plans and their view on environmentally acceptability of biomass heating system.

The last section was dedicated to their opinion on acceptability of district heating system on biomass. In the first part of the section we placed three images of already existing good practice, specifically three biomass power plants from Postojna, Semič and the Institute of incarceration Dob (which is located in the case study area). In the second part, we asked the participants, whether they find the power plants esthetically acceptable, would they mind living in close proximity to them, how much are they willing to pay for heating per year (irrespective of the heating source), and what is their opinion on importance of exploitation of local resources.

The link to the questionnaire was posted on the municipality's official website on April 6. The research period has ended on April 19 due to deadline for submitting the paper. However, for the needs of the municipality, the questionnaire will be available after the end of research period in order to collect as many opinions as possible.

5 CASE STUDY

The Municipality of Šentrupert is one of the youngest municipalities in the southeast statistical region in Slovenia, it was established in the year 2007 when it became independent of the larger Municipality of Trebnje. It is situated in the central area of Mirna River Valley. It has been first mentioned in the 1044 and it has a rich history, nowadays it is known as a land of hayracks. Here, the first hayrack museum in the world can be found. The municipal center Šentrupert, famous for the regional Gothic church dedicated to Saint Rupert (Figure 2) is surrounded by populated hills, covered by forest and vineyards. The municipality covers an area of 49 square kilometers and has approx. 2900 inhabitants, who live in 25 settlements (Občina Šentrupert, 2014).

The most typical landscape feature is forest, which covers roughly 66 % of national territory. Municipality of Šentrupert is not much different from the rest of the country and almost half of municipal territory is covered by forests. In its energy plan, the municipality has stated, that one of the main strategic long-term

goals is encouraging district heating. District heating could be backed by one of the country's richest renewable resource – biomass(Carbon trust, 2008; Dremšak, 2013).

The municipality altogether consumes about 1.156.000 liters of heating oil per year and only prison Dob consumes from 700.000 to 900.000 litres per year, that means over 1.1 million € per year. First step in the project is to change the energy supply for the public facilities. Wood is the strategic natural material in the municipality and Mirna Valley as well (Občina Šentrupetrt, 2014).

Figure2: Gothic Church of Saint Rupert in the center of Šentrupert (Source: www.dolenjskilist.si)

The public company Energetika Šentrupert was established in year 2012, wood processing center Puščava, few kilometers away from municipal center Šentrupert will be established. A woodchip boiler room and woodchip cogeneration were built and prison Dob and primary school complex with kindergarten are already heated with the system of district heating. Electricity production from cogeneration is sold to the grid and waste heat is sold to investors. Woodchips are processed as wood waste from wood processing center (Občina Šentrupert, 2014; Remida, 2014).

The vision of municipality is to become energy self-sufficient by the year 2020. To reach this goal they plan to harvest renewable natural resources of the valley, rich with wood. In Mirna valley, there is approximately 100.000 cubic meters of annual increment of wood. In Slovenian forests there is an annual increment of 7,985,256 cubic meters of wood or 6.74 cubic meters per hectare. The wood processing center Puščava, will create new working spaces for construction of wooden products, and consequently heat, energy and power are produced (Občina Šentrupert, 2014; ZGS, 2014).

To be more resilient and responsible to the environment there is a potential to produce energy by processing wastes and a power station for electric cars is also to be built.

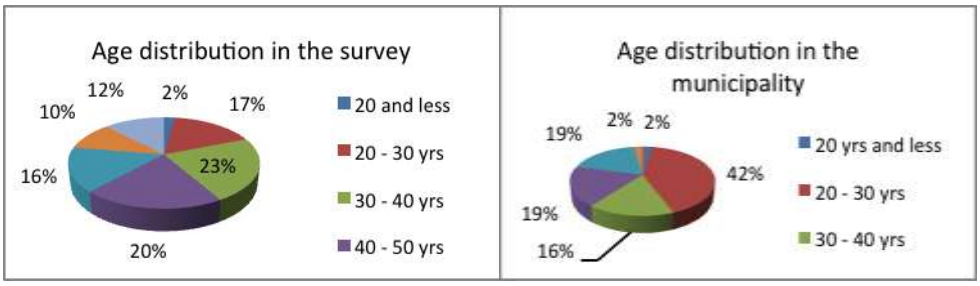
An important task is also to have well-informed stakeholders and for this purpose the municipality is very interested in our work, since they want to establish a clear way of communication, which goes in both directions.

This municipality is part of the Remida (smaRt Energy chains and coMmunities in the meDiterranean Area) project which aims at developing new energy efficient cities thorough promotion of smart management of energy supply and demand. In this project several countries are involved: Italy, France, Greece Bosnia and Herzegovina, Montenegro and Slovenia (Remida, 2014).

6 RESULTS

By April 19th, 43 survey responses were received and analyzed. The responses were not only from the settlements of Šentrupert and Slovenska vas, but also from ranges outside of frontiers of the municipality. 21 responses were gained from stakeholders in settlements Šentrupert and Slovenska vas, others were from other settlements in the municipality and from the Mirna valley area.

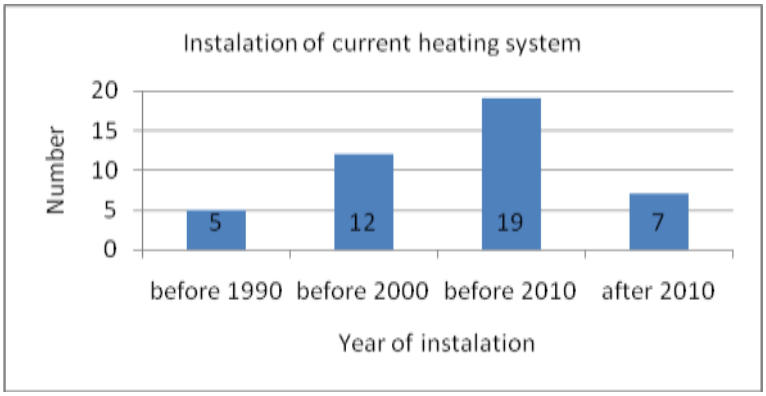
Age distribution is presented in the graph 1.



Graph 1: Age distribution in questionanare and municipality (SI-Stat, 2013)

If we consider that the theme of the survey is interesting for the subjects who within the household are paying the bills, we adopt the standpoint that these people are at least 18 years old and preferably older. A comparison of age samples of the survey with the composition of population in the municipalityshows that the survey did not scope inhabitants with age of 70 or more, and the number of interviewers between the ages of 20 – 30 years is higher than the actual percent of persons that age in the municipality.

The main energy resources used for heating (Graph 2)are: 81 % wood timber and oil or a combination of both (60 % just wood timber, 16 % oil and 5 % some sort of combination of both). The average age of the current heating system is 14 years and approximately 40 % of current heating systems were installed before the year 2000, whereas 44 % of heating systems were installed between years of 2000 and 2010.

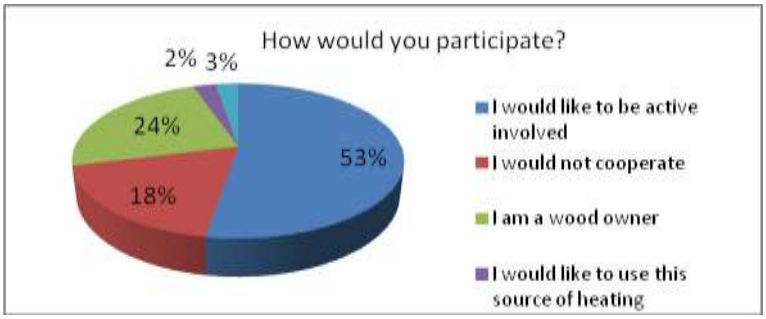


Graph 2: Installation of current heating system

Results to the question regarding whether they are considering a renovation or an upgrade of the system were as follows: 47 % of interviewers answered with »yes« and 53 % answered with »no«. Furthermore 75 % of those who would upgrade their current system would use biomass or combination of biomass with heat pump, solar power as an energy source. Only 5 % of stakeholders would become clients in a district heating system, 20 % would use other heating resources such as oil, gas and heat pumps. These answers are consistent with answers regarding their opinion on what is the most environmentally friendly energy source.

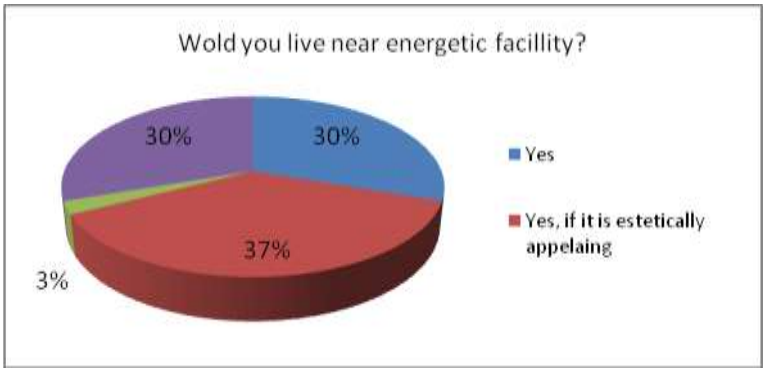
More than 70 % of interviewees answered that biomass and district heating is the most environmentally friendly energy resource, followed by solar power and gas, which got fewer responses (5 %). Regarding the question on which energy strategy is the best for the municipality, more than 70 % of interviewers answered district heating system, and approximately 20 % answered that the best way would be grants for renewable sources of heating. Only one person answered that the municipality should not interfere and should leave the inhabitants to make this decision on their own, since heating systems are expensive investments and many cannot afford to pay the bills for district heating.

The remaining questions were focused on the participation of stakeholders. Based on the answers, everyone is at least particularly informed about the energy visions of the municipality and close to two thirds of population is interested in the system of district heating. Nearly two thirds would also attend a lecture about the energy vision in the municipality. More than half of the interviewed would like to be actively involved in the process and only 18 % would not like to participate in the process. (Graph 3).



Graph 3: Options of participation selected by participants

General opinion on energy facilities for district heating is that with the right precautions and implementation they have minimal effect on the surroundings. 70 % of participants would be prepared to live near such a facility. (Graph 4)



Graph 4: Willingness of participants to live close to energetic facility

The general belief of the stakeholders is that implementation of district heating would also create new workplaces, since more than 90 % answered »yes« to that question. Also, taken into account that local energy sources are used, most of the stakeholders believe that exploitation of local resources should be mandatory.

Inhabitants generally feel that if they want, they can find desired information and participate in the development of the municipality, or that they are always informed and have the option of participating (81 %). Only 2 % of participants are not interested in the topic, and close to 10 % feel that they are never informed.

The last question asked was regarding the bill for heating and how much are they prepared to pay for it. Only 14 % would pay 500 € or less, 60 % up to 1000 € and 19 % 1500 €. Others are prepared to pay more.

7 DISCUSSION

We have established that in our case questionnaire was the right selection from different existing e-tools. Our goal was to reach at least 10 % of households in Šetrupert and Slovenska vas and we succeeded. We focused on Šentrupert and Slovenska vas, we informed entire municipality about the questionnaire by regular mail notice. An interesting fact is that we received almost half of the answers from the other settlements in the same municipality and even some from another municipality. We can conclude that people care about energy and spatial planning in their municipality and follow the official web page of the municipality.

There were some doubts in the early stages if we would be able to cover all of the different age groups, since older people have limited access or simply do not use Internet as often as younger generations. Surprisingly 20 % of participants were older than 50 years, but there was only one older than 60 years. We think that in this case the participation of older people is sufficient, since there are manly residential houses in the municipality. In Slovenia it is common that two generations live in the same household, therefore it is more likely, that a member of the active generation (30-50 years old) has filled out the questionnaire. The answers are valid for the entire household, since they are using the same source of heating. People in the range of 30-50 years of age represent the active-working generation and are usually paying the bills. In our questionnaire, the majority of people belonged to that age group, which supports this assumption. In conclusion, we believe that the selected method was suitable and resulted in transparent results.

Having a district heating system is an interesting option to more than 60 % of participants, who would like to hear more about it. Almost every participant believes that we should use our natural resources and that there is a possibility of new working spaces in this sector. It is obvious that the Municipality of Šentrupert is more agrarian since almost one quarter of participants have forests and want to contribute to the system by selling the biomass. We believe that a district heating system is a good option for selected municipality because of its size and natural resources though not everybody would be interested,since there was an increase in renovation of heating systems between 2005 and 2010 due to availability of EU funds.

Inhabitants are not included in decision making process early enough.

Our first hypothesis was wrong. More than 80 % of people expressed their opinion that they feel included in the process or that they can be included if they intend to be. They mostly also know where to find information they need. This could be related to the fact, that questionnaires like ours are normally answered by active inhabitants, who care about environment and gather information from different sources if needed. The second reason might be that Šentrupert is quite young municipality (only 7 years old) and people are more involved because of the recent process of independence. It is quite small, which makes it even more connected and information spreads faster because people know each other (connected to the fact that this is rural environment). More than one third of

participants expressed their wish to be involved in further decision making process which supports the assumption that people want to be a part of the process.

Inhabitants are not familiarized enough with energy plans of the municipality.

The second hypothesis was also wrong. Only 5 % of participants expressed the opinion that they are not familiarized enough with energy plans. More than half of them are at least partially familiarized, even though there is a high rate of interest about energy plans. If there would be a presentation of district heating organized by municipality, more than 90 % of people would attend it. There is relatively high level of interest for finished projects too – more than half of participants would be interested in the presentation of district heating system in Dob.

Due to large availability of EU funding for environmentally friendlier ways of producing energy, a lot of citizens have recently renewed their heating systems. These individuals will not be interested in becoming clients of the planned district heating system.

This hypothesis turned out to be true. 70 % of participants, that renewed their heating systems in 2008 or later are not interested in becoming clients of the planned heating system ("Eco subventions" were available in Slovenia after 2008, so we only analyzed cases that renewed their systems in 2008 or later). There is a different situation when we focus on participants that have built their heating system in 2007 or earlier. More than half of them want to change the system of heating, and biomass is the most common option.

Citizens do not want to live near a biomass power plant (NIMBY effect).

Almost one third of participants would not want to live near biomass power plant. An interesting fact is that on earlier questions 70 % of those same people said that such objects are esthetically acceptable. Half of them even believe that appropriate application would result in minimal impact on environment and that impacts would be comparable to ones from individual furnaces. The biggest problems people see are noise, excessive CO2 emissions and smell. In conclusion, half of the participants do not have a reason against living next to biomass power plant, but if possible they would chose not to. NIMBY effect is noticeable, maybe if people would be better informed about consequences the effect would be smaller.

8 CONCLUSIONS

Inhabitants should be included in decision-making process

This is easier in smaller municipalities with fewer inhabitants. In our case, the Municipality of Šentrupert is relatively young and small (established in 2007, with 2900 inhabitants) and has a small social network, which results in relatively fast dispersion of information.

We gathered responses not only from the Municipality of Šentrupert, but also beyond its borders

This implies that people are not only aware of the situation inside of the municipality, but are interested in plans and development of surrounding areas. That means that all other participants have found the survey on the municipality's web site on their own and have decided to participate.

People are aware of the high availability and the importance of exploiting local resources

Forest owners are interested in providing biomass needed for selected district heating system. Their general opinion it that use of biomass from local forests should be mandatory. They also think there is a potential for creating new jobs from exploiting local resources.

Our research and its results are interesting for Slovenia, which consists of 212 municipalities that are relatively small and mostly comparable to selected Municipality of Šentrupert

Most of the municipalities in Slovenia have less than 20.000 inhabitants (only 17 municipalities have more), and therefore we can apply our study to any another municipality. Firstly we would have to analyze their energy plans and adapt some of the questions in the survey. It would be interesting to gather the results from one of the larger municipalities (Ljubljana - 282.000 inhabitants or Maribor - 111.000 inhabitants) due to their urban character.

In our research, we have analyzed the importance of public awareness and the inclusion of inhabitants in the process of urban design. At the same time we have carried out a survey analyzing public acceptance of Šentrupert energy plans and provided the municipality with information crucial for implementation of actions in the process of becoming more energy efficient and environmentally friendly.

E - tools are appropriate for gathering public opinion in spatial planning

Results from our study show good potential of use of e - tools when collecting data from households, since it is very likely that at least one member of household is prepared to participate and is able to use the technology. If results would be gathered from each individual not per household, the results of the survey would be probably different from those gathered in our study.

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RELATION OF AUTHORS

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Don MESSENGER works as a private sector consultant and has been involved with a number of planning and development projects across Central London. He has a wide experience of producing planning reports for sites to inform their disposal, as well as preparing and assisting in the management of planning applications. This includes advising on sensitive planning issues such as heritage.

Harry MANLEY. Following a brief spell studying abroad in Lyon, Harry now works as a planning consultant in the private sector. He focuses on Central London and is involved with a variety of development projects. These range from large residential-led mixed-use schemes to more technical commercial schemes. This often involves dealing with detailed issues such as heritage.

Jonathan DOUGLAS-GREEN works in the private sector, having previously worked in the public sector for a Local Planning Authority. He provides advice on major planning applications for infrastructure projects. These have included the Thames Tunnel project in London, Crossrail and now the proposed high-speed rail line from London to Birmingham.

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