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Carrots, Sticks, Tigers and Wheels

A Case Study of Municipal Governance for Energy Efficiency in New Buildings in the Öresund Region

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Abstract

The Öresund Region, comprising areas of Sweden and Denmark, is involved in a process of sustainable urban transformation. The region has high ambitions in terms of carbon emissions reduction and has set itself steep targets to meet over the next 15-20 years. The energy consumption of buildings accounts for a significant proportion of carbon emissions. With the urban areas of the Öresund Region expanding rapidly, energy efficiency in new urban developments has been identified by regional municipalities as a key target area in their climate change mitigation strategies. However, while the Öresund Region is a leader in Europe in terms of energy efficient urban development, developments still struggle to fully realise their technological potential.

The purpose of this thesis is threefold. Firstly, it presents the Öresund Region as a case study of successful municipal governance in the field of energy efficiency in new buildings. The current governance approach is conceptualised through the lens of transition management theory, and the innovative municipal governance tools that have been implemented in the region are analysed in terms of the methods of mobilisation they employ, the area of capacity they aim to generate, and the actors that they target within the local property development sector. Secondly, this thesis identifies through interviews with key actors, the barriers to energy efficiency in new urban developments which continue to persist in the region. These are organised within a framework of three constraining factors; acceptance, motivation and practice. From the interviews it is evident that barriers pertaining to all three areas are perceived by key actors. Finally, this thesis draws on suggestions offered during interviews, and best practice cases from outside the region, to explore options and opportunities to address the constraining factors of acceptance, motivation and practice identified. In conclusion, while presenting an exemplar of successful and innovative municipal governance of energy efficiency in new urban development, in a rapidly progressing sector new challenges and new opportunities will inevitably arise. This requires an iterative process of barrier identification and policy adaption on the part of the region's municipalities in order continue to drive the property development sector towards the regional goal of sustainable urban transformation.

Keywords: Energy efficiency, buildings, sustainable urban development, municipal governance, transition management.

Executive Summary

The Öresund Region, compising areas of Sweden and Denmark, is involved in a process of sustainable urban transformation. The region has high ambitions in terms of green growth and carbon emissions reduction, and has set itself the target of achieving carbon neutrality within the next 15-20 years – this is 20 years ahead of the Swedish national target. Buildings are significant energy consumers and are responsible for 40% of EU carbon emission (EC, 2009a). Buildings also have a design life of around 50 years. This is significant from a sustainability perspective as it means that the environmental impacts built in to them in the present will be locked in for subsequent generations. With substantial expansion of the urban environment planned in the Öresund Region over the coming decades, minimising the impact of new developments becomes a key target for regional climate change strategy.

Promotion of energy efficiency in new urban developments has been identified as both an effective and a cost effective approach to reducing the climate change impact of buildings and there exists significant technological potential with regards to energy efficiency measures (Endkvist, Dinkel, & Lin, 2010; IEA, 2010). It is crucial that the property development sector respond to the challenge of climate change, however progress in terms of energy efficiency in the sector in Sweden and Denmark has been stagnating and in practice this technological potential is not being realised (Hansen, 2010; Nässén, Sprei, & Holmberg, 2008).

This thesis approaches energy efficiency in the property development from a sociotechnical regimes perspective which views technical change as 'an unremittingly social, and thus contextual, localised and temporally specific, process' (Shove, 1998 p.1109). The regional property development regime is conceptualised as a system which can, though application of 'a careful, localised understanding of contemporary patterns of interest and opportunity' be shaped through municipal governance to favour the adoption of energy efficiency technologies and practices in the development of new urban areas (Shove, 1998 p.1110).

Municipalities have significant existing capacities for managing urban planning. They are also the level of government which shares the closest proximity to local industry and the public. These competencies write them an important role in driving and supporting the property development sector in its contribution to climate change mitigation efforts. This leading role is supported by academic theory on the governance of sustainable transitions which view municipal interventions as a crucial element of transition management (Rotmans et al., 2001). Through innovative governance approaches municipalities can build capacity within their own institutions, the industry itself and amongst the public, which can be instrumental in helping the sector overcome the barriers to energy efficiency inherent in the system.

This thesis sought to answer the research question of how municipalities in the Öresund Region can more effectively govern the property development regime so as to ensure that the energy efficiency of new urban developments is maximised. In answer to this question three objectives are explored:

1) To visualize and analyse energy efficiency in the property development sector within the conceptual framework of transition management.

2) To identify what are the most significant barriers to the attainment of high energy efficiency in new developments in the Öresund Region from the perspective of key decision makers.

3) To identify what opportunities exist within the structure of municipal-actor relations for innovative governance targeted at overcoming the barriers identified in objective 2.

In addressing Objective 1) this thesis visualises energy efficiency governance in the region within the conceptual framework provided by transition management theory. Transition management frames municipal spheres of action in terms of the landscape, regime and niche levels. Each level of the Öresund region case is analysed with reference to the transition model:

- The landscape section describes and analyses the policy framework that applies to Sweden and Denmark in terms of energy efficiency in new urban developments. In addition to an already supportive national policy landscape, the Öresund Region has its own visions and targets which serve to further raise the floor of ambition and create a unique and nurturing landscape for the promotion of innovation in energy efficient urban development.
- The regime section describes the sociotechnical system of the regional property development sector. A map of the relations and flows of influence with reference to energy efficiency is presented alongside an overview of the planning and development process. The reach of municipal powers in shaping urban development outcomes in Sweden and Denmark is also expanded upon.
- The niches section presents and discusses the various innovative municipal programmes that have been executed in the region with regards to energy efficiency in new buildings. Analysis of the niches indicates that a number of tools have been developed which address the key constraining factors related to acceptance, motivation and practice. These make use of structural mobilisation opportunities inherent in the municipal planning system as well as mobilising the sector through the development of knowledge and relational resources. At present niches are targeted largely at the design phase as opposed to the construction and operations phases and thus focus more on barriers relating to acceptance and motivation than practice. Niches addressing motivational constraints are also predominantly focused on regulatory measures – using sticks as opposed to carrots.

In addressing Objective 2) interviews with key actors in the region's property development sector were carried out in order to identify the critical barriers to the adoption of energy efficiency measures in the Öresund Region.

- Findings are discussed in terms of barriers relating to acceptance of energy efficiency as a goal; to company's motivation to act on this acceptance, and to the successful implementation of energy efficiency measures in practice.
- From interviews it was concluded that barriers related to acceptance, motivation and practice continue manifest in the regime.
- The three most significant barriers are identified as risk aversion; energy efficiency as a low priority in decision-making; and issues related to the user phase. The margins between them are however small and it is noted that the interconnectedness of the constraints means that focusing on individual barriers is neither feasible nor desirable.
- Importantly as the regime progresses some barriers will be overcome – this was evident in interviews in the case of suppliers as a barrier – while other will become more significant. For example as more integrated planning processes are adopted resistance to very-low energy buildings amongst consultants will become increasingly influential. These dynamics demand an iterative process of barrier assessment and policy adjustment on behalf of the region's municipalities.

In addressing Objective 3) the gaps identified in under Objective 1) and the barriers identified under Objective 2) are brought together with themes from interviews and examples of best practice from beyond the Öresund Region to offer recommendations as to how municipalities can more effectively govern for energy efficiency in new urban developments. Objective 3) ultimately serves to answer the overarching research question.

Barriers related to acceptance are addressed through:

- Improvements in dialogue processes between municipalities and developers (and other key actors). While good dialogue processes have been initiated in the region these were not yet universal. Also it was evident from interviews that not all actors knew how to work with these new processes and certain aspects relating to communication and trust were not fully developed. Dialogue processes also tend to focus on the developer, however resistance amongst architects and engineers was identified during interview and thus there may be need to engage with these actors also.
- The development and strengthening of industry and municipal networks. This was offered as tool for facilitating the sharing information and experience with regards to energy efficient development, and building up industry awareness and confidence in such measures.

Barriers related to motivation are addressed through:

- Management of the different municipal mobilisation approaches available. To maximize the impact of regulatory measures they must be designed so as to provide developers with certainty and must be supported by the identification and promotion of opportunities for industry learning and mutual benefit.
- The potential of energy companies to bridge the gap of broken agency is described.
- Opportunities for initiating cultural shifts in the local landscape through the development of city identities and creative communications are explored.
- It is concluded that while it must be ensured that structural (regulatory) mobilisation opportunities are fully exploited such as the implementation of a robust follow-up system, it is important that these are delivered in a manner that is non-adversarial. By maintaining good relations between the municipality and developers, self-generated motivation and beyond compliance performance within the industry can be facilitated.

Barriers related to practice are addressed through:

- Improvements so as to ensure municipal institutions have the appropriate capacity in terms of knowledge and communications is emphasised.
- Option for restructuring the processes so as to facilitate knowledge sharing and learning within projects and from one project to another is then expanded upon.
- Options for developing energy efficiency skills in the construction sector and improving accountability during the construction phase of the development process; this was highlighted as an important barrier and a gap in the niches.
- Finally the necessity of acknowledging the end-user as an instrumental actor in the energy performance of new buildings is emphasised and possible methods of involving this actor are explored. These include the use of housing associations as an access point to residents, the introduction of smart technologies, the inclusion of household energy use in energy demand calculations, and the adoption of a living lab model as a framework for implementing, testing and learning about energy efficiency innovations as they are used in situ.

The overarching conclusion to be drawn from the results of this thesis is that municipalities in the Öresund Region are already executing a very effective governance strategy for the promotion of energy efficiency in new urban developments. The Öresund Region has established itself both within Europe and globally as a leader in terms of governance for energy efficiency and sustainable urban development. The approach of the region fits well within the framework of transition management – raising the floor in an already supportive national landscape through regional visions and targets, and supporting this with innovative municipal level projects and programmes to develop the capacity of the regional property development sector.

Transition is however not a static state that can be reached but a dynamic process and despite strong governance, the levels of energy performance technically feasible in new buildings persistently fail to be realised. The property development sector functions as a complex sociotechnical system and the successful implementation of energy efficiency measures is reliant on the outcome of numerous interactions between different actors and stakeholders – each with their own, sometimes conflicting, interests. As a result energy efficiency in the sector continues to face a number of barriers which serve to limit the adoption and optimization of energy efficiency measures in new urban developments.

In continually driving progress in the regime there needs to be a continual assessment of the barriers and opportunities that arise in the wake of progressive changes. This thesis aims in part to contribute to this iterative process in offering regional municipalities feedback directly from the sector on their perception of the challenges being faced and the opportunities available to overcome these challenges. It is hoped that these observations will contribute to municipal governance endeavours in the Öresund Region as they continue their transition towards a more energy efficient and sustainable property development sector.

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1 Introduction

Background

Europe is experiencing a clear trend towards increasing urbanisation, with projections suggesting that by 2020 over 80% of Europeans will be living in urban areas (Ellen, 2010). This growth in the urban population demands a growth in the fabric of European cities also; it demands the construction of buildings. While urban development is not a new challenge in itself, the increasing prominence of sustainable development discourse in the global agenda – in particular the threat of climate change – has introduced a new dimension to its management.

Climate change mitigation has been established as a priority for the European Union (EU) and several commitments have been made with regards to this endeavour. As signatories to the Kyoto Protocol the EU has pledged a reduction in greenhouse gas (GHG) emissions of at least 20 % below 1990 levels by 2020, and 30 % in the event of an international agreement being reached (UNFCC, 1997). To achieve this target the EU has set additional targets to ensure 20% of total EU energy consumption comes from renewable sources, and to reduce energy consumption by 20 % by 2020 (EC, 2002, 2009). While the EU is on track to achieve its CO_2 reduction and renewables targets, it is currently 50% below its projected targets for reducing energy consumption (EC, 2009, 2012c). In response the European Commission (EC) is proposing a new Energy Efficiency Directive which will render the target binding and require member states to establish robust energy saving plans (EC, 2011).

The Öresund Region comprises areas of Sweden and Denmark in the vicinity of the Sound. Sweden has the ambitious target of becoming net emission neutral by 2050 with renewables making up 50% of the energy usage by 2020 (Swedish Government, 2009). An energy efficiency target of a 20% reduction in energy intensity between 2008 and 2020 has also been set (Swedish Government, 2009). Denmark is committed to achieving a 40% emissions reduction by 2020 alongside a 30% renewable energy share by 2020 and a target of 4% reduction in gross energy consumption as part of the Energy Policy Agreement (DEA,2008). In addition, the Öresund Region has set itself the goal of achieving carbon neutrality within 15-20 years (Harboe, 2012).

In their *450 Scenario* for carbon emissions reduction, the IEA (International Energy Agency) identifies energy efficiency as 'the single most important component of a lowcarbon future.' (IEA, 2010 p.23). Crucially, reducing energy consumption is not only important in itself but is also a key enabling factor in the transition to renewable sources, which forms the cornerstone of both EU climate change mitigation strategy and EU energy security strategy (EC, 2007b).

In the European Union, buildings currently account for 40% of total energy consumption and 36% of CO_2 emissions (EC, 2009a). This establishes the property development sector as a key target area for the reduction of energy consumption if the EU is to honour its commitments to reduce carbon emissions and increase energy independence (EC, 2010). The sector is also expanding, which will inevitably increase its potential energy consumption further (EC, 2010). In the Öresund Region Copenhagen is planning the development of 45,000 new dwellings over the next 25 years (Copenhagen-Kommune, 2009), while in Skåne there have been 783 new dwellings constructed in the first quarter of 2012 alone – a 24% increase on 2011 figures (Statistiska-Centralbyrån, 2012)[1]. Thus the energy performance of

[1] Dwellings includes the categories multi-dwelling houses, student accommodation and residential buildings for communities of all ownership types as provided by Statistiks Denmark.

new buildings (in addition to that of the existing housing stock) becomes an important focal point for policy makers seeking to ensure targets are met.

Buildings are also of particular concern in terms of sustainable development since they have a long lifecycle in comparison to other infrastructure. Buildings have a design life of between 40-100 years with Life Cycle Assessments (LCA) normally using 50 years as the standard lifespan value (Malmqvist et al., 2011; R. Shaw, 2007). This characteristic is important from a sustainability standpoint since it means that buildings being constructed now will likely be still standing for future generations. Thus the performance qualities that are designed into buildings in the present, and their resultant impacts – the energy demand and associated emissions – will be locked in for decades (Maria-Christina P. Georgiadou, 2011). Directive 2010/31/EU on the energy performance of buildings (EPBD) deals specifically with energy efficiency in the property development sector. In particular Article 6 of the recent recast reiterates the importance of ensuring new buildings are developed with future proofing in mind (EC, 2010).

While buildings present a major challenge with regards to climate change, the property development sector also offers significant opportunities. The IPCC (Intergovernmental Panel on Climate Change) notes that the property development sector, when compared with other major carbon emitting sectors such as transport, has the greatest potential to deliver significant, long-term and cost effective reductions (B. Metz, 2007). According to the McKinsey curve, addressing energy efficiency in new builds has significant abatement potential and results in a net benefit in terms of € per t CO_2 abated (Endkvist et al., 2010). Based on these opportunities the EU has high expectations for the potential of energy efficiency to contribute to climate change mitigation. The EPBD is expected to generate a 5 – 6 % saving in the EU's total energy consumption by 2020 and a 5 % saving in the EU's total CO_2 emissions by 2020 with the abatement costs being predominantly negative (EC, 2009a).

The growing attention being given to energy efficiency in buildings at the political level has resulted in an explosion of innovation in the field of energy performance in buildings. The development of certified *Passive* houses and now even *Active* houses has become a technically feasible reality[2]. However despite this, uptake of innovative building practices has been slow in the construction industry (Levitt, 2010; Ryghaug & Sørensen, 2009). Nordic countries are often regarded as the benchmark in terms of energy efficient buildings in Europe (Ko & Fenner, 2007; McCormick & Neij, 2009), however, even in this region there has been stagnation in the adoption of energy efficiency technologies in new builds (Nässén & Holmberg, 2005; Nässén et al., 2008). According to statistics for new build, multi-dwelling buildings in Sweden, energy use per floor area has actually increased since 1995 and average new buildings use two thirds more energy than the best available low energy buildings (Nässén & Holmberg, 2005). In Denmark also, new developments are not reaching their potential, with just 10% of construction being built according to the voluntary low energy classes which go beyond the minimum standards (Hansen, 2010).

Buildings are central to society – they are where we live, for most of us where we work and where we spend much of our leisure time. In Europe the average person spends around 90% of their time indoors (EFA, 2004). Making changes to the way in which our buildings use and source energy will have far reaching impacts on how we, as a society, use and source energy.

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[2] Passive House standard represents the highest standard of energy efficiency, requiring an annual heat requirement of ≤ 15 kWh/ m²/year compared to 70 kWh/ m²/year for an average energy efficient house. Active house classification requires that the building produces more energy than it consumes; this is achieved through the addition of microgeneration technology to Passive House designs (Holladay, 2009).

Problem Statement

Despite the prevalence of technological solutions for improving energy efficiency in buildings there still exists a significant performance gap between the best available technology and the average standard of new developments in the Öresund Region. There is also the issue that even in cases where ambitions were high, low energy buildings are using more energy in practice than was intended in the design (Branting, 2012). Although much of climate change policy comes from the national and international level, the success of the EPBD and other policies is ultimately determined at the level of municipal implementation. Transformations in the way urban development is enacted will require transformations in the way it is governed. Alongside research and development into technical solutions for improving the energy performance of new buildings there must also be research into the mechanisms for integrating such innovations into everyday construction practice (McCormick & Neij, 2009). The premise of this paper is that advances in the energy performance of buildings will not come simply from the development of technological innovations but rather through innovation in the processes associated with their integration into buildings during the design, construction and operations phases of building development. As key actors in the urban development process municipalities need to work to ensure new urban developments are not only planned and built in line with ambitious energy performance targets but also that these targets are actually achieved during the use phase of the building's life cycle. The Öresund Region has set itself the goal of becoming carbon neutral within the next 15-20 years. With continuing development planned in the region, optimizing the energy performance of new buildings becomes an important objective for local policy makers.

Research Question

How can municipalities in the Öresund Region more effectively govern the property development regime so as to ensure that the energy efficiency of new urban developments is maximised?

Objectives

This thesis looks at how municipalities in the Öresund Region are currently governing the transition towards more energy efficient new buildings within the sociotechnical regime of property development. Through an examination of the gaps in current procedures, the barriers to energy efficiency, and the perception of municipal-actor relations from the perspective of key actors, opportunities for furthering progress are explored. This is achieved through execution of three objectives:

1) To visualize and analyse energy efficiency in the property development sector within the conceptual framework of transition management.

2) To identify what are the most significant barriers to the attainment of high energy efficiency in new developments in the Öresund Region from the perspective of key decision makers.

3) To identify what opportunities exist within the structure of municipal-actor relations for innovative governance targeted at overcoming the barriers identified in objective 2.

Methodology

1.1.1 Conceptual and Analytical Frameworks

This thesis uses transition management (TM) theory as a framework within which to conceptualise and analyse the case of energy efficiency governance in new urban developments in the Öresund Region. The framework is based on the sociotechnical systems

perspective of TM which approaches transition scenarios using a multi-level model originally developed by Geels and Kemp (2000). This framework breaks down the transition scenario into the arenas of landscape, regime and niche (Loorbach, 2007). The Öresund Region's aspirations to create a more energy efficient and sustainable property development sector are fundamentally aspirations for transition. TM theory provides an approach to governing such transitions which has been employed successfully in the transition towards more sustainable systems in the energy and property sectors in other cases (Loorbach, 2007). TM is also useful in that it allows for the acknowledgment of the different levels at which governance in enacted. When specifically addressing municipal level governance as this thesis does, it is important to contextualise municipalities within the wider system. Municipalities do not function in isolation but are working within a regional, national and international political and cultural landscape, yet their scale limits their scope of influence largely to local arenas. TM not only offers a precedented framework with which to analyse the approach of the Öresund Region in governing this transition towards a more energy efficient property sector, but also provides a framework through which the municipality can be conceptualised as a key actor in this process.

Within the framework of TM two additional frameworks are employed as analytical tools in assessing municipal governance of energy efficiency in the property development sector. Firstly, analysis of niches, identification of barriers and presentation of recommendation is structured using a framework based on that employed by (Ko & Fenner, 2007). This framework discusses energy efficiency in the property sector in terms of three constraining factors; acceptance of energy efficiency principles; motivation to act on these principles; and implementation in practice. Secondly, theory on municipal level governance in urban development as developed by Magalhaes, Healy, and Madanipour (2002) is employed to facilitate the analysis and discussion of the municipal niches and recommendations. This framework approaches governance of urban development as a process of utilising and developing institutional capacity, comprising of structural and agency mobilisation approaches, relational resources and knowledge resources.

1.1.2 Data Collection Methods

The data collection methodology of this thesis comprises two approaches. Firstly, a literature review is conducted to establish the context of the research question. The literature review provides an overview of TM as strategy for the governance of sustainable urban transformation from an academic perspective and was used to characterise the building development industry as a sociotechnical regime for which such a governance strategy is appropriate. Literature on the diffusion of energy efficiency innovations within the sociotechnical regime of the property development sector was also consulted. A review of policy documents and municipal government publications provided background on the policy context in which planning and development in the Öresund Region takes place. This was used to develop the case study. The literature review also yielded a set of potential barriers to the diffusion of energy efficiency innovations in the sector and to the attainment of high energy efficiency standards in new buildings. These barriers are incorporated into the interview design discussed below.

The second data collection method involved the collection of information from personal communications with relevant actors involved in urban development in the Öresund Region and elsewhere. Informal discussions with staff from the urban planning and environment departments at Öresund Region municipalities were carried out, as well as discussions with staff and researchers from Lund University, from other research institutes and organisations related to sustainable building, and from municipalities outside of the region. In addition semi-structured interviews with professionals from key actor groups in the planning and

development process were conducted. Results from these semi-structures interviews formed the primary data input for Chapter 4: Barriers in the Öresund Region, and Chapter 5: Discussion and Recommendations. These interviews are referenced in the text by code number as opposed to name. The reason for this choice was that within this thesis interviewees are speaking as representative of the regional industry rather than as individuals. It was therefore deemed beneficial from the perspective of both the researcher and the interviewees that a degree of separation was maintained. All statements are traceable to the original interview transcripts by contacting the author of this thesis, however for publication purposes interviewee's identities have been separated from the perspectives presented.

The interview method was selected as it allows for the collection of in-depth, qualitative information which is valuable when discussing actors' perceptions of complex concepts such as governance. When gathering information in a context in which people are not speaking their native language, interviews – as opposed to questionnaires or surveys – can allow for clearer communication by offering the opportunity for both interviewee and researcher to clarify meanings and expand on concepts where necessary. A semi-structured interview method as opposed to a more structured format was employed firstly to accommodate the fact that the actor groups had different roles within the property development process (making a one size fits all approach would be unsuitable), and secondly to allow for interviewees to bring up and discuss what was important to them and not simply what was imposed by the researcher. Interviews followed three core themes outlined below:

- Mapping the planning and development system and identification of the flows and mechanisms of influence;
- Identification of barriers using the framework expanded upon below; and,
- Discussion of perceptions of the relationship with the municipality and the identification of drivers and opportunities for improvement in municipal governance for energy efficiency.

For interviews with the developer, construction, architect and engineer groups (those actors with direct influence over the energy efficiency of a development), a table of potential barriers was used as a data collection tool. This table (see Appendix 1) was drawn up based on the literature review (Ko & Fenner, 2007; Peterman, Kourula, & Levitt, 2012; Ryghaug & Sørensen, 2009). Interviewees were asked to identify and rank the barriers they felt most significant to their company when developing in the Öresund Region and to discuss their selection. The table was used to provide structure to the collected data on barriers and to ensure interviewees had considered all angles.

Interviewees consisted of professionals working in companies from key actor groups in the local property development regime. The key actor groups were identified based on the literature review and personal communications with municipal planners, as those most influential in terms of determining the energy efficiency outcome of developments and comprised; developers, construction companies, building engineers, architects and energy companies. The interviewees are presented in the Personal Communications section of this thesis. During the background research developers were identified as the most pivotal actor group and thus made up the majority of interviews. Their decisions and outcomes are however reliant on other actors – architects, engineers and construction contractors – thus it was decided that these actors should be included in the study to incorporate a broader perspective. Energy companies were also interviewed to attain a deeper understanding of the interaction between built infrastructures and energy infrastructures and the possible solutions in this area.

To ensure interviews were targeted at those best able to inform this research, choice of companies approached, and the actors selected for interview within these companies, were based on the following criteria:

- The company is from an actor group which plays an influential role in the energy efficiency outcome of the development process;
- The company has in the last 5 years worked on – or is currently working on – a large-scale development project of the type this research paper is addressing within the Öresund Region (see scope);
- The interviewee is a key energy efficiency decision maker within company projects (this role was normally that of the project development manager).

A list of 45 relevant companies was drawn up based on discussions with municipal planners in Malmö, Lund and Copenhagen. These companies were contacted by telephone and email. The final 16 informants were then chosen via a process of self-selection dependent on the willingness and availability of individuals within the companies to take part. Participating actors were sent an interview briefing detailing the background and aim of this research and the themes to be discussed during the interview to ensure that they understood the nature of the interview and were able to prepare some contributions (see Appendix 2). It was the researcher's intention to carry out interviews in person as face-to-face communication is generally richer in detail and more dynamic. This was however not possible in all cases and thus some interviews were carried out by telephone. Importantly these actors are all geographically located in the region and are consistently active in the regional property development sector. This gives the sample greater validity in terms of its representation of the regional sector as a whole, as they will have shared experiences of the same municipalities, planning systems and industry context. A draft of this thesis was sent out to all interviewees to allow them to review their statements as they had been incorporated into this thesis and ensure that comments were both accurate and appropriately contextualised.

While other actor groups such as the end-user and suppliers are significant, these groups were not included. End-users although playing a crucial role in the energy efficiency outcome of buildings are not directly involved in the planning and construction process. They are a large and varied group and analysis of end-user behaviour would be another thesis in itself. Therefore end-user behaviour is discussed in this study only in so far as it can be shaped by energy efficiency decisions made by developers. Suppliers are also a large and variable actor group. There is a multitude of products each with its own characteristics and within this a multitude of suppliers some of which are internationally based. This makes identifying actors which would be representative of the group as a whole problematic. Unlike the other actor groups interviewed suppliers are also not necessarily geographically located in the Öresund Region. Ultimately suppliers, while influencing energy efficiency decisions do not directly control the outcome and so were not included.

Scope

This thesis limits its scope to the issue of energy efficiency in new building developments. The building type being addressed is that of large-scale multi-dwelling residential and commercial developments. In defining this scope it must be acknowledged that energy efficiency in existing housing stocks is also an area that demands significant attention if energy and climate targets are to be reached. In addition, when planning new urban developments it is crucial that a holistic view of the development's energy system is taken; this should include aspects

relating to transport, waste and energy source. This thesis however, is focused purely on the energy efficiency of the building.

The niches presented in Chapter 3 have been collected from Energi Öresund and Urban Transitions Øresund (UTO) partner municipalities as these municipalities constitute the target audience (see Appendix 3 and 4 for project summaries). While there are 79 municipalities in the region as a whole, the 7 encompassed by the scope of this research include the largest urban areas in the region (Malmö and Copenhagen) and thus are most relevant from an urban development perspective. Where examples of good practice from outside the Öresund Region are referred to, these have been selected from within Northern Europe so as to maximize political and social compatibility. This is based on the assumption that such countries share to a certain degree similar political structures, cultural values and expectations with regards to building development. While this thesis addresses the opportunities that exist for more effective governance of energy efficiency in new buildings at the local municipality level, the role of national legislation in supporting municipal level initiatives and as a driver of more widespread change must not be overlooked.

This research takes place within the geographical scope of the Öresund Region, and the focus is on the development of governance recommendations that are tailored to the region. The case study of the Öresund Region was chosen as an exemplar of progressive governance for sustainable urban development. With this in mind, it is hoped that the barriers and drivers identified, and the recommendations offered may be relevant to other contexts.

Limitations

The self-selection of interviewees has the potential to bias the sample in favour of those actors who are already more engaged in energy efficiency progress in the sector as those who are less engaged may have been less willing to participate. The TM framework recommends focusing on forerunners when designing policies and programs. Thus this does not necessarily conflict with the TM framework. However, the barriers being faced by those more resistant to change could also offer valuable inputs as such actors are still active in property development in the region. Availability of interviewees represented an issue. The research period ran over June and July which in both Sweden and Denmark is considered vacation time. This meant that some relevant people within the private companies and municipalities targeted were not available to participate in interviews thus limiting the research sample somewhat.

Language also presented a notable limitation in the research process of this thesis. Firstly, many relevant documents – particular grey literature – were in Swedish or Danish. While satisfactory translation tools are available, the necessity of translation did slow down the research process and increase the likelihood of comprehension error. Secondly, all interviews were conducted in English; a non-native language in both Sweden and Denmark. While most interviewees had a very good grasp of English, the use of a non-native language as an interview medium does increase the possibility of misunderstanding on both sides. For example interviewees sometimes struggled to express certain concepts in English and thus could not discuss them in detail. Some potential interviewees were also unable to participate in interviews as a result of the language barrier. This was most pronounced in the case of actors involved in the construction element of property development but was also true for some municipality staff.

Within this paper there is the assumption that emissions savings generated by energy efficiency measures will result in a net reduction in the region. However, research into the rebound effect suggests that under some circumstances savings made will be compensated for by additional emissions generated in other areas; for example as the result of spending the

additional spare income that results from savings made on energy bills (Berkhout, Muskens, & W. Velthuijsen, 2000). Energy efficiency in new buildings must form part of a society-wide drive to reduce consumption if net emissions reductions are to be achieved.

Intended Audience

The inspiration for this thesis comes from a larger project being managed by Energi Öresund. This research will feed into Activity II of Energi Öresund's work, *Energy for Low Energy Buildings*. The objective of the Energi Öresund project is to develop a set of Green Building Guidelines targeted at municipalities in the Öresund Region. The aim of these guidelines is to help municipalities to govern more effectively to ensure high energy performance standards are attained in new developments. This research is also linked to the UTO project and aims to contribute further to the generation of knowledge on governance for sustainable urban transformations in the region. The initial target audience of this research is Energi Öresund and it is hoped that the results of this research will contribute towards the development and implementation of the Green Building Guidelines. Thus the final target audience is the region's municipalities – in particular those staff in charge of urban planning. In addition, as a case study of best practice in governance for energy efficiency in new urban developments, this thesis would also be of interest to municipal planners from elsewhere in Europe as an informative and inspirational example from which learning could be gleaned and knowledge transferred.

2 Sustainable Urban Transformation

Rotmans et al. (2001 p.14) define transitions as the 'social transformation processes in which society or a complex subsystem of society changes in a fundamental way over an extended period'. Within the context of sustainability, transitions can be defined as the 'processes of change that structurally alter the culture, structure and practices of a societal system' with the normative ambition of sustainability (Loorbach, 2007 p. 17). These structural changes are needed in order to transcend the 'lock-in' to unsustainable practices that currently characterise our societal systems (Loorbach, 2007).

The characteristics of transitions are defined by Rotmans et al. (2001 p.14) as the following:

- They concern a structural change to society or a complex subsystem;
- The change process is a gradual one;
- There are technological, economic, ecological, social-cultural and institutional developments at different scale levels which all influence and reinforce each other;
- A transition is the result of slow changes (development in stocks) and fast dynamics (flows); and
- They cover at least one generation (25 years).

In striving towards carbon neutrality and fossil fuel independence, the cities of the Öresund Region are essentially engaging in a process of transition as defined by Rotmans et al. (2001). This process is part of a wider national transition in Denmark and Sweden towards a more sustainable energy system which in turn forms part of the European-wide transition.

Cities as economic, social and creative hubs have been identified as presenting a number of opportunities to contribute towards the development of a more ecologically and socially sustainable built environment (Kes McCormick, Neij, Anderberg, & Coenen, 2011). Significant transformations in the material, political, socio-economic and cultural make-up of the region's cities will however be required if the region is to realise its goals. Such transformations cannot occur instantaneously but require a process of transition. Sustainable urban transformation, and the transition process it involves, demands changes in practice from all sectors of society and thus requires the support and cooperation of industry and public actors as well as the direction of government.

Traditionally, the realm of policy making and decision-making in urban planning has been dominated by government in a top-down structure. However, top-down, unidirectional decision-making is no longer seen to be sufficient to meet the challenges of sustainable urban development both from the perspective of international policy makers and academics. The need for governance as opposed to government crops up repeatedly in academic literature on urban sustainability (H. Bulkeley & Betsill, 2005; Murphy, 2000; Varol, Ercoskun, & Gurer, 2011). It is also incorporated into the principles of numerous policy documents such as Agenda 21[3], the Aarhus Convention[4], and the EU Thematic Strategy on the Urban Environment (TSUE)[5]. In terms of energy efficiency this step-change in the approach to

[3] Agenda 21 is a voluntarily implemented sustainable development action plan developed as a key outcome of the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992.

[4] The Aarhus Convention refers to the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, which was signed on June 25, 1998.

[5] The EU TSUE was adopted by the Commission in 2006 and constitutes a strategy to improve the environment of Europe's cities addressing social, economic and environmental aspects.

governing is exemplified by the IEA's report *Energy Efficiency Governance* in which strong emphasis is placed on the importance of stakeholder engagement and the role of partnerships and collaboration between government and the private sector (IEA, 2010).

TM is a theoretical and methodological approach to the governance of large and complex transformations such as those required in the movement towards a more sustainable built environment in the Öresund Region. This thesis is dealing with the management of sustainable transition within the societal subsystem that is the sociotechnical regime of property development, with a special focus on the adoption of energy efficiency measures. This chapter outlines the property development sector as a sociotechnical regime and the opportunities and challenges that such systems present in terms of the adoption of energy efficiency measures. It then goes on to describe the TM approach as a conceptual framework through which to envision energy efficiency governance in the Öresund Region. Finally, the researcher will present a justification for the role of municipalities in driving this process of transformation and the mechanics of this governance will be elucidated.

Property Development as a Sociotechnical Regime

This paper takes as its problem statement the existence of a gap between the technological potential for energy efficiency and the norms of building practice. This problem is often addressed in terms of 'non-technical barriers' to innovation diffusion (Shove, 1998). However, accepted theories of technological change often fail to take into account the complexities of social action involved in property development (Guy, 2000). Shove argues that the distinction drawn between the technical and the social is flawed and that 'technical change is an unremittingly social, and thus contextual, localised and temporally specific, process' (Shove, 1998 p.1109). The concept of technical potential is meaningless without looking at the social context which determines its implementation.

The property development process involves a number of different actors and stakeholder linked by relational ties[6]. Pryke (2004) categorises such ties in the sociotechnical regime as follows:

- Transfer of material resources , e.g., business transactions;
- Behavioural interaction , e.g., dialogue; and,
- Formal relations, e.g., contracts and regulations.

In viewing property development as a complex system a different approach to governance is required. The actors and stakeholders in the regime can act to both influence and constrain one another and this interconnectedness must be acknowledged in policy making (Ko & Fenner, 2007). A sociotechnical regime approach demonstrates that in placing controls in one area, such as, say, building regulations on developers, other highly influential areas such as customer demand or skills availability will not be addressed, a deficit which clearly limits the effectiveness of such policies.

Shove argues that '[e]quipped with a careful, localised understanding of contemporary patterns of interest and opportunity, sociotechnical analysts might well be able to specify ways of advancing the cause of energy efficiency within specific settings' in the property development

[6] This thesis makes a distinction between actors and stakeholder. Stakeholders are defined as all parties with potential to influence directly or indirectly the system, or those whom are impacted by the system. Actors are defined as those parties who are directly involved in the planning, construction and use phases of property development and have agency in determining the energy efficiency of the final building.

sector (Shove, 1998 p.1110). In line with Shove (1998) this thesis adopts a sociotechnical regimes approach which views the property development sector as a system that can be shaped through municipal governance to favour the adoption of energy efficiency technologies and practices in the development of new urban spaces in the Öresund Region.

2.1.1 The Challenge of Energy Efficiency

The energy efficiency of buildings is the result of 'a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems; all of them embedded in institutions and infrastructures' (Geels, 2002). Innovations in energy efficiency involve not only new technologies and materials but also new techniques in design and construction, and new user behaviours and norms. The final energy performance of a building is reliant on the interaction of all these aspects, meaning that the adoption of a new technology such as triple glazed windows is not normally sufficient alone to heavily impact the energy performance. Rather, it must be integrated as part of a new house system involving energy efficient construction techniques, internal systems and informed user behaviour.

The standard measurement for energy efficiency in buildings uses annual energy consumption expressed as kWh/m^2 per year. This figure can be shaped by a number of factors notably:

- Location and orientation of the building, e.g., *passive* design minimises the amount of artificial light, heat or cooling required by exploiting existing sun, shade and shelter;
- U- values[7] of the materials used, e.g., whether single or triple glazed windows are fitted;
- Quantity of materials used, e.g., the number of windows installed, or how thickly insulation is applied;
- Composition and position of these materials, considering that losses from thermal bridges and leakages can be minimised through tight sealing, and natural light and heat sources can be taken advantage of through careful positioning of windows;
- Efficiency of installed internal systems, ensuring that all energy consuming systems such as heating, lighting and ventilation meet high energy efficiency standards; and,
- Use of the building and its systems, e.g., the average temperature of the indoor climate that users maintain.

A number of standards for energy efficiency have been developed. These range from prescriptive measures such as requiring particular technologies, to performance based measures such as the setting of energy frames which set a maximum limit on the amount of energy a building demands, to whole house certification standards such as the Passive House standard which have their own set of criteria.

As the sociotechnical regime approach suggests, the successful diffusion of energy efficiency innovations in the property development sector does not simply rest on the costs and benefits of the technologies themselves but requires management of the system in which one wants these technologies to be adopted. Costs and benefits are commercially and culturally defined and these contexts change over time. Actors creatively adopt technologies and practices based on the varying pressures and opportunities affecting them at a point in time, therefore, it is these pressures and opportunities that should be explored not simply the characteristics of the technologies themselves. (Guy, 2000)

[7] The U-value is the unit used to measure the rate of heat loss through a material.

2.1.2 The Business Case for Energy Efficiency in New Buildings

The business case for energy efficiency is complicated and depends firstly on how one is defining energy efficiency. The level of energy efficiency being discussed changes the cost benefit calculations of the investment significantly. For instance the upfront costs of developing to Passive House standards are much higher than the costs of developing within an energy frame of 60 kWh/m^2 per year which is still more efficient than minimum standards[8]. The business case will also vary depending on which actor one is considering. Since developers tend to drive the business case of other actors such as architects and construction contractors, this section necessarily focuses on the business case from a developer perspective (Dieperink, Brand, & Vermeulen, 2004; Ko & Fenner, 2007). The business case for energy efficiency can be broken down into three driving elements: economics; risk management; and stakeholder relations. This section gives a brief overview of the drivers for energy efficiency measures from the perspective of developers.

Economics

In considering economics, reduced operations and maintenance costs are key. Energy efficiency can reduce operations and maintenance costs for companies who also manage the properties once built. Higher initial investment costs can be recouped and profit can even made through savings generated by reduced energy bills and maintenance costs (Danielle, 2009).

Next, higher property values are obviously crucial. Energy efficiency can contribute to higher property values (Andrew J. Nelson, Oliver Rakau, & Philipp Dörrenberg, 2010). These are justified by the promise of lower energy bills for the end-user, higher levels of comfort such as a more consistent indoor climate and proliferous natural light and the positive association of buying 'green' (Andrew J. Nelson et al., 2010).

Finally, there is the quality of investor attractiveness. Increasingly, investors are taking into account the corporate social responsibility (CSR) portfolio of companies when making investment choices. Energy efficiency can be an asset to the CSR report of a developer and a strong profile could increase the attractiveness of the company to investors.

Risk Management

Concerning the ever-present regulatory risks, developers must be able to achieve these standards when new, stricter legislation comes in, so as to reduce the risk of building-related litigation costs. Regulations are to be tightened dramatically at 2015 and 2020 in both Sweden and Denmark making this a significant driver. Participating in demonstrations and pioneer projects allows for process and product innovation which could translate into competitive advantage. Process efficiency and product quality can be improved by taking a leadership role in the industry. In addition, this acquired experience will give consumers and investors confidence (Danielle, 2009).

Lastly, climate change itself brings with it a number of economic risks to property developers and could serve to bring climate change mitigation, as a general goal, in to line with business interests. For example, temperature rises are accompanied by risk of increased costs for cooling and ventilation; changes in weather patterns raise the risk of flooding which can result in loss of asset value and higher insurance premiums for low lying and coastal properties (Danielle, 2009).

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[8] The figure of 60kW/m^2 per year is used here as this was the figure quoted independently by Interviewee #1, Interviewee #2 and Interviewee #4 during interviews as the threshold beyond which costs significantly increase.

Stakeholder relations

In terms of business reputation, public awareness about the importance of climate change mitigation and other environmental issues, more generally, is increasing. Developing buildings that are energy efficient communicates the company's commitment to take responsibility for its impacts and its mission to contribute to wider societal goals. This can translate into improved reputation amongst consumers, investors and shareholders. The internal reputation of the company from the perspective of the employees can also be improved, with increased employee job satisfaction due to the fact that people feel they are contributing to a greater good (Danielle, 2009).

Customer satisfaction must also be considered. Energy efficiency often comes hand in hand with high quality building and design, since quality materials, precise craftsmanship, and innovative design are required. This means that energy efficient buildings often result in high levels of customer satisfaction. For office spaces, improved building quality as a result of energy efficiency measures can also contribute to increased productivity. Customer relations can also be strengthened through education of end-users (Danielle, 2009). Importantly, there is also the attraction of lower energy costs. Energy prices are predicted to rise, thus, with energy efficiency measures in place, customers will potentially benefit from lower energy bills.

Finally, the relationship between the developer and government is crucial. Both the Swedish and Danish governments are strongly committed to improving the energy performance of buildings, with individual municipalities pushing this ambition even further. By showing a commitment to energy efficiency goals, opportunities for negotiation and mutual benefit can be opened up (Yudelson 2010).

2.1.3 Constraining Factors

Despite the strong business case for energy efficiency in new buildings, the property development regime has some unique characteristics which place limitations the adoption and proper integration of innovations. While regulations are a key element in driving the adoption of energy efficiency technologies and practices, when imposed on a system that does not favour energy efficiency, barriers will continue to manifest. This is exemplified in the Öresund Region by the case of Bo01 in the Western Harbour development of Malmö[9]. The first of the Western Harbour developments Bo01 was very ambitious in its energy efficiency goals and significant investments were made to support these ambitions. However in practice, the energy demand of the buildings turned out to be significantly higher than originally estimated (Nilsson, 2003). While ambition and appropriate regulation can make a big difference, it is necessary that a reconfiguration of the development process as a whole also takes place so that the system can effectively accommodate and support new technologies and practices as they arise (Ko & Fenner, 2007). This is the goal of transition management.

The following set of barriers have been identified in the literature review as the most common and significant in holding back the adoption and successful implementation of energy efficiency measures in the property development sector (Ko & Fenner, 2007; Peterman et al., 2012; Ryghaug & Sørensen, 2009). These barriers have been organised within the framework of three constraining factors based on that used by Ko & Fenner (2007). Firstly, there are barriers associated with the acceptance of the principles of energy efficiency as a social good; secondly, barriers associated with motivation, i.e., identifying convincing drivers related to regulations and business case; and thirdly, barriers associated with practice, i.e., the availability

[9] Western Harbour (*Västra Hamnen)* is Malmö's new urban district. Currently being developed on the grounds of the old shipyard it has been the focal point of sustainable development in the city.

of the materials and skills required to implement energy efficiency. These constraining factors are sequential in that acceptance is a prerequisite for motivation, and action as a result of motivation is necessary for practice related barriers to come into effect. However, all three may of course manifest simultaneously within the sector, within individual companies and within individual projects.

Acceptance

An initial barrier is that energy efficiency principles may not be wholly accepted and as a result can end up as a low priority in decision-making. If energy efficiency is not valued as a desired quality of a building it inevitably gets out-weighed by other considerations, such as cost or appearance, in the design phase. Even where energy efficiency has been accepted as an important element of property development by individual developers, within the system there remains a 'lock-in' to existing design and building practices which can prevent progress. Secondly, resistance can also come from other actors in the process, such as architects or construction contractors, who see new methods as hindering creativity. Or, in the case of construction, reducing worker-efficiency and increasing their own costs. (Ko & Fenner, 2007)

A third barrier is risk aversion. There is still uncertainty surrounding the use of new technologies and techniques which have not been extensively demonstrated. To be a leader in the implementation of these innovative technologies is risky; thus, resistance arises and the *status quo* prevails. These immediate risks are often perceived as more compelling than the longer-term risks associated with lower energy efficiency and the negative consequences of climate change itself. However, while reducing the (perceived or actual) risks associated with the tightening of building regulations is an important consideration, a consequence may be that environmental standards for new construction may not be driven much beyond current regulations. (Ko & Fenner, 2007; Peterman et al., 2012)

Motivation

Where the underlying principles of energy efficiency as a positive and important element of good property development have been accepted, there still remains the issue of motivation. While companies may in theory support energy efficiency and understand its benefits they may not have access to appropriate knowledge and resources to drive action.

The first issue in relation to this group is lack of information. Decision makers are not always aware and up to date with the energy efficiency options available and the potential benefits of making good energy efficiency choices. Knowledge of the technical potential and the business case for action may not be sufficient to influence decisions. The energy efficiency standards in large property development companies are often set centrally within the company, giving project managers less freedom to determine the costs and benefits of particular solutions for a specific project. (Ko & Fenner, 2007; Peterman et al., 2012)

The second issue is financial. Market failure results in a situation where the market does not take into account externalities related to energy use and carbon emissions. This results in low energy prices which serve to undervalue energy efficiency measures. Where payback on investments is feasible (which is the case for many energy efficiency measures) there then can come the problem referred to as 'broken-agency' (Peterman et al., 2012). This phrase describes the phenomenon whereby the actor making the investments in energy efficiency is not the actor receiving the benefits. Energy efficiency investments can be recovered by savings generated through lower energy consumption during the use phase. However, in the case of developers who sell the buildings on to new owners, the investments made essentially become unrecoverable costs. While it is possible to try and compensate for energy efficiency savings

by including these in the sale price, buyers are still not fully primed to take into consideration life-cycle costs when buying, and will simply see higher prices on the market.

Property companies are, ultimately, in the business of generating value for their shareholders through the creation of profits; thus, consumer interests are a crucial driver. The lack of consumer demand, or the perceived lack of consumer demand (there are some studies that indicate that demand does exist (e.g., Andrew J. Nelson et al., 2010)) has been identified as a major barrier. It would appear that developers are largely of the opinion that house-buyers and other customers do not value energy efficiency highly when making purchasing choices and as a result developers do not want to make investments that consumers are not willing to pay for. (Ko & Fenner, 2007; Peterman et al., 2012; Ryghaug & Sørensen, 2009)

A third issue is that of uncertainty surrounding regulations and the planning process. With rapidly changing regulations, confusion about what is required in terms of energy efficiency can serve to undermine the driver of regulatory risk management as developers are not certain that a detailed understanding of the energy-efficiency measures being employed will be applicable under future regulatory regimes. Where regulations exist, the inadequate enforcement of these regulations can also serve as a barrier to ambition. In this situation the consequences of not meeting the energy efficiency demands of a contract are not sufficient to drive compliance, thus the value of the contract is undermined and the probability of underperformance is increased. (Ko & Fenner, 2007; Peterman et al., 2012; Ryghaug & Sørensen, 2009)

Practice

Once designed into a building, the feasibility of specific energy efficiency measures still relies on the availability of the appropriate materials such as windows with a very low *U value,* or particular insulation materials. There exists here a potential bottleneck in the form of reliance on suppliers. Energy efficiency technologies are still relatively novel and thus, in some cases, the supply chain may not be mature enough to provide the necessary materials for large-scale developments involving innovative energy efficiency measures.

As is characteristic of a sociotechnical regime, the existence of the necessary materials and technologies is not sufficient in itself; the interaction of people with these materials and technologies also has a significant influence on the overall result. The energy performance of a building is heavily reliant on aspects relating to the craftsmanship of the construction. In particular, gaps in the airtightness of the building envelope as a result of poor sealing around windows and other thermal bridges can have a significant impact on the energy efficiency outcome and can undermine the positive impacts of higher insulation levels and other measures. Building workers are not always trained in energy efficient techniques and technology installation. This can result in the construction of leaky building envelopes which are very difficult to rectify once built. In addition, time pressures which result from developers wanting to minimise costs in the construction phase, can mean that proper attention and priority is not given to these aspects. (Ko & Fenner, 2007)

A third issue in this group is the problem of organisational learning in project based industry. Project based work means that different actors are involved each time in new projects so that, at the level of the city, knowledge gleaned from one project is not necessarily carried into the next. As such best practice is slow to diffuse. The number of actors involved and the fact that developers often hire teams of consultants also means that learning within discrete organisations can be slow. Newly acquired knowledge and competencies are retained by the individual consultants and contractors, thus, breaking a key communications link and resulting

in the possibility that insights and innovations may well not be carried into the next project by the developer. (Peterman et al., 2012)

Finally, the energy performance of a finished building is not simply locked in through the features of its design and construction. Buildings are lived and worked in and the energy performance of the building is heavily dependent on how it is used by its occupants. Energy efficiency calculations are based on a number of assumptions about user behaviour, such as the maintained indoor temperature and the rational use of heating and ventilation (for example, the assumption that people will not turn the heat on and then open windows). Energy efficient installations, such as heating and ventilation systems, also require proper adjustment and maintenance in order for the energy efficiency savings to be optimised. Despite the best intentions of developers and the highest quality of craftsmanship in construction, end-user behaviour can still present a significant barrier to the achievement of optimal energy performance.

Transition management theory

The transition management (TM) approach emerged in the Netherlands where it was applied by the government to the Dutch energy system (Geels & Kemp, 2000). By definition transitions cannot be controlled; they are too complex and the outcomes long-term and uncertain (Loorbach, 2007). Instead TM aims to guide the process by influencing the direction and speed at which transition takes place. As a conceptual framework TM employs a multi-level model originally developed in the field of innovation and technology studies (see Figure 1) (Geels & Kemp, 2000). This theory analyses sociotechnical regimes as part of a three level system where transitions occur as the result of a managed interaction between the landscape, regime and niche levels. Each of these levels will now be examined in turn.

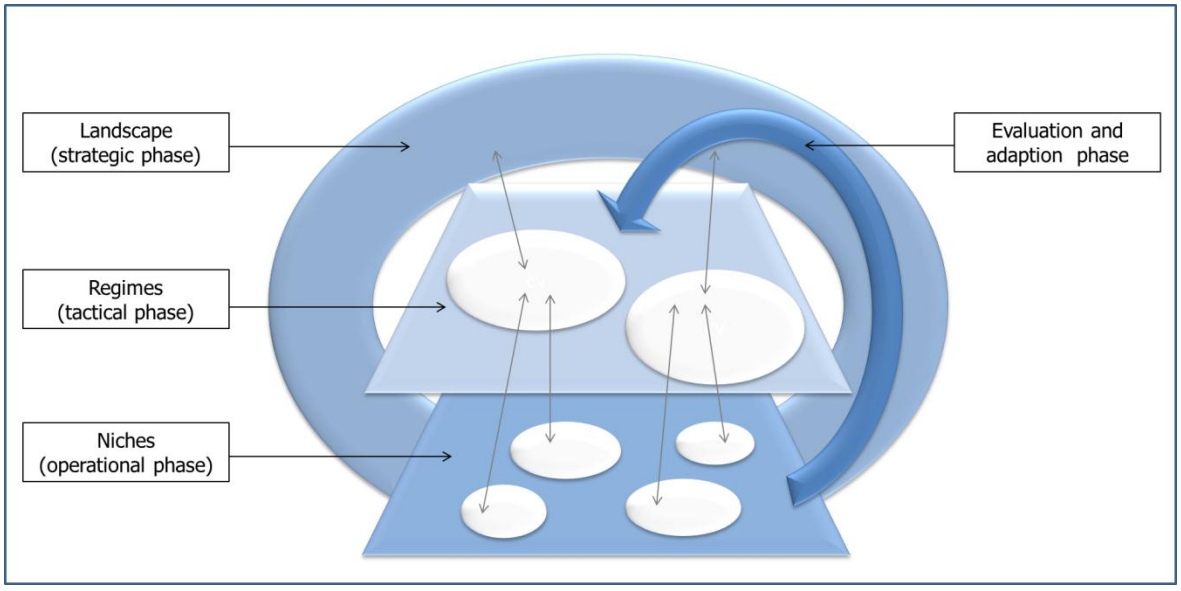

Figure 1 The multi-level transition management model based on Geels and Kemp (2000)

2.1.4 The Landscape

The macro level is the 'Landscape'. This refers to the overarching societal setting in which change is occurring, and includes the political, social and economic climate and trends. Landscape is integral; it shapes the regime and niche levels by 'defining the room and direction for change'(Loorbach, 2007 p. 20). The landscape level is the level at which the *strategic* phase takes place. This is where the overall problem is envisioned and includes the generation of large paradigms. In this case, the foundational paradigm is that of climate change mitigation as

a societal goal. Within this then, there is also the acknowledgement that the property development sector should contribute to this goal. This phase is largely, although not exclusively, a national government and EU endeavour. (Loorbach, 2007)

2.1.5 The Regime

The central meso level is the 'regime'. This represents 'the dominant structure, culture and practice' of the system 'embodied by physical and immaterial infrastructures' (Loorbach, 2007 p. 20). This includes actor networks, power relations, regulations and physical infrastructures such as energy grids. The regime structure shapes the norms of actor behaviour and guides decision-making within the regime. These structures give the system stability; however enacted this stability also represents rigidity thus making the regime typically resistant to change. (Loorbach, 2007). The regime is the arena of the *tactical* phase of activity where the broader visions are translated into agendas or more specific goals and actions that have direct implications for the regime such as targets and national minimum standards for the industry. At the tactical level structural barriers in the regime are identified.

2.1.6 The Niches

The micro level is that of innovations or 'niches'. It is here that innovations can be developed and tested. Innovations refer not only to new technologies but also innovations in legislation, organisation and concepts; the latter forming the basis of this thesis. From the niche level such innovations are subsequently diffused into the regime through processes of social learning. The development of niches is referred to as the *operational* phase. It is here that creative responses are tested in an attempt to overcome the structural barriers identified at the regime level. The niches are designed to be small steps in the direction of the overall transition vision. They are experimental and should explore different pathways to achieving the desired goal and serve as demonstrations. (Loorbach, 2007)

2.1.7 Application of the Model

From a policy perspective the interaction between the levels of the TM model is important in analysis and planning (Loorbach, 2007). It provides a framework for mapping policies and contextualizes small projects within the wider vision, acknowledging how actions at different levels can impact on the system as a whole. The three phases mentioned above are also combined with a fourth phase which embodies the process of *evaluation and adaption*. In this phase, the effects of interventions are monitored and reflected upon in relation to their success in stimulating regime change in the direction of the driving vision. As projects run their course and learning is accrued, old barriers can be overcome, new goals may be defined and new barriers may arise. Thus it can be seen here that while there is a sequential element to the model, once a transition has been initiated all four phases are in constant interaction. (Loorbach, 2007)

The TM process is made up of a set of central elements which relate to the above levels and interact in a cyclical manner (see Figure 2). Initial goals and agendas should be set by a process of multi-actor policy making in which key actors in the process of change are involved in setting the direction of that change. An important note is that TM employs selective participation which is based on 'narrow and temporary consensus between forerunners' as opposed to taking a broad consensus (Loorbach, 2007 p.88). Whereas a broader participatory approach can result in the dilution of ambition through use of consensus decision-making based on the lowest common denominator, a more selective method harnesses the ambition and competencies of forerunners to drive change in more conservative parties by essentially forcing them to keep up. Once the long-term vision has been established, the next step is that of experimentation and innovation directed towards the overarching vision. The outcomes

generated by this experimentation continue to feed back into the long-term goals and agendas. (Loorbach, 2007) The long-term goals and agendas are not designed to be fixed but rather form the initial guide for shorter term action. This is described by Loorbach (2007) as the adaptive or reflexive process.

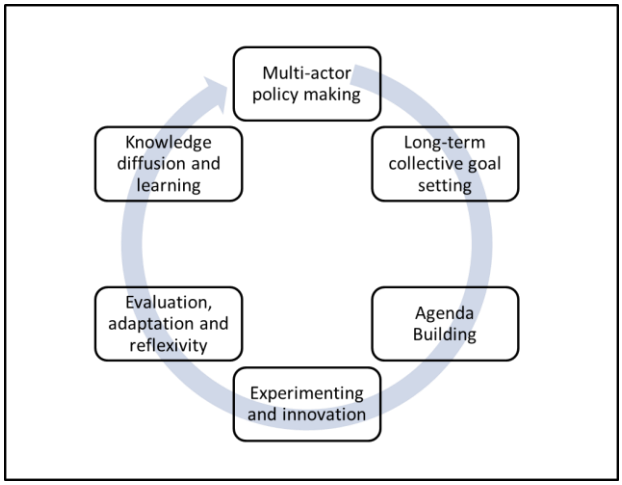

Figure 2 Elements of the transition management process as outlined by Loorbach (2007 p.88)

Loorbach (2007) states that 'the ultimate goal of TM should be to influence and empower civil society in such a way that people themselves shape sustainability in their own environments, and in doing so contribute to the desired transitions to sustainability' (Loorbach 2007 p.284). In this context the aim of TM is to strategically alter the landscape and niche levels to create changes in the regime structure so that it naturally generates the desired outcomes; in this case, energy efficient buildings.

The Role of Municipal Government

The role of municipal government in sustainable urban transformations was solidified by Local Agenda 21 (LA21) of the Agenda 21 action plan[10]. This communication proposes that local governments (or municipal governments as they will be referred to from here on within this thesis) should be significant actors in the design of policies for sustainable urban planning and development (Varol, Ercoskun, & Gurer, 2011). Much of TM theory discusses governance at the national government level; however, municipal government is also written a role as outlined below by Rotmans et al. (2001):

> The lower authorities, such as provincial and municipal authorities, also have a role to play in 'Transition Management'. They stand closer to the citizens than the national government, the local situation can permit radical experiments (such as car-free town centre or city heating). Furthermore, they have been assigned their own tasks in areas that are often relevant with regard to societal transformations, such as environmental planning, house construction, the environment and waste. (Rotmans et al., 2001 p.55)

Rotmans et al., (2001) suggests municipalities have most impact in the operational phase through the development and diffusion of niches, although they also have influence over the

[10] Part of the Rio Declaration on Environment and Development which was an outcome of the 1992 United Nations Conference on Environment and Development.

tactical and strategic phases by lobbying for policy change at the national level. Municipalities can also increase their influence by working in collaboration with one another at a regional level as in the case of the Öresund Region. In this case regional based visions and agendas can be developed collectively by municipalities setting a new landscape within the wider national landscapes.

When looking at the governance of energy efficiency in new urban developments, local government is in a particularly privileged position in that it has traditionally controlled decisions over local planning and development and has existing capacities for this task. Many municipalities own land that is desirable for development giving them significant leverage to determine the outcomes. In cases where land is not municipally-owned, municipalities still have powers to influence the characteristics of a development through the creation of city plans and zoning laws, and the administration of the planning permit process.

Importantly, municipal government is also the level of government with the most direct access to citizens and the local industry. Small and medium cities such as those in the Öresund Region present opportunities for relation building with industry by taking advantage of the close proximity of industry actors to municipal government actors, and the consistency in the companies and the individuals taking part in the urban development processes. Policies set by national government will ultimately be felt by civil society at the local level in their daily lives, and thus municipal government has been identified as a key arena in which policies for change can be developed and implemented, and in which public and industry support for these transformations can be nurtured (Evans, 2005). This premise underpins the work of both Energi Öresund and UTO which cast municipalities in the leading role, driving sustainable urban transformation.

TM as a governance theory views municipalities not simply as administrative institutions which deliver national regulation, but as possessing the capacity to be facilitators of change, using their close proximity to other actors to drive progress beyond the dictates of national policy (Savitch, 1998). Municipalities are in a position to both contribute to the shaping of the landscape and take advantage of this landscape to further their own agenda of city level development through experimentation within their processes and the encouragement of innovation amongst other actors. In a strong governance system the city level goals and those of the wider landscape should be well aligned so that niches serve to develop the capital and resources for the city's own development on a more short to medium-term time scale, as well as contributing to wider societal goals in the long-term. The remainder of this section expands upon some of the key concepts and methods which emerge from theory on municipal level governance of sociotechnical regimes with particular reference to the urban development context. These concepts will feed into the analysis of existing governance niches in the region in Chapters 3, and the recommendations presented within Chapter 5.

2.1.8 Institutional Capacity

When addressing TM at the level of municipal governance the concept of institutional capacity becomes central. Magalhaes et al. (2002) define institutional capacity as 'the capacity of urban governance to make a difference in sustaining and transforming the qualities of cities' (Magalhaes et al., 2002 p.54). As part of their research they have developed a framework for assessing municipal interventions in the context of urban regeneration through analysing the contribution of the intervention to the institutional capacity of the city. The authors propose that institutional capacity in urban governance can be built up by 'transforming, creating and mobilising the "institutional capital" of a place in the collective effort of shaping its future' (Magalhaes et al., 2002 p.54). This is essentially what the process of TM is striving for.

According to Magalhaes et al. (2002) there are three core elements to the development of institutional capacity: mobilisation capacity; relational resources; and knowledge resources. These are not exclusive but interact and reinforce one another. Through experimentation in the niches municipalities can develop their institutional capacity and the institutional capital of the city, both of which translate into the municipality's ability to effect change in the regime. In this context the capital being transformed, created and mobilised is that of the property development sector in the Öresund Region, of which municipalities are also an integral part. The following sections discuss these elements of institutional capacity and their interactions.

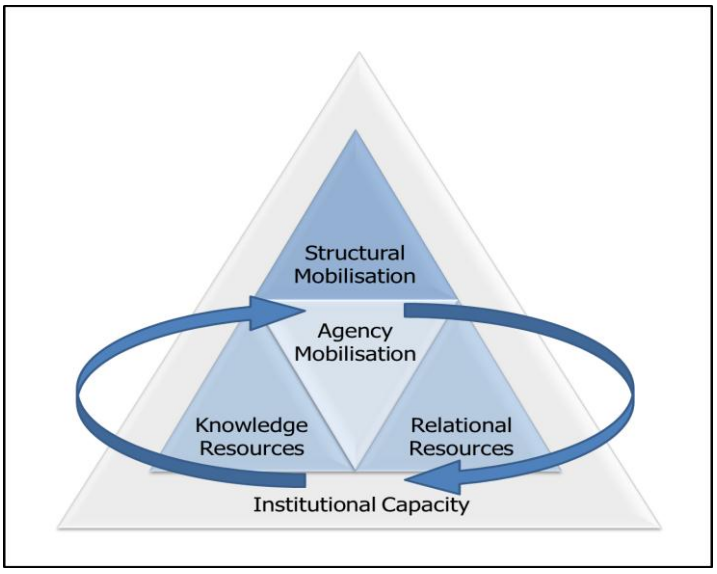

Figure 3 The governance framework for urban development as outlined by (Magalhaes et al., 2002).

2.1.9 Mobilisation

Mobilisation capacity refers to the way in which relationships and knowledge are activated to achieve action. This can be approached from both an structural and an agency perspective (Magalhaes et al., 2002). The former refers to the ability of actors to identify 'windows of opportunity' in existing structures (Magalhaes et al., 2002 p. 57); for example, structural mobilisation might make use of the legal leverage opportunities that reside in municipal planning procedures such as the powers to determine land-use zoning or the ability to insert energy efficiency criteria into contracts of sale for municipal land. The latter refers to the development of trust, the processes of learning that are generated and the release of creativity through more collaborative rather than regulatory procedures.

With reference to mobilisation the power concept, as outlined by supply chain management theory (SCM), is useful in classifying actors in a system in terms of the possibilities for influence over one another and the extent to which collaboration is possible. Concerning the legitimacy of power, Cox observes that 'there must be an appropriate power circumstance in place for innovations to be made to work. Only when the buyer is in a position of dominance over the supplier and capable of leading innovation, or there is an interdependence of power in which a mutual coincidence of interest encourages joint learning, can this approach be made to work' (2001c: p. 46). If we substitute municipality for buyer and developer for supplier one can see how such a mapping of power relations is very relevant to urban governance in this context.

In the case of new urban developments, both parties are always in a relationship of interdependence to a certain extent as developers must always meet basic municipal

requirements in order to be granted permission to construct. On the other, side municipalities are themselves in competition with one another to attract vibrant development; thus, if they create conditions that are too unfavourable for developers the developers will eventually be forced to go elsewhere. Although some state of interdependence is the foundation of this relationship, the nature of the power relation varies between projects. Crucial variables which determine the power balance include which actor has initial land ownership, the regulatory powers of the municipality and the state of the market for new developments, i.e., how desirable the city area is to the developers.

Figure 4 based on Cox (1999), illustrates how different power relations present different opportunities for managing interactions. Traditional governing of the property development process consisted mainly of arms-length leverage in the form of the standards set by building regulations and the threat of litigation for not meeting them. This aspect, of course, always underpins municipality-developer relations. When municipalities raise ambitions for energy performance within this legal framework, they can shift into the area of adversarial arms-length governing. When municipalities raise expectations beyond what can be required by law they move themselves into a position of greater interdependence. This interdependence opens up opportunities, but also demands a more collaborative agency approach if results are to be achieved.

An important point with regards to this model is that there is the opportunity to share the value created by the relationship. Municipalities, while having some of the attributes of a firm, are not simply concerned with maximising their benefits as an organisation but are also concerned with the generation of benefits for civil society, which includes the developers themselves. A purely structural arms-length approach could contribute to very good energy performance, but may not be optimal for nurturing creative solutions, a healthy property development industry or a vibrant city.

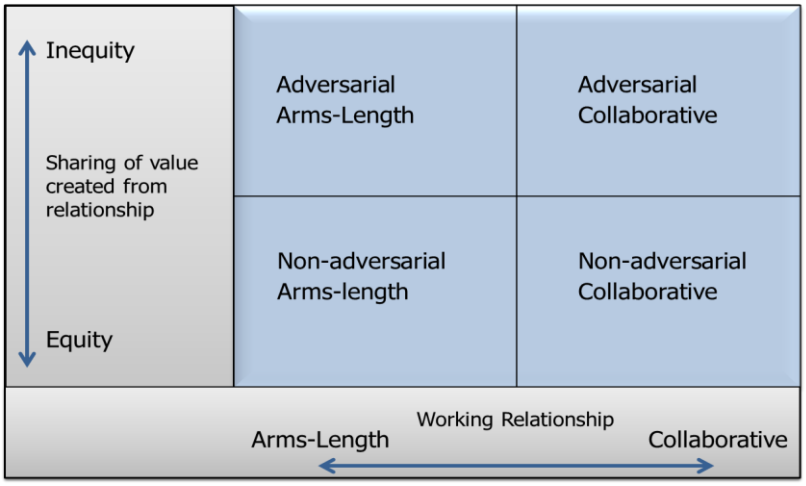

Figure 4 Illustration of potential relationships adapted from Cox (1999 p. 23)

2.1.10 Relational Resources

Within this framework, central to the development of institutional capacity is the creation or harnessing of relational resources. Relational resources refer to the strength of social relations between different actors in the system, the quality of communication and levels of trust and reciprocity that they embody and the power relations inherent within them. The importance of relationships for energy efficiency governance is highlighted by the results of an IEA survey which indicate that 'on-going engagement with energy efficiency stakeholders' is one of the

top three necessary elements for institutional effectiveness, ranking as more important even than having a dedicated funding source (IEA, 2010, p.113).

Collaboration between different actors – municipalities, industry and the public – forms one of the cornerstones of governance. Collaboration serves as an umbrella term and is used to describe the host of various relationships between government and civil society that can occur as part of the governance process. These relationships can range from stakeholder engagement (such as through the processes of dialogue and consultation), to cooperation (such as voluntary agreements) to contracted partnerships. These relationships fall on a spectrum from formal to informal, long-term to short-term and can involve just two actors or several actors (Evans, 2005).

Theory on urban governance is also closely linked to aspects of business management theory (Magalhaes et al., 2002). The collaborative paradigm as employed in SCM adds useful detail to the discussion. In this context collaboration emerges from the relational view of firms (RV) [11]. Drawing on the idea of the resource based view of the firm (RBV), if we view energy efficiency in the city as a resource for the municipality – a resource they want to generate and develop – it must be first acknowledged that this cannot be done by the internal efforts of the municipality alone. A relational view of the firm (or the organisation) must be adopted. This acknowledges that critical resources are not housed solely within individual organisations but can also be 'embedded in the inter-firm routines and processes' (Gold, Seuring et al. 2010: p. 231). To harness these resources requires a more in-depth understanding of how the system functions and the interdependencies that exist. In the context of urban development where diverse interests and diverse competences are drawn together in projects, collaboration can be an invaluable method for mutual learning and aligning of goals.

Looking specifically at the governing of urban planning for energy efficiency collaboration offers a number of potential benefits. Firstly, it allows governments to capture diverse perspectives when developing policies. Property development – planning, design, construction and use – is a complex process involving many actors and the deeper the understanding that municipalities have of the way in which the system functions, the more targeted and effective their policies should be. Stakeholder engagement also helps to build up relationships between municipalities and the key actors in the process – those who will actually be implementing the policies (IEA, 2010). This enables better alignment of goals and increases the capacity of all parties involved to achieve these goals through sharing of knowledge and experience, and the identification and utilisation of the core competencies of different actors (IEA, 2010). Private actors play an increasingly powerful role in shaping society. Collaborative governance offers municipalities an opportunity to develop their own institutional capacities by harnessing these competencies through partnerships with private actors (Evans, 2005; Savitch, 1998).

Involving affected parties in the development of policy tools not only helps to ensure that the policies developed will be workable on the ground which should in itself contribute to their effectiveness but it also gives actors ownership over the outcome. Rather than viewing policy as simply another regulatory hoop that they are obliged to jump through, if actors are able to view their performance as contributing to the realization of a shared vision in which they have a stake, they are likely to invest more resources and outcomes have much greater potential to be improved (IEA, 2010). In this way relation resource development can contribute towards agency mobilisation. Collaboration does however have its associated risks. Firstly, it is often time-consuming and expensive and secondly, there are never any guarantees of results (IEA,

[11] In the context of SCM the organisations referred to are normally firms but in this context the organisation can also be the municipality.

2010). It has been argued that one of the major risks with collaborative governance is that in the process of reaching consensus only incremental change results (Harriet Bulkeley, 2010). Municipalities must manage the process carefully to ensure the dialogues are genuine and stakeholder inputs are taken into account so as to avoid undermining trust, while at the same time ensuring that their own ambitions are not diluted (IEA, 2010).

2.1.11 Knowledge Resources

In this context knowledge resources in part refer to 'static' formalised knowledge such as technical knowledge about energy efficiency solutions. However, knowledge resources also refer to the process via which knowledge is produced through social interaction, and the various actors' awareness's of the different perspectives. In this respect, the development of knowledge resources is very closely tied to the development of relational resources. For example, engineers, architects and research institutes all have stocks of potentially transformative knowledge. It is up to the municipality then to coordinate the dissemination of this knowledge in such a way as to target areas where is can be most useful. As with relational resources, knowledge resources flow two ways; it is not simply the knowledge resources of the municipality that are important, but the knowledge resources present in the system as a whole. Municipalities need to be aware of where the knowledge gaps are, how the appropriate knowledge can be harnessed and how it can be effectively delivered.

Expert or technical knowledge is needed as a base to inform projects and policies, but from this the niches should then be generators of knowledge creation and social learning. Projects should not be ends in themselves but should contribute not only to the municipality's learning but also to the knowledge resources of the developers and other actors involved, and the knowledge base of the wider regime. The third element, therefor, is the dissemination of the knowledge created. How niche projects are structured and communicated is very important in determining their success as tools for institutional capacity development and transition stimulators.

Chapter Summary

This chapter discusses the current drive towards greater energy efficiency in new urban developments as an element in the process of sustainable urban transformation that is taking place in the Öresund Region. Taking a sociotechnical systems perspective on the property development sector, this chapter describes the nature of the property development sector and outlines the drivers and barriers to the adoption of energy efficiency innovations within the regime. TM is then outlined as a conceptual framework through which to visualise energy efficiency governance in the Öresund Region. As part of this framework the role of municipalities as key actors in the TM process is justified. Finally, the mechanisms through which municipal governance is enacted in urban development are expanded upon. This provides a theoretical framework with which to analyse municipal niches in the region.

3 The Öresund Region

Situated either side of the Öresund straight, the Öresund Region encompasses areas of both Sweden and Denmark. On the Swedish side the region covers the county of Skåne and on the Danish side the region incorporates the Capital Region of Copenhagen and the Region Zealand. Currently the Öresund Region has a population of 3.7 million people with this total predicted to grow to 4 million by 2025 (Copenhagen-Kommune, 2012b; Tendens-Oresund, 2012). While the Öresund Region officially covers 77 municipalities, development in the region is centred on the largest cities of Copenhagen and Malmö which is set to become Scandinavia's largest metropolis (Copenhagen-Kommune, 2012a, 2012b). For the purpose of this thesis, research has been focused on the 7 municipalities that combined make up the partners in the Energi Öresund and UTO projects (circled in Figure 5).

Figure 5 Map of the Öresund Region highlighting Energi Öresund and UTO partner municipalities

The region is a hub of high tech industry and is striving to become 'northern Europe's border regional powerhouse for sustainability, innovation and green growth' (Harboe, 2012). The aspirations of the region are high and to realize them will require significant transformations in the way in which the urban areas of the Öresund Region are governed and lived in. The phrase *sustainable urban transformation* is used by UTO to describe this shift towards more environmentally and socially sustainable urban development. In many regards the Öresund Region does not require sustainable urban transformation so much as it is in the process of it. The largest cities in the region – Copenhagen and Malmö – are already internationally recognised as being at the forefront of sustainable development and much of this can be owed to the ambitious and innovative municipal programmes that have been pioneered here[12].

The following three sections give an overview of municipal governance for energy efficiency in the Öresund Region conceptualised through the multi-level model of transition management. The Landscape section describes the international and national policy framework within which the Öresund Region is situated as well as its own generative visions. The Regime section outlines the development process in the region, giving an overview of the actors involved and the relations of influence that exist between them. Finally the Niches section describes and analyses the various innovative energy efficiency initiatives that are taking place in the region. This is followed by a general discussion of the findings.

[12] For example Copenhagen has won the 2012 European Green Capital Award and Malmö's sustainable city concept developed alongside E.on is being used as a best practice model for the UK initiative.

The Landscape

The overarching landscape in the region's transition to a more energy efficient property sector is characterised by the global narrative of anthropogenic climate change and the urgent need for all nations to act to mitigate its effects. The narrative of energy security in a world of growing population and increasingly scarce energy resources also plays a significant role. The necessity of carbon emissions reduction and the need for greater renewable energy generation – as outlined in the EU's Energy Roadmap 2050 – form the basis for energy efficiency policy at the EU level (EC, 2012b). In pursuance of this the EU has set an Energy savings target of a 20% reduction of EU energy consumption compared to projections for 2020 (EC, 2007a). The importance of buildings and the property development sector in helping the EU achieve this target is communicated and supported through the directives and funding streams outlined below (EC, 2012a).

3.1.1 EU Policy Framework

Directives Relating to Energy Efficiency in Buildings

The most influential policy with regard to energy efficiency in buildings at the EU level comes from Directive 2010/31/EC on the energy performance of buildings (EPBD). The EPBD contains a number of articles which require national legislation and policy relating to energy efficiency in new buildings and forms the foundation of current energy efficiency policy for buildings in Sweden and Denmark. Significant points include requirements for:

- A common general methodological framework for calculating the integrated energy performance of buildings;
- Performance standards for new buildings; and,
- Energy certification of buildings or building units. (EC, 2010))

The Directive also requires that all new buildings are to be near-zero energy buildings from 31 December 2020, and that new buildings used and owned by public authorities are to be near-zero energy buildings from 31 December 2018. In addition the EU has established a Green Building Certification which is awarded to buildings which use 25% less energy than a typical building of the same type developed in adherence to national building regulations. While the EPBD establishes a floor for energy efficiency in buildings, this certification communicates that ambitions should be set higher.

Directive 2006/32/EC on energy end-use efficiency and energy services (ESD) sets an indicative energy savings target of 9% by 2016. It also requires all Member States to develop a National Energy Efficiency Action Plan (NEEAP) detailing the energy efficiency measures they will take in order to meet this target including the allocation of funding. The property development sector as a significant energy consumer is addressed by the NEEAPs. Also relevant is Directive 2005/32/EC on establishing a framework for the setting of ecodesign requirements for energy-using products (EuPs) which aims at reducing the environmental impact of products, throughout their entire life cycle. One element of this is provision of a framework for ecodesign which includes guidelines on setting energy efficiency requirements. Particularly relevant for new buildings are the requirements relating to heating and ventilation systems.

The EU continues to struggle to be on course to meet its energy saving target of 20% by 2020 (EC, 2012a). In 2011, in response to this deficit, the European Commission proposed an Energy Efficiency Directive (EED). This would have a number of interesting implications for the energy efficiency of new buildings. Proposed measures are to include:

- An obligation on energy distributors and sales companies to save 1.5% of their energy sales by volume each year, through the implementation of energy efficiency measures;
- Measures to ensure consumer access to free of charge data on their real-time and historical energy consumption through more accurate individual metering; and,
- Requirements for Member States to take measures to remove barriers to energy efficiency, notably as regards the issue of 'broken agency' or split of incentives between the owner and the tenant of a building. (EC, 2012a)

Funding for Energy Efficiency in Buildings

There are a number of instruments available at the EU level which provide financial support to building related energy efficiency investments and research. During the current financing period (2007-2013), EU Cohesion Policy funding has increasingly focused on energy efficiency investments (in figures, this amounts to €4.6 billion in planned funding allocations dedicated to energy efficiency) (EC, 2012a). Additionally the Joint European Support for Sustainable Investment in City Areas (JESSICA) initiative offers Member States the possibility to invest Structural Funds allocations in financial instruments aimed at supporting sustainable urban development with particular focus on public-private partnership (PPP) investments. Funds for energy efficiency of around € 730 million are also available through the Intelligent Energy Europe Programme II (IEE) which focuses on removal of non-technological barriers to energy efficiency and renewable energy market uptake. In terms of research the current EU Research & Development Framework Programme (FP7 2007-2013) has dedicated approximately € 2.3 billion to energy-related research. This funding is predominantly targeted at technological development and demonstration projects.

3.1.2 National Policy Frameworks

Targets in Sweden and Denmark

Table 1 Energy efficiency related targets in Sweden and Denmark

Sweden	Denmark
Net emission neutral by 2050 with renewables making up 50% of the energy usage by 2020.	Emissions reduction of 40% by 2020 alongside a 30% renewable energy share by 2020.
20% decrease in energy intensity by 2020 under the bill entitled 'An Integrated Climate and Energy Policy' (2008/09:163) (Swedish Government, 2009).	4 % gross energy consumption reduction target of by 2020, relative to 2006 under the 'National Energy Agreement 2008-2011' (DEA.Danish-Energy-Agency, 2008).
Annual energy savings target of 9% by ninth year of the period 2008-16 in accordance with EU Directive2006/32/EC, Copenhagen Accord.	Annual energy savings target of an average of 7.5 PJ during the period 2006-13 in accordance with the EU Directive2006/32/EC, Copenhagen Accord.

Institutional and Regulatory Framework in Denmark

The EPBD is enacted in Danish legislation through the 2005 Act on the Promotion of Energy Savings in Buildings. In Denmark implementation of energy efficiency in buildings is predominantly governed by the Danish Building Regulations 2010 (*Bygningsreglementet* or BR10) in pursuance of the Danish Building Act (details of what is required under BR10 can be found in Appendix 5). In addition to the standard requirements for energy efficiency in buildings,

Denmark also provides a voluntary low energy Building Class 2015 which is set to become the minimum requirements in 2015 (see Appendix 5 for energy frames). The Building Class 2020 (designed to fulfil Article 9 of the EBPD which requires a national plan for "almost zero energy buildings") has also been defined by Danish government and can be certified although it is not included in the current regulations. By allowing the industry to build up experience through adoption of the voluntary class it is hoped that by 2020 the capacity will be in place to meet the near-zero energy target when it becomes mandatory. Denmark has established a clear roadmap in terms of the tightening of the building codes with the ambition of a 25% reduction in energy consumption for each 5 year period up to 2020.

Alongside the requirements of BR10, Denmark employs market based and informative instruments. Carbon and energy taxes are used to drive the market for energy efficiency while grants and subsidies are available for some energy efficiency measures, however these tend to be targeted at improving the existing housing stock (McCormick & Neij, 2009). Other energy efficiency programmes include the mandating of energy companies to promote energy saving amongst their customers. This is managed by the Danish Energy Authority (*Energistyrelsen*) and often takes the form of informative campaigns. Energy certification of all new buildings is required by law under the EPBD. This tool promotes energy efficiency as a building characteristic to buyers and helps sellers communicate property value attributable to energy efficiency performance.

Institutional and Regulatory Framework in Sweden

Energy efficiency in buildings as outlined by the EPBD is governed by the Boverkets Building Regulations (*Boverkets Byggregler* or BBR19) in accordance with the laws of the Planning and Building Act (PBL) and the Planning and Building Ordinance (PBF). Alongside the standard building regulations two voluntary energy classes – *Low energy*, and *Very Low energy* – are also provided by BBR19 as a guideline for those wishing to go beyond the minimum (see Appendix 5 for details of energy frames). Unlike in Denmark the energy frame for near-zero energy buildings in Sweden has not yet been defined as it is felt that there is not yet sufficient information. It has however been stated that that these limits will be set in 2015[13].

As part of the national *Miljömal* environmental programme the Swedish government has established a set of 16 national environmental objectives, one of which is to achieve 'a good urban environment' ('*God bebyggd miljö*'). Responsibility for achieving this objective has been given to Boverket which in turn has developed regional targets. In relation to buildings, Skåne has set the objective to reduce total energy consumption per heated unit area in residential and commercial buildings in the region by 20% by 2020 and 50% by 2050 relative to 1995 levels. The regional goals also state that energy use in buildings should no longer be dependent on fossil fuels by 2020 (Miljömål, 2012).

Alongside the building regulations Sweden also supports energy efficiency in buildings indirectly through taxes on fuels, electricity and carbon dioxide (Swedish Energy Agency, 2008). At various points subsidies and grants supporting energy efficiency in buildings have also been provided although, as in the case of Denmark, these tend to focus on renovation of existing buildings rather than new buildings (Kes McCormick & Neij, 2009). The Swedish Government has also undertaken informative campaigns to raise awareness of energy efficiency as an issue and support home owners in reducing consumption. While not targeted at the property development sector as such, these measures still help support energy efficiency

[13] This was outlined in government letter 2011/12: 131 Vägen till nära-nollenergibyggnader, which was presented to Swedish Parliament on March 29.

in new developments by priming both decision makers and buyers to be energy aware. Under the Swedish certification scheme, which is in pursuance of the EPBD, owners of detached houses, apartment buildings and commercial premises are required to provide information on the energy use of the building when constructing, selling or leasing the property (SMSD 2006) .

3.1.3 Regional Vision

The Öresund Committee which is the political organisation of the region, has as part of its Regional Development Strategy (ÖRUS) the goal to create a 'climate-smart region' and have the region become 'a centre for cleantech solutions and sustainable urban development' (Oresundskomiteen, 2010). ÖRUS also hopes to host an Öresund Region EXPO in 2022 to showcase the sustainability work of the region (Oresundskomiteen, 2010). Green growth is a central element of the Öresund development strategy and this lays fertile ground for energy related innovations in the built environment to take root. In line with the general ambitions of ÖRUS, regional partners have also set themselves the target of making the Öresund Region CO_2 neutral within the next 15-20 years with energy efficiency activities in built environment being expected to contribute significantly to this (Harboe, 2012). Copenhagen has set itself the target of becoming the world's first carbon neutral capital by 2025, with Malmö aiming to achieve carbon neutrality by 2030. If these goals are achieved this would make the Öresund Region the first CO_2 -neutral frontier in Europe by 2030 (Harboe, 2012). These targets create a landscape in which the ambition floor in terms of sustainable urban development and climate change mitigation has been raised significantly beyond national ambitions.

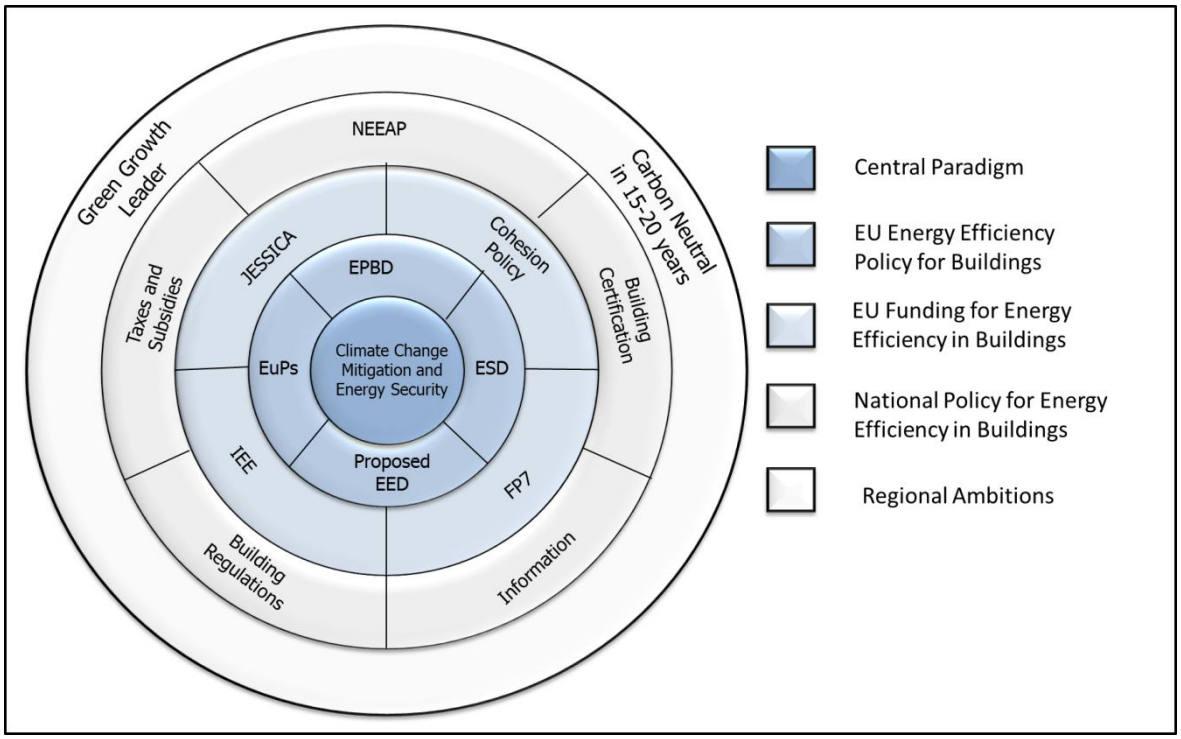

Figure 6 Landscape for energy efficincy in buildings.

The Regime

The regime element of TM is centred the norms of system function. This chapter explores how the structure of the property development regime shapes decisions and outcomes with regard to energy efficiency in new urban developments in the Öresund Region. An understanding of such standard practice is crucial in identifying the roots of inertia and the opportunities for leveraging change. Firstly, the sociotechnical system of the property development regime is mapped. This helps identify the key actors, the relationships that exist between these actors, and their respective influences over the energy efficiency outcomes of a development based on the stocks of resources that they possess and their ability to leverage these resources. Following on, this chapter then discusses the legislative frameworks within which Swedish and Danish municipal urban planning is executed, highlighting the leverage opportunities available to municipalities in effecting the energy efficiency of new urban developments. This chapter is based on grey literature and data collected during interviews with actors in the local sector.

3.1.4 The Sociotechnical Regime

The necessity of stakeholder engagement and collaboration between actors is constantly reiterated in the literature on governance (e.g., Evans, 2005; IEA, 2010). It is, therefore, important to have an understanding of who constitutes a stakeholder and an actor in the building development system. It is also important to understand how they interact with each other, through what mechanisms this interaction takes place and where the gaps in municipal engagement exist. Figure 7 illustrates the sociotechnical regime of property development in the Öresund Region[14]. The arrows indicate flows of influence and competencies in relation to energy efficiency measures and their adoption. These are made up of the transfer of material resources*,* e.g., business transactions; behavioural interactions*,* e.g., dialogue; and formal relations*,* e.g., contracts and regulations (Pryke, 2004). The actors highlighted, indicate the central players in terms of influence over the energy efficiency of the building.

While still highly simplified, the complexity of the regime is clear, highlighting the necessity of viewing property development as a system. From this map it can be observed that the pivotal actors in the regime are the municipality and the developer. However, it is also evident that the municipality and the developer, while being central decision makers in the regime, are also subject to a host of direct and indirect influences; these influences having both the potential to promote and inhibit energy efficiency. Potential sources of barriers to energy efficiency optimisation inherent in the structure of the system are indicated by the dotted circles. One can observe from this diagram both the complexity of interconnection in the system and also the existence of disconnect between certain actors. In terms of communications it can be noted that while the municipality deals extensively with developers, they only interact with architects and construction contractors via the developer. A lack of connection between external consultants and contractors themselves can also be noted. In terms of untapped competencies energy companies while having the potential to greatly influence energy efficiency through their duel role as infrastructure provider and consumer facing actor are largely not active in this regard. In addition end-users tend not to be directly addressed as influential actors with regards to energy efficiency within the planning and development process, but rather as members of the general public only.

[14] For a detailed overview of actor roles within the regime please see Appendix 7.

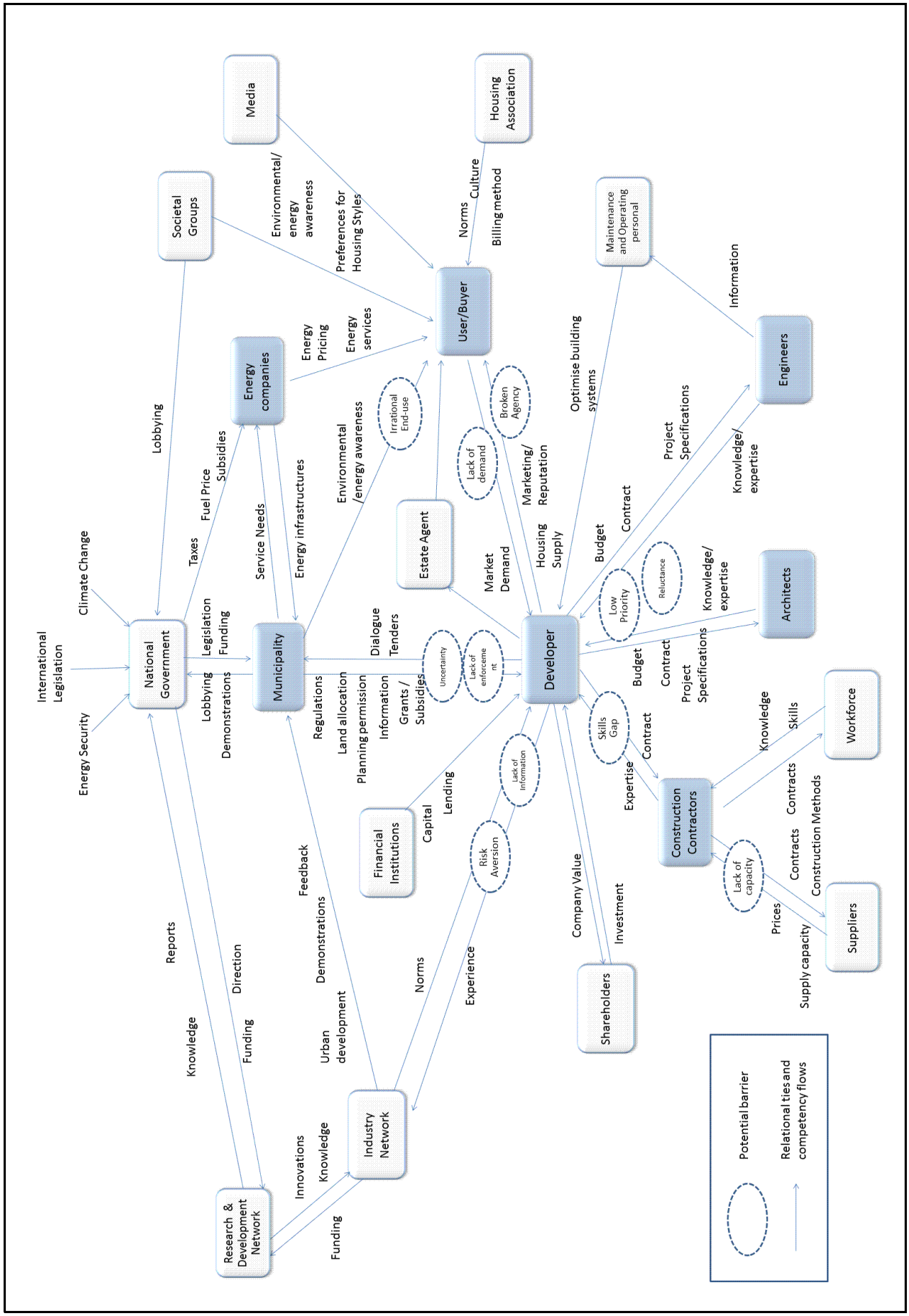

Figure 7 Energy efficiency influences in the sociotechnical regime of property development based on the visualization of the UK building industry by Ko and Fenner (2007).

The Planning and Development Process

The traditional planning process as illustrated by Figure 8 is the norm in both Sweden and Denmark. This is a fairly linear process and can be divided into three phases; the design phase, the construction phase; and the operations phase; with each phase involving a particular combination of actors. There are of course a number of possible variations on how this process is enacted in practice and which actors are involved in the different stages but Figure 8 illustrates standard practice. The development processes in Sweden and Denmark share many similarities. There are however some key differences between with regards to municipal regulatory powers and leverage opportunities; these are explored in the following section.

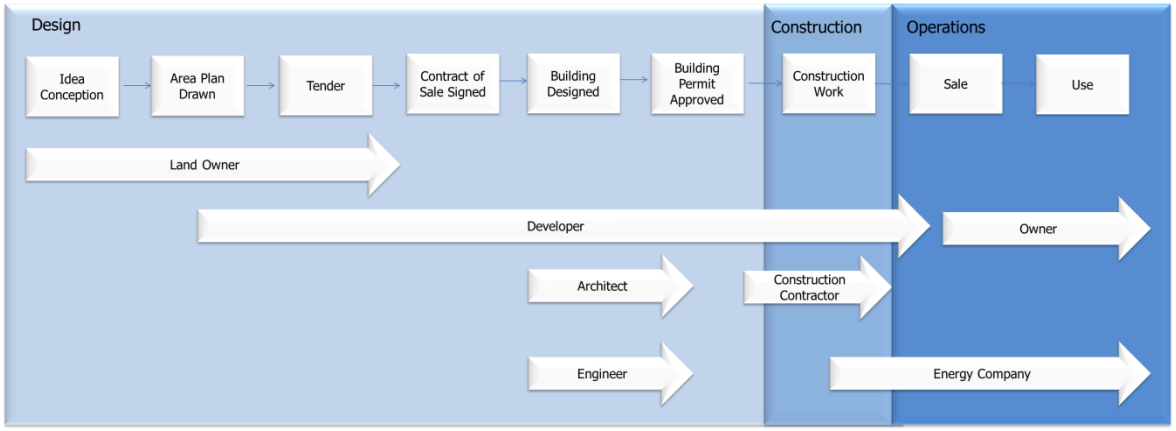

Figure 8 The standard planning and development process in Sweden and Denmark.

3.1.5 Municipal Leverage in the Regime

During urban development in the Öresund Region it is predominantly the municipality who decides through planning and permit procedures how land resources are to be used (Kalbro, 2000). The municipality can have three roles in the property development process depending on the nature of the project. Which role they take on in each project will affect their ability to influence energy efficiency decisions. Their fundamental role, which they must play in all developments is that of regulator. Secondly, they can have the role of land owner whereby the municipality sells its land to a private developer to build on. Thirdly, the municipality can act property owner, in which case the municipality commissions a development for municipal use.

There are a set of legislative tools in place in Sweden and Denmark to guide the municipal decision-making process in urban planning and development, inherent in these are powers to make demands regarding the energy efficiency of buildings to be developed. At the very least municipalities can, through the planning process communicate their expectations and desires *vis a vis* an area and make use of non-regulatory interactions such as dialogue in an attempt to influence outcomes. These tools and their potential to shape energy efficiency outcomes are outlined and discussed below as are the differences between the Swedish and Danish situation.

City Level Planning

Every few years in Sweden and Denmark each municipality draws up a city level plan; in Sweden this is referred to as the comprehensive plan (*Översiktsplan)*; in Denmark this is referred to as the municipal plan (*kommuneplan)*. The city level plan outlines the land use zoning in the city – which areas can be used for residential, which for industry and which should be conserved – and provides guidelines on energy sources to be used, the energy performance of buildings and traffic planning among other points. This plan provides an

overview of the intentions of the municipality with regards to urban development and forms the basis for area level plans.

The Danish municipal plan is prepared under the Danish Planning Act which sets out the basic rules that public authorities should follow in urban planning. Legislation in the Planning Act also allows for municipalities to write legal requirements into the municipal plan; this is a significant leverage tool. For example, under the municipal plan it has been established that all major urban areas in Copenhagen must meet the new construction requirements of the lowest energy class in the BR10[15]. The municipal plan is legally binding and thus this legislation raises the minimum standard for all new developments in the city. The Swedish comprehensive plan on the other hand is not binding but rather serves as a guideline. Intentions laid out it the Swedish plan can therefore be overruled by the detailed plan at later stages in the process.

In addition, in Denmark the Heat Supply Act, means that a municipality can mandate that buildings located in a district area must be connected to the DH system. This is not the case in Sweden where DH connection is optional, with it being the responsibility of the energy company to make a persuasive case to the developer. Recent changes in the legislation in Denmark have meant that in the case of low energy buildings (as required by the municipal plan in Copenhagen) connection is no longer mandated and other heat sources such as heat pumps may be utilised instead. The aim of this policy change is to allow developers the flexibility to use alternative solutions in very well insulated buildings where DH may not be optimal. So while Copenhagen is entirely classified as a district area, connection is no longer mandatory changing the relationship between the DH company and developers. DH is however still encouraged by the municipality.

Area Level Planning

If an area of the municipality has been designated for development a more detailed plan is required as part of the planning permit process; this is a mandatory requirement for any significant change in land use in the city in both countries. In Denmark this is referred to as the local plan (*lokalplan*) and is comparable to the Swedish detailed plan (*detaljplan*). . Such plans can stipulate aspects relating to the design, size, layout and function of buildings as well as environmental requirements such as energy performance, proportion of green space and connection to common infrastructures and are therefore useful tools is setting energy efficiency requirements.

On municipal owned land area level plans can be drawn up by the municipality prior to the registration of development interest, or in response to development interest. In the case of municipal owned land the municipality often draws up an area level plan as the basis of competitive tendering. In the case of privately owned land the area level plan will be drawn up by the developer in communication with the municipality. Once in force the plan is legally binding and entails rights and obligations on the part of the developer and the municipality to honour the conditions set. Finally once the detailed plan has been agreed upon developers must then apply for a building permit. This ensures that the planned development meets national regulations and any additional requirements agreed upon in the contract of sale.

Land Ownership

Urban development can take place either on privately owned land or municipal land. This land ownership structure greatly affects the level of influence the municipality has over the

[15] Up until 2015 this means that all new constructions must meet the Building Class 2015 and beyond 2015 they will be required to meet the Building Class 2020 (see Appendix 5 for details).

development. In the case of private land, the structural mobilisation powers of the municipality only stretch as far as their role as regulator. The municipality must ensure developers adhere to zoning and building regulations, and grant planning permission permits but their influence beyond this is limited to persuasive dialogue. In the case of municipal land, the municipality has, in theory, full control over who they sell or lease to and the conditions of that sale. In Sweden there is the system of development agreements which is a key point of leverage for municipalities. The agreement for municipal owned land (***markanvisningsavtal)*** can be regarded as a contract of sale. Within this contract the price of land, design of buildings and facilities and responsibility for the different elements of the development are agreed upon. This can include *inter alia* requirements related to the energy demand of buildings and the energy source (e.g., DH). In this case the fact that the municipality owns the land gives them significant leverage to make demands on developers who must agree to the contract if they are to purchase and develop the land.

In the Öresund Region the Swedish municipalities own significantly more land than in Denmark where brown field sites are predominantly owned by private enterprises. The majority of land in Copenhagen is owned by the company By & Havn. By & Havn is in fact owned in equal parts by the municipality and the state but functions as a private company with a bottom line and not as a municipality. In the case of Copenhagen the municipality will work with developers on the local plan but do not have powers to control the outcome beyond their legal reach and their influence as shareholders. They will then sell plots of land inserting adherence to the local plan as part of the contract of sale. The collaborative nature of the area plan development and the municipality as shareholder does offer some opportunities for influence in terms of inserting energy efficiency criteria into contracts of sale, but as a private company By & Havn's priority is to make profit rather than contribute to the municipal emissions reduction targets.

Even in cases where the municipality owns the land (or where they potentially have significant influence over contracts of sale such as in the case of By & Havn), in practice there are a number of limiting forces acting on municipalities. Such limitations include housing market forces and the capacities of the industry i.e., if they demand criteria that are too strict or prices that are too high developers will simply go elsewhere. Copenhagen offers up one pertinent example of this; the company By & Havn have land assets with a theoretical development potential. Given that the company is municipality and state owned, this might give them significant leverage to control development outcomes in terms of energy efficiency. However, due to current economic conditions, few developers are willing or able to make the large investments needed for such large-scale new developments. Thus, in the current economic climate in Copenhagen, land-ownership provides limited leverage *vis a vis* developers and intervention by the municipality based on a more collaborative approach might be required to stimulate the adoption of ambitious energy efficiency measures.

In the third ownership scenario where municipalities are commissioning properties for their own use – for example social housing – they have full control of the project (within budgetary and regulatory limits). In Copenhagen the more ambitious demonstration projects tend to be on social housing projects rather than purely private projects as the municipality supports the developer with funding and can therefore influence the outcome (Interviewee #8). In some municipalities such as Albertslund the majority of new developments have been municipal properties allowing them opportunity to be ambitious while also diminishing the urgency for developing dialogue with industry (Christensen, personal communication, 13th August 2012). The particular circumstances of each city therefore greatly affect the opportunities and approach of the municipality regarding energy efficiency in new developments.

The Niches

Several innovative niches addressing energy efficiency in new urban developments have been implemented by Öresund municipalities over the past decade, full descriptions of which can be found in Appendix 8. This section is organised in terms of the constraining factors that the niche predominantly addressed; acceptance, motivation; and practice. The niches are discussed in relation to the dominant tool of institutional capacity development that is being employed, referring to the concepts of structural mobilisation (regulatory opportunities); agency mobilisation (encouraging voluntary beyond compliance performance); relational resource development; and knowledge resource development. The aim is to provide an overview of activities in the region; looking at which barriers are being addressed, which stage of the urban development process and which actors within this process being targeted, and identifying where gaps may exist in current municipal governance strategies for energy efficiency in new urban developments.

3.1.6 Acceptance Related Niches

Table 2 Acceptance related niches

Niche	Description
Inspirational Catalogue *(Inspirationskatalog)* Copenhagen	• Aimed at informing and inspiring developers. • Provides information and guidance on energy efficient development alongside best practice cases from Copenhagen.
Proposed Energi Öresund Green Building Guidelines	• Aimed at informing municipalities. • Will provide guidance on the planning and governance of energy efficient urban developments.
Constructive Dialogue (*Det Goda Samtalet*) Malmö	• Part of the national Bygga-bo-dialogen project. • Involves voluntary sustainability agreements between developers and the municipality which include a set energy frame (see Appendix 6). • Encourages communication and pooling of resources between developers.

Acceptance related niches predominantly use knowledge and relational resource development tools. These aim to address barriers which stem from lack of information, and raise energy efficiency as a priority for developers. By communicating municipal desires and fostering a more collaborative relationship between the municipality and developers, these niches are intended to give the municipality greater influence over urban development, stimulating ambition and promoting the negotiation of voluntary agreements. Such resource development has been largely targeted at actors in the design stage – in particular developers. Through development of knowledge based and relational resources the municipalities hope to facilitate agency mobilisation by enabling the sector to motivate itself.

Knowledge resources take the form of printed materials – e.g., the Inspirational Catalogue – as well some seminars and events. It should be noted that while important, static knowledge resources such as the Inspirational Catalogue and the proposed Green Building Guidelines represent an arms-length approach. Once distributed it is in the hands of the developers or (in the case of the Green Building Guidelines the municipality) to appropriate and apply this knowledge. It is therefore crucial that such knowledge resources are supported by other capacity building tools such as relations building.

Relational resource building tools in the region are designed, through open communications and the nurturing of trust between actors, to create opportunities for generating mutual benefits within energy efficient development. Targeted at developers the Constructive Dialogue is the most highly developed relations building tool in the region. As one element the dialogue encourages collaboration between developers working on the same area; through sharing of ideas, procurement and marketing, costs and risks can be lessened.

3.1.7 Motivation Related Niches

Table 3 Motivation related niches

Niche	Description
Low Energy Zoning (Lavenergiområder) Copenhagen and Roskilde	• Applies to all new developments. • Requires Building Class 2015 standard as mandatory (see Appendix 5). • In Roskilde this applies only where DH is not possible, if possible DH is mandated. • In Copenhagen the DH connection mandate is waived.
Environment in Building and Construction 2010 (*Miljø i Byggeri og Anlæg*) Copenhagen	• Applies to municipal buildings only. • Requires Building Class 2015 (see Appendix 5). • Prescribes the required efficiency of windows and internal systems.
Environmental Building Programme South (*Miljöbyggprogram SYD*) Lund and Malmö	• Applies to municipal land sales. • Sustainability criteria (including energy frames) inserted into contracts of sale. • 3 Classes are provided, C is mandatory for municipal land while B and A are voluntary (see Appendix 6). • Also used in voluntary agreements on private land.
E.ON Sustainable Cities Hyllie Malmö	• Private sector lead partnership between the energy provider, communications technology provider and the municipality. • Aimed at delivering smart solutions to the Hyllie development in Malmö.

Motivational niches in the region are largely focused on the use of structural mobilisation tools which rely on regulations to enforce set energy frames and energy efficiency criteria. Developers, as the actor legally accountable for the development, are the target of such tools which make use of the powers of legal leverage opportunities in the legislative systems of the region. While powerful, structural mobilisation tools do have their limitations. Municipalities on both sides of the Sound would like to drive energy performance beyond compliance; beyond Building Class 2015 in the case of Denmark, and beyond Miljobygprogram SYD (MBPS) Class C in the case of Malmö and Lund. Also in Copenhagen, while connection to DH is no longer mandated this is still, from the municipality's perspective, the optimal choice as DH is more energy and economically efficient the more properties it serves. Thus DH connection is another voluntary energy efficiency measure that municipalities seek to promote.

Positive incentives have been provided as motivation in some projects. For example funding, was provided for the Western Harbour demonstration projects. Alongside the funding in Western Harbour there was also the promise of plots in subsequent developments based on good performance outcomes in the initial development. Interestingly MBPS, in addition to using land allocation as leverage, also places a strong emphasis on the communication of performance results as a mobilisation tool. The use of the rosettes which are displayed on the

programme website aims to trigger the reputational performance driver of development companies and serves to encourage voluntary high performance (Lund Municipality, 2009). In order to motivate developers beyond regulatory compliance municipalities must support structural mobilisation with agency based mobilisation techniques such as, for example the rosettes.

In many respects the E.on Sustainable Cities project represents the fruits of Malmö's labour in projects such as Western Harbour. The municipality's capacity for collaboration and progressive energy-focused developments has helped to overcome acceptance related barriers amongst certain actors and facilitated the self-organisation of industry towards climate mitigation goals. Here the motivation is no longer coming directly from regulatory pressures but rather from the shared business opportunities that can be generated through collaboration. Such partnerships, as can be seen in the Sustainable Cities project, allow for the sharing of different competencies in technology, infrastructure, urban planning and end-user relations. From this niche it is evident that the industry is beginning to see the opportunities that such relationships can provide in developing creative solutions to the challenge energy performance in new urban developments which mutually benefit the private companies and the municipality (E.ON, 2012).

3.1.8 Practice Related Niches

Table 4 Practice related niches

Niche	Description
The Generations of Western Harbour Malmö	• Three stage development programme focusing on the demonstration and subsequent mainstreaming of sustainable building practices. • Designed to facilitate creativity within, and learning between projects.
Climate Living in Cities Concept (CLICC) Malmö	• Aimed at existing buildings. • Trained individuals work with residents in to reduce the carbon footprint of buildings consumption using personal communication and online tools.
Climate Butler (*Klima-Butler*) Ballerup	• Aimed at existing buildings. • Trained individuals work with residents to reduce energy consumption. • Further aim of involving residents in the design of proposed energy efficiency retrofit projects for the buildings.
Star Meetings Copenhagen	• Brings developers and all relevant departments from the municipality together at the initial planning stage to facilitate communications.

In terms of practice as a constraining factor the generations approach of Western Harbour was designed to provide continuity and facilitate learning in the sector – both amongst developers (and other members of the design) team but also amongst the construction group. Developers were encouraged to work together in generating solutions for the area as a means of stimulating creativity and constructive competition. Also, by structuring the projects in a sequence of generations the Western Harbour development seeks to promote the retention of knowledge within the local sector. Actors are able to view innovations not simply as one-off ventures but as part of a wider urban development context and part of their future business prospects.

Copenhagen's Star meetings are a useful tool in terms of improving intra-municipal communications which can be considered a practice based barrier. The Constructive Dialogue (described in 3.1.6) also addresses some practice based barriers. By encouraging developers to work in collaboration to meet procurement needs, costs and risks associated with suppliers are shared, ultimately rendering innovative energy efficiency measures more attractive.

While the above niches focus on developers as the key actor Klima-Butler and CLICC take a different approach, working instead with relations building between the municipality and building residents – or end-users. These projects are focused on the consumption and renovation of existing buildings rather than new builds (and should therefore be out of the scope of this thesis). They have however been included an example of innovative municipal – end-user relations and an interesting approach to addressing user related practice based barriers. Since new residential urban developments are intended to be occupied in the same manner as existing ones, the concepts and working methods employed could have application in new developments also. Of particular relevance is the use of the housing associations as an access point to residents. The programmes are not targeting general energy efficiency awareness in the public but are very much focused on the buildings themselves. Particular buildings are targeted and strong relationships with residents are developed, with the information provided being tailored to specific community involved. Working with buildings which are managed by the original developer they also rely on a collaborative working relationship with developers during the operations stage which is unusual. Engaging developers in the operations stage may serve to also generate new awareness and knowledge which can then feed back into the planning stage of future developments. The creation of such feedback loops is very valuable in terms of promoting learning within companies. In an alternative approach the E.on Sustainable Cities initiative through the delivery of smart systems to new developments is also addressing the end-user as a key actor in the energy efficiency outcome of a development.

3.1.9 Discussion

It is interesting to look at which phases of the development process and which actors are being targeted. Figure 10 illustrates how the niches in the region are concentrated on the design stage with less attention being paid to the construction and operations phases. Within the design phase developers are the main actor group addressed; this is justified by their influential position in the regime. Engineers and architects are not targeted directly but are addressed as part of the design team alongside developers. The focus on design is not unjustified as this is the foundation upon which good construction and rational energy end-use rely. However, un-satisfactory construction quality and user behaviour can go far to undermine the performance of a good design and thus must not be neglected. End-users in the operations phase are addressed by the E.ON Sustainable Cities, Klima-Butler and CLICC niches, although in the case of the latter two, the programmes are not currently targeted at new developments (hence represented in Figures 9 & 10 by a dotted line); this presents a possible gap. The construction phase is only addressed indirectly through the promotion of learning in Malmö's Western Harbour generational approach with construction contractors and labourers also not being targeted directly. Overall the constraining factors of acceptance and motivation appear to be more comprehensively addressed with clearly targetted programmes whereas practice based measures while explored in individual projects are not methodically approached in the same way.

When looking at individual municipalities and development projects it is clear not all areas are being addressed in each case. While Copenhagen makes powerful use of the structural mobilisation opportunities available to them and is more demanding in terms of energy frames they appear to be weaker in terms of the development of relational resources. For instance,

Copenhagen municipality does not have a clearly established dialogue process. While acknowledging the need to motivate developers beyond what is required by legislation and providing valuable information, the Inspirational Catalogue still constitutes an arms-length approach. In contrast the Swedish programmes tend to have a stronger emphasis on relational resource building. This may in part be due to the fact that, while able to make use of land allocation leverage in a way that Copenhagen is not (due to lack of municipal land), Swedish municipalities do not have the same powers to mandate energy frames in the *Översiktsplan* zoning. This makes them more reliant on good relationships with developers if they are to influence them to go beyond the BBR19 in developments on private land. Also, geographically the niches are very much concentrated in Malmö and Copenhagen. These are the largest urban areas in the region and thus this concentration is somewhat justified. In smaller, slower growing municipalities new urban developments are not as significant an issue and as such these municipalities have tended to prioritise energy efficiency measures in existing buildings[16]. However, the achievement of regional targets will require regional effort.

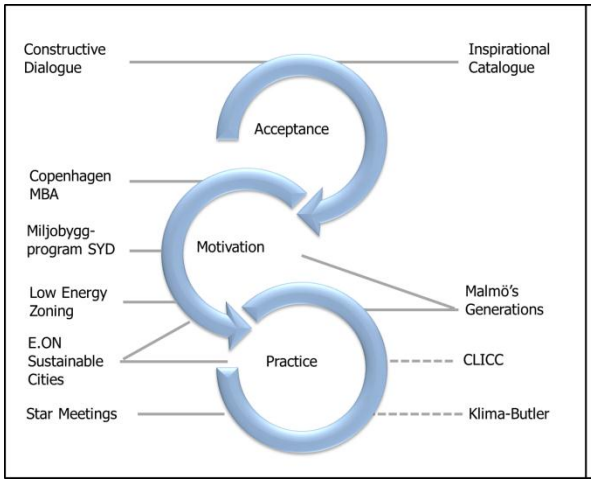

Figure 9 Illustration of targeted constraint factors

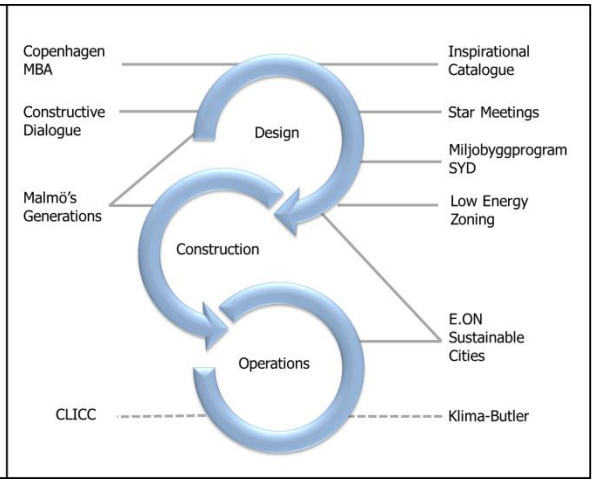

Figure 10 Illustration of the targeted phases

Case Study Discussion

This chapter has attempted to visualise energy efficiency governance in new urban developments in the Öresund Region through the conceptual framework of TM theory. It is clear that the landscape of the region is a supportive one and one which opens up a number of opportunities for municipal level action. On the back of the EU Directives Sweden and Denmark have both set ambitious targets and implemented a range of policy instruments which operate at the national level to guarantee minimum standards of energy efficiency in buildings, support energy efficiency in the market and encourage energy efficient behaviour. Both countries are also striving to encourage beyond compliance performance by providing additional voluntary classifications. These targets and the narratives upon which they are based can be considered as constituting the element of *long-term collective goal setting and anticipation* as outlined by TM theory. Studies on energy efficiency policy indicate that while Sweden remains a forerunner at the European level, in comparison to Denmark, progress in the field of energy efficiency activities in the property development sector has slowed (Kes McCormick & Neij, 2009). This suggests that Denmark may present a more favourable landscape for energy efficiency innovation than Sweden at the level of national overview.

[16] Ballerup Klima-Butler is one example included in this thesis. Another example not included is that of the Albertslund Concept developed by Albertslund. This focuses on the development of energy efficiency solutions for 1970's prefabricated houses and won Nordic Energy Municipality of the year 2011.

In addition, and most significantly, visions and targets have also been established at the level of the Öresund Region itself, creating a unique landscape in which energy efficiency innovations can develop and diffuse. This process serves to guide the direction of more concrete short-term agendas, raising the floor of ambition amongst actors within the region and raising the expectations and norms with regards to what is desirable in terms of urban development – both from a municipal and a public perspective. In some respects the Öresund Region can be seen to represent a niche in the national scale landscape, driving progress at the national level by demonstrating what is feasible within the national policy landscape.

From the regime analysis is evident that there reside both opportunities to drive energy efficiency, and barriers to its achievement. There are, as Figure 7 illustrates, many different stakeholders involved from idea conception through construction, to delivery and subsequent use, each influencing directly or indirectly the energy efficiency of new urban developments through various mechanisms. While the mapping of the property development regime has identified developers as the central actor, it is also evident that effective management of the system cannot simply address this actor alone; the interdependence between actors in energy efficiency decision-making must be acknowledged and incorporated into policy making.

The mapping of the regime has identified a number of sources of structural mobilisation capacity available to municipalities. In terms of the political structure, both Swedish and Danish municipalities possess significant powers and freedoms in terms of setting budget priorities, allocating resources and administering their own programmes[17]. This opens up opportunities for progression beyond national approaches towards more regionally specific initiatives and lends itself to the nurturing of niches for innovation (Blomqvist & Bergman, 2010). A case in point is the devolution of power down to the regional and municipal level as seen in the Swedish environmental programme *Miljömal*. The administrative structure of programmes such as this lay important groundwork for enabling niches as municipalities are encouraged to use the resources unique to the local context. Notably, there is the opportunity to utilise the human resources within the municipality and the skills stock in industry and educational institutions, to develop creative and context specific solutions to national problems rather than simply applying the solutions handed down from central government.

The results of this supportive landscape can be seen clearly in the array of niche projects that have developed in region over the past decade. The Öresund Region as a whole possesses a patchwork of niches that address the constraining factors of acceptance, motivation and practice and make use of various institutional capacity building tools. However, despite a strong landscape and progressive regime the niches are still niches. They tend to be executed within individual projects or individual municipalities and have not yet diffused throughout the region. Their implementation also still requires significant mobilisation efforts on the part of the municipality – the regime is not yet as a whole self-organising towards the goal of high energy efficiency performance (at least not as it is defined by the municipalities in the Öresund Region). Despite innovative policies and high ambitions it still remains a struggle to push developers beyond what is required by law and in cases where expectations were high projects are not always able to deliver in practice. The following chapter addresses this problem by exploring what barriers continue to persist in the region's property development regime from the perspective of regional actors in the property development sector.

[17] The Danish municipal reform in 2007 saw responsibility for urban planning devolved from regional bodies to the municipalities increasing their influence, while in Sweden the municipality has been described as 'a local self-government' (Witt, 2005) (SEA 2009. p35).

4 Barriers in the Öresund Regime

Having provided an overview of the landscape of the Öresund Region, this chapter now explores some of the barriers that continue to persist despite the strength of the landscape and the existence of innovative governance niches. Interviews with key actors within the region were carried out to identify which factors within the regime continue to hold back energy efficiency performance in new developments[18]. Interviewees were asked to rank the barriers presented in terms of their relative impact on the energy efficiency outcome from an industry actor perspective, and discuss how these barriers express themselves in the regime. The results of this ranking are presented in Figure 11 below in which a higher number of points allocated indicates perception of a more significant the barrier. Evidence of the existence of these barriers and discussion surrounding their expression in the regime are presented in the following sections of this chapter. Findings are organised within the core framework of this thesis which groups barriers in terms of the constraining factors of acceptance, motivation and practice.

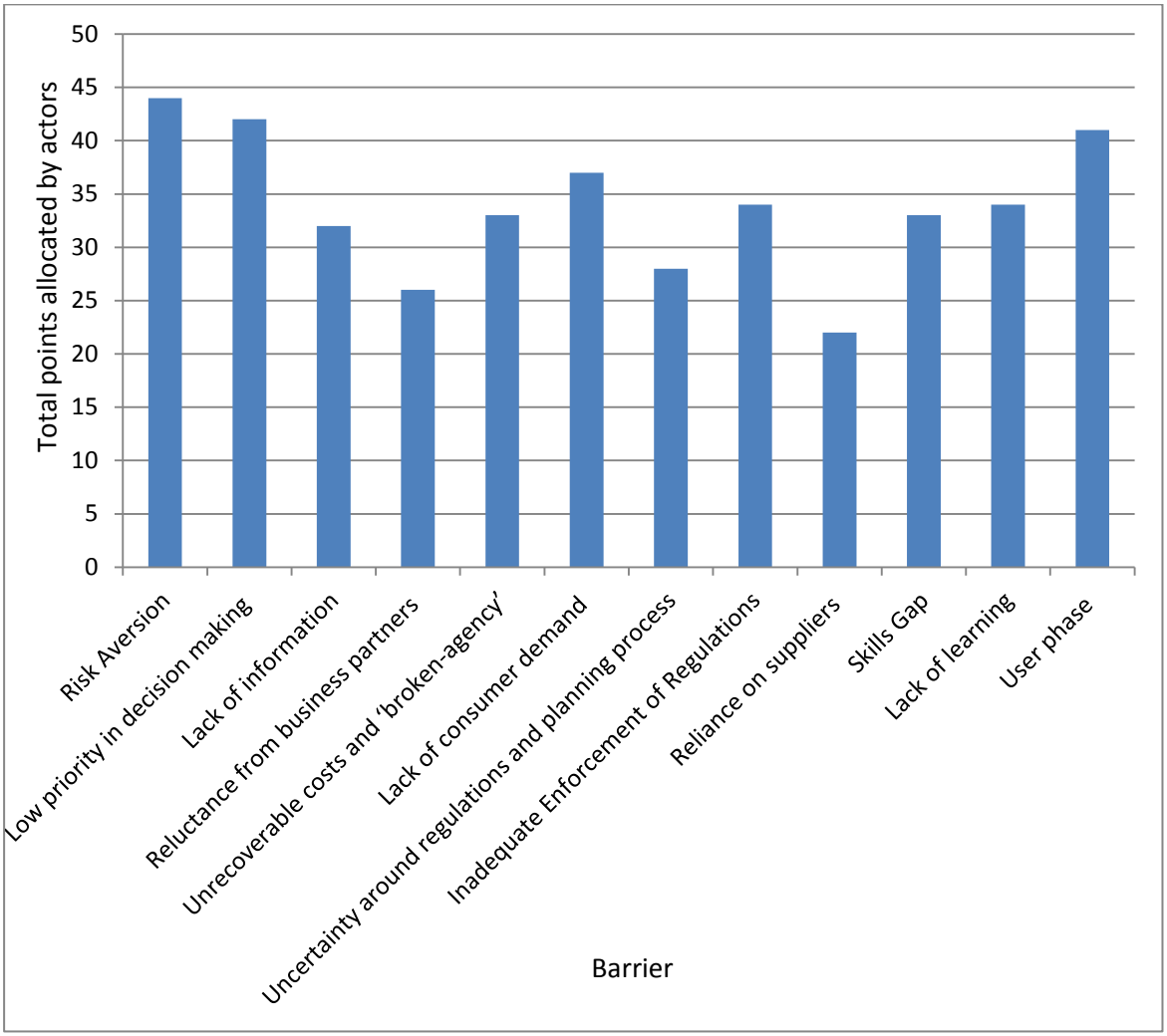

Figure 11 Graph illustrating the ranking allocated by interviewees to the barriers identified..

[18] List of interviewees contributing to this discussion can be found in the References section.

Barriers Related to Acceptance

4.1.1 Risk Aversion

The highest ranking barrier was that of risk aversion within company decision-making. New energy efficiency technologies are surrounded by much uncertainty and the impact of this was clear from the interviews. Interviewee #2 cited the case of a new energy efficient façade technology which turned out to have detrimental effects on indoor moisture levels. This resulted in the company having to rebuild a project only a few years after initial completion. Such failures while being costly in themselves, also generate bad press for the company which can have a longer lasting impact on business adding to the risks. Similarly, Interviewee #6 cited a case involving an innovative water treatment technology[19]. This system had been included in designs in response to dialogue with the municipality. However, it was removed from designs just prior to construction as the municipality had added a clause in the planning permission which required the developer to fund the installation of a conventional system should the innovative system fail water quality tests. This additional risk, on top of the increased investment required for the innovative system, meant the innovation could not be justified from a business perspective and, thus, a conventional system was installed. This example also touched on the issue of lack of trust between developers and the municipality as a barrier. A number of developers also noted that risk only becomes a barrier when you move beyond an energy frame of approximately 60kWh/ m^2 per year[20]. The industry has the capacity to develop buildings that perform significantly better than current building regulations in both Sweden and Denmark demand. However, this is the threshold beyond which new materials and processes are required and uncertainty, costs and risk increase to the point where potential gains from company reputation and green profiling are not able to compensate.

4.1.2 Energy Efficiency as a Low Priority in Decision-Making

Energy efficiency as a low priority in decision-making was ranked as the second highest barrier overall. This barrier is linked closely to the fact that energy efficiency is not yet perceived to be valued by house buyers. One developer described the house buying process as an 'emotional' one, with consumer's decisions being based much more on intuitive feelings about a building and the cost of the building than its functional statistics (Interviewee #1). Elements such as appearance and cost take precedence in consumer decision-making and, therefore, also take precedence in developer decision-making. This is a landscape based problem in that it is related to wider societal values and consumer expectations in relation to buildings and their qualities.

A number of companies do recognise that value can be generated through the development of their green profile and are making attempts internally to be 'proactive' in response to tightening regulations. A strong CSR reputation is considered essential as part of a strong company profile. Many of the companies interviewed had their own low energy standards which go beyond mere compliance with the national building regulations. This serves both to contribute to reputation and risk reduction by keeping a wide buffer between minimum regulations and actual performance. However, these drivers only work up to a certain level of energy performance after which the value added does not compensate for additional investments required and risks generated. Beyond this level acceptance waivers and additional incentives are required to raise energy efficiency as a company priority.

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[19] Although not energy efficiency related he cited this as an example of the risk management process that takes place when dealing with new green building innovations.

[20] This approximate figure was cited independently by Interviewee #1, Interviewee #2 and Interviewee #4.

4.1.3 Reluctance from Business Partners

Reluctance from business partners was not cited as a very significant barrier. Developers in general felt that architects and engineers were willing to work with the energy efficiency they specified. Developers are the main drivers of the energy efficiency specifications and, thus, decision-making internally within these companies is the most significant root of barriers. A pivotal issue in this discussion was the level of energy efficiency being demanded. As with risk aversion, there was a cut-off point before which energy efficiency is a key element of a good quality building and after which it can conflict with it. During interviews, there was a sense amongst the engineer and architect groups that developers are not generally demanding energy efficiency levels which present a major challenge. This may account for the fact that this barrier was not perceived as very significant.

As discussion moved towards the Passive House end of the energy efficiency spectrum, opinion clearly shifted. When asked about Passive Houses one interviewee from the architect group stated that 'I don't believe in Passive Houses', a sentiment that the municipalities had come across in relation to other architects (Lindholm, personal communication, 28th June 2012). This resistance towards Passive Houses as a concept again emerged in interviews with the developer and engineer groups (Interviewee #4; Interviewee #12). In particular, there was resistance to the tight sealing and lack of natural air flow that comes with Passive House building. In developing green buildings there were also doubts amongst the engineer and architect groups as to whether energy efficiency was the most cost effective strategy in terms of environmental benefits, and whether other solutions such as biodiversity could be more advantageous (Interviewee #12; Interviewee #13). Whether or not this argument is valid (the cost effectiveness of environmental innovations will depend on the weighting given to different factors and is debatable) it indicates that energy efficiency is not wholly accepted amongst the industry as a universal good. There is clearly a perceived conflict between some of the values in the industry – the norms surrounding the qualitative perception of what is a good building – and the values of the municipality which are focused on the achievement of emissions reduction targets.

As the building codes tighten in the lead up to the EU target of all new buildings being near-zero energy by 2020, it is likely that such resistance will become an increasing problem and the architectural and engineering industries will need to shift their values to include building characteristics that were not previously considered good quality. Integrated planning processes (IPP) are also becoming more common[21]. With architects and engineers being increasingly involved in the earliest planning stages, these actors will become more influential. Therefore, a conservative consultancy sector has the potential to hold back ambition. This is something municipalities should be aware of as integrated planning becomes standardised.

4.1.4 Lack of Information

Lack of information was not generally perceived as a barrier *per se*. The more significant barrier was associated with the communication of existing information, i.e., knowledge stocks exist in the regime but are not always utilised. This is explored further in section 4.1.11. That said, some areas where lack of knowledge does present a barrier were highlighted during interviews; lack of information presenting a limitation within municipalities, amongst consultants and amongst developers.

[21] With IPP actors such as engineers, architects and in some cases construction contractors are brought in at the very earliest stages of the planning process. This has been shown to optimise energy efficiency by enabling synergies between the different areas of expertise.

Firstly, one Swedish developer noted that, sometimes, by the time the developer is involved in the designing process, the detailed plan has already specified the orientation and layout of buildings in such a way that passive techniques, such as taking advantage of natural light or shelter, cannot be implemented. Similarly, specifications of building heights and roof angles can render them unsuitable for solar panel installations (Interviewee #2; Interviewee #13). In this case, an initial lack of information on the part of municipal planners could in some cases be considered a barrier. In a similar vein, one interviewee from the engineer group stated that consultancies are not always aware of new legislation and the relevant information is not always easy to find. Thus, communications between the municipality and other actors could be improved in this regard (Interviewee #11).

Thirdly, it was pointed out by Interviewee #14 from the architect group that developers often lack information about the 'side-effects' of energy efficiency. This was supported by Interviewee #11 from the engineer group who noted the lack of technical literacy on the part of developers who 'don't know what they are asking for'. They can be unaware of the links between the quality and comfort aspects of a building (both the positive and negative) and the necessity for end-users to interact appropriately with a building if the impacts of energy efficiency measures are to be optimised. It was suggested that architects could be more proactive in communicating the benefits of energy efficiency to their clients in terms of the sellable attributes energy efficiency generates. Architects are in the best position to do this as they have a strong knowledge of the characteristics of different materials and compositions and are aware of how this translates into consumer appreciable qualities. Developers also need to be more aware of the end-user as an important actor in determining the final energy efficiency outcome of the building and need to consider how they can better communicate with them.

Copenhagen's Inspirational Catalogue was cited as a very useful tool for developers in communicating municipal desires and informing developers of the opportunities available. The challenges faced by the different actors in implementing low energy buildings vary. The 2020 Building Class was considered a technical challenge by the engineer group (Interviewee #11). Thus, the catalogue was not deemed as helpful to engineers as the challenges they face with regards to the 2020 Building Class are more of a technical nature than at the level of acceptance. In addition, it was also noted that the heavy focus on heating solutions as opposed to design solutions somewhat excluded architects (Interviewee #14).

Barriers Related to Motivation

4.1.5 Lack of Consumer Demand

Lack of consumer demand was cited by all developers as a key barrier to achieving higher energy efficiency standards. One developer summed up the consumer position as 'I like it but I don't want to pay for it' (Interviewee #2). From their perspective it is difficult to sell the benefits to consumers whose priorities will always be location, cost, size and appearance. This issue has been described in part in section 4.1.2 above, in relation to decision-making priorities. Consumer demand drives company decisions on the type and characteristics of the buildings they develop. Developers need to generate profits for their shareholders and to do this they must sell or rent out their properties at a price that allows for appropriate payback on their investment. Energy efficiency must be aligned with this overarching company goal otherwise there will be little justification for action. It was noted by one developer that the company vision and the municipality vision are very much aligned – both are moving in the direction of better energy performance – 'the battle field is set up by the consumer' (Interviewee #6). If the consumer is not willing to pay then the company cannot push forward.

Energy efficiency measures should result in buildings requiring less energy to achieve comfort levels, which in turn should translate into lower energy bills for the end-user. Such a financial incentive might present a driver in terms of consumer demand for low energy properties. However, even in the case where the end-user will benefit as a result of lower energy bills, this long-term thinking has not yet permeated the house buying culture and such figures are not perceived to be of prime concern to consumers. Low energy taxes were cited as one contributing factor; energy efficiency is only valuable if energy prices are high. This factor, however, relies on national policy.

Interestingly it was, noted by interviewees that the impact of this barrier varies between property types. While residential buyers do not generally place energy efficiency high on their priorities, the situation for commercial buyers is different. Just as CSR and the benefits related to company reputation that it generates are of importance to developers, they are also of importance to the companies wishing to house themselves in new properties. The environmental performance characteristics of a building can, thus, have value to commercial end-users. Operational costs also present a higher priority to commercial end-users who seek a productive and profitable business space; this is much more easily quantifiable than a good 'home'.

4.1.6 Broken Agency

Broken-agency describes the situation whereby the benefits that result from energy efficiency investments (lower energy bills) are reaped by the end-user and not the investor. While, in theory, the savings made on lower energy bills should be able to be internalised in the sale price, in practice, consumers do not recognise this process and only perceive the higher upfront capital costs. This inability to transfer costs to the consumer is closely related to the barrier of lack of consumer demand discussed above.

Interestingly, 'broken agency' was not an issue across the board but rather was dependant on the business model of the company. Some companies interviewed, such as HSB, Botrygg and Whilborgs, maintain control of their properties after construction is completed. They are, therefore, able to recoup energy efficiency investments through the lower energy bills generated during the building's lifecycle, whereas companies such as NCC, Skanska and JM, which sell their properties upon completion, lose all connection to the building once the last unit has been purchased. Companies which maintain control over the buildings do therefore have some incentives to be ambitious in terms of energy performance targets. With tightening regulations requiring heavier investments in energy efficiency from all companies, those not involved in building management are having to consider new business models so as to link their investments to the benefits gained (Interviewee #1; Interviewee #2). This pressure on such companies creates potential for collaboration with a third actor – the energy company.

4.1.7 Uncertainty in Planning and Regulations

A recurrent theme during interviews was the uncertainty created by changing municipal requirements both in time and space. While Copenhagen has established a clear roadmap towards 2020 with regards to the standards of energy efficiency required by developers, Sweden has not yet defined its near-zero energy building class and thus municipalities have not outlined clearly the progression. To give an example, as part of MBPS it is stated only that standards will be adjusted in line with national building regulations; the specifics of these adjustments are not provided. Uncertainty makes the option of sitting tight and waiting for regulations more appealing than trying to anticipate them and risk wasting resources; the result being a dampening of ambitions. Variations in the requirements being made between different municipalities was also cited as a problem by a number of interviewees.

A major criticism that was levelled was that, with different requirements in different municipalities and uncertainty concerning future legislation, developers felt that each development was starting from scratch and that the knowledge gained during one project may not be applicable to future projects. Several times it was stated in interviews to the effect that 'we don't want to reinvent the wheel each time' (Interviewee #1; Interviewee #2; Interviewee #4; Interviewee #5). Most large companies have a template for their buildings and a well-established process that they apply region – or nation-wide. Variations in regulations mean that such general templates are of limited use and frequently have to be disregarded in favour of design and construction processes tailor-made for specific circumstances. This adoption of new processes will, initially, reduce the efficiency with which a project is delivered as greater time and error is involved.

One developer described how, from a company-wide perspective, programmes such as MBPS are challenging as they mean, for example, that you can't build the same house in Malmö and Lund as you can everywhere else (Interviewee #5). This makes the process less efficient and means that a great deal of the knowledge and experience generated cannot be applied in subsequent projects. A particular consequence of this is that the value of energy-efficiency pilot projects, from a company perspective, is reduced. There was also an issue of branding. While demonstration projects can be good for a company's reputation, developers also value branding and the presentation of a consistent image to the consumers. One interviewee noted that as a company they do not need to stand out; it is more valuable for them to perform well across all their buildings than perform exceptionally in a one-off situation (Interviewee #1). Consistency is clearly important to the industry. This relates back to the issue of energy efficiency as a low priority.

Building regulations with regards to energy efficiency are set to tighten significantly up to 2020. In this respect, it was acknowledged by developers that municipal pioneer projects can be a good learning exercise for their companies, allowing them to test out and practice processes and techniques in preparation for tighter regulations. Developers did communicate an understanding that getting a head start has the potential to generate a competitive advantage as they will have developed the competencies to meet regulations before many competitors (Interviewee #5; Interviewee #6). While the costs and risks incurred during innovative projects can be considered acceptable if they contribute to company learning, this advantage must be clear.

4.1.8 Lack of Enforcement of Regulations

When asked how the current follow up process functions, one Swedish developer simply answered 'it doesn't' (Interviewee #7). Lack of enforcement was seen not only to undermine the actual outcomes with respect to the original intentions, e.g., buildings exceeding their estimated energy demand, but also to undermine initial ambition. In the first instance, lack of enforcement of regulations was cited as weakening accountability throughout the actor chain. It was also noted by one developer that the fact that construction workers are aware that follow up is weak serves to lessen the pressure on them to prioritise, potentially more costly, energy efficient techniques, resulting in underperforming buildings.

In the second instance, the lack of enforcement of regulations was seen as dampening ambition. One developer stated that with everyone making promises about the environmental performance of their buildings, it was important for municipalities to be able to verify and lend such claims legitimacy (Interviewee #7). In this case, the developer was not just talking about legitimacy in the eyes of the consumer but also within the developer network. It was stated that if green washing is the norm, there is no drive to actually perform better than competitors – only a need to be perceived to be out-performing competitors. Developers do

not wish to make additional investments and take risks if their results are not viewed by customers and by others in the industry as having validity. While interviewees felt that corruption was low and most companies were not actively underperforming, it was thought that stronger enforcement of regulations would greatly improve accountability and legitimacy and motivate not only greater ambition but also give a stronger guarantee that the positive outcomes of such ambitions are realised.

Barriers Related to Practice

4.1.9 End-Users

The barrier ranked third most important in holding back the achievement of high energy performance standards was that of end-user behaviour. This barrier does not directly affect design but, rather, was cited as one of the main reasons why actual energy consumption can end up being significantly higher than estimated energy consumption. Estimated energy consumption calculations are based on a set of assumptions about end-user behaviour such as the average indoor temperature being maintained, the amount of hot water being used and factors such as windows being kept closed when heating is on. However, in practice people use their buildings in different ways and have set habits and routines that may not be appropriate for the optimisation of energy efficiency measures in the building. As with the issue of 'broken agency', the impact of this barrier is partly dependent on whether the developer maintains control of the property or not once construction is completed. Companies who retain ownership of their buildings have the ability to monitor energy consumption, control the way in which energy consumption is billed and provide information to end-users on their energy performance and how they can improve it. For example, although Botrygg include hot water consumption in the overall rent (it is not billed by metering), use is still monitored and households which are consuming significantly higher than average are contacted and informed. For companies who sell their properties there is no room to manipulate end-user behaviour and, thus, this variable is out of their control and can present a significant barrier.

One developer gave an example where their company fitted fake thermostat controls in the properties based on the knowledge that people change the thermostat settings in response to habit and not in response to temperature (Interviewee #6). For example, in a poorly insulated house a lowering of outdoor temperature requires the user to increase the heating rapidly to prevent a temperature drop indoors. However, in a well-insulated house there is a significant time-lag between the change in outdoor temperature and the lowering of the indoor temperature, making such instant adjustments unnecessary. Having a better understanding of how end-users interact with the building and its systems is an important element in minimising energy demand in buildings. One emerging solution that was cited by four interviewees was the use of smart systems which communicate with users, as well as adjusting automatically in response to, for example, outdoor temperature, thus, ensuring optimisation (Interviewee #1; Interviewee #8; Interviewee #15; Interviewee #16).

4.1.10 Supply Chain

Barriers related to the supply chain ranked as least important overall. Most interviewees felt that the supply chain for the materials necessary for energy efficient buildings were mature enough to support the industry and only one interviewee reported a significant supply chain-related problem in a project. It was noted that for many energy efficiency measures, the general materials needed are not different from those required for conventional projects – it is the composition of the materials that is most important.

4.1.11 Lack of Learning as a Result of Project Based Work

The project based structure of property development was highlighted by interviewees as an issue in the diffusion of energy efficiency innovations. Learning in the regime occurs at various different levels. Firstly, there is the internal organisational level. Projects are ultimately delivered by individuals working within a department; this is true of both the developers and the municipalities. Thus, learning accrued during one project may not be carried forward into subsequent projects if different individuals are involved. The use of external consultants in the designing and engineering of buildings also means that a developer's capacity to deliver energy efficiency can be heavily reliant on external competencies. The result can be that the knowledge resources of the developers themselves with regards to energy efficiency may not be significantly enhanced even if the final building is very innovative. Delivering innovations requires investments in the form of time, effort and financial resources. It is, therefore, in the interests of both developers and municipalities to promote good communication and knowledge sharing within the organisation so that knowledge resources generated are retained, shared and built upon, and not restricted to a specific set of individuals. One interviewee mentioned that there is a balance between the learning, efficiency and control that can be gained by working with the same templates and actors – engineers, architects, contractors – over a number of years and the creativity and innovation that is generated by having a more a more flexible approach and working with ambitious external actors (Interviewee #7).

The relationship between engineers and architects was also cited by two interviewees as an important area for improvement (Interviewee #11; Interviewee #14). This issue was not so much one of active resistance to energy efficiency, but more an observation concerning the structure of standard working practices. As was noted in section 3.1.4, the planning process is structured in such a way that engineers and architects tend to work in isolation from one another and so, are not always engaged either with each other or with the developers until later stages in the design process. A consequence of fragmentation is that the expertise of both parties is not always fully exploited as each party is forced to layer their solutions on top of the work of the other. The result being that highly integrated and innovative solutions are not formulated and the energy efficiency potential of a building (given a set location and budget etc.) may not be realised.

Thirdly, there is the issue of learning at the city-wide level. Developments can often take place in relative isolation and companies may not be aware of what has been done in terms of best practice elsewhere in the city, or the energy efficiency options available. Thus, the delivery of an innovative building by one developer may be followed by a standard building by another developer with no steady progression towards better energy performance being established (Interviewee #14). One developer mentioned that it was not always clear what was considered 'best practice' in green buildings as it changes between different cities and over time, making it difficult for companies to benchmark themselves; this benchmarking being the first step towards raising ambitions for energy efficient building construction (Interviewee #7).

4.1.12 Skills Gap

This brings us to the barrier of a skills gap in construction practices. How this barrier was perceived depended upon whether the developer company also managed building construction, such as in the case of Skanska and NCC, or whether external contractors are hired. Where construction is internal this barrier was perceived as minimal as the developers are able to clearly communicate the requirements for a project to the contractors and, most significantly, the aspirations of and incentives for the two actors are aligned as they are both working for the same company. In the case of companies who outsource their construction such as HSB and Whilborgs, the skills gap in construction was highlighted as very significant

in diminishing the final energy performance of the building in comparison to estimated energy performance. The attention to detail required by energy efficient construction is time consuming, which can increase the costs of labour. In cases where the contractor is a separate company it can be in the contractor's interest to keep these costs down and thus incentives become misaligned. While the presence of external commissioners is required by Swedish municipalities, their effectiveness in ensuring results is not always certain, thus the skills gap remains a challenge.

Discussion

It was evident from the interviews that all interviewees perceived the existence of barriers to the adoption of high energy efficiency standards in new buildings relating to acceptance, motivation and practice. Although barriers related to acceptance ranked the highest overall, this was marginal and there was no single barrier category that dominated. In part this may be due to the fact that many of the barriers are interdependent. This may also be due to the fact that the specific combination of barriers being faced by a company is dependent on a number of variables. These variables include the business model of the developer company, the initiatives and routines of the municipality with which they have worked, the type of building being developed and the individual people involved. The specific energy frame that is being required also has a significant impact on the barriers that present themselves and their relative importance.

Interviewees indicated that over the past decade since the first EU EPBD came into force some barriers that had previously been significant had to an extent been overcome. For example the capacity of suppliers was not considered by many to be a major constraint. Substantial improvements in construction quality with regards to energy efficiency techniques were also noted. This suggests that progress is being made in the regime and the structure of the sector is shifting towards one that is more enabling in terms of energy efficiency. In the Öresund Region, it could be argued that the existing policy support and experience of the industry in dealing with energy efficiency, renders barriers related to all three constraining factors less significant than they are in contexts such as the UK, where energy efficiency is a more nascent concept (Ko & Fenner, 2007). However, the increasingly high demands being made by municipalities continue to challenge developers to push beyond the levels that the wider industry comfortably supports, requiring them to be forerunners and to take risks. In pushing the local industry, municipalities must be sure to employ good management so that these high demands do not become a barrier to good performance in themselves by creating uncertainty and generating adversarial relations.

As the building codes become tighter, municipalities will need to remain aware of how this affects the barriers that present themselves. As the regime progresses the culture that currently guides routines and procedures may no longer be adequate to support the demands of such high energy efficiency standards, and practices that were previously not presenting a barrier, such as compartmentalised working of architects and engineers, will begin to present greater problems. Development of near-zero energy buildings, will demand new processes, such as greater integration between engineers and architects and greater attention to detail in the earliest planning stages. Such changes in structure will inevitably impact upon the patterns of influence and patterns of constraint that exist in the regime. For example while a more integrated planning process can help overcome barriers that result from a lack of communication between consultants, such processes also increase the influence of said consultants. Thus the level of acceptance amongst consultants becomes increasingly instrumental in determining energy efficiency outcomes; this creates potential for resistance from such actors to emerge as a notable barrier. A continuous assessment of barriers is, therefore, required to support continuous progress in the regime.

5 Discussion and Recommendations

This chapter builds upon the case study of the Öresund Region presented in the previous chapters. Based on analyses of the landscape, regime, niches and the results of interviews, this chapter identifies areas for further work and development in terms of municipal governance for energy efficiency in new urban developments in the region. Taking the form of a discussion, this chapter outlines some of the key issues that emerged from interviews with actors in relation to municipal governance of energy efficiency in new urban developments in the region. Discussion and recommendations are structured around the constraint factors of acceptability, motivation and practice that were elucidated in Chapter 4. Recommendations offered within the discussion are based on suggestions and themes that emerged during interviews, as well as on the experiences of other municipalities which have embarked on similar transition processes in the property development sector.

Addressing Acceptance

The following section addresses acceptance of energy efficiency as a constraining factor in property development. Comments on and solutions to overcoming barriers related to acceptance are centred on communications between actors and the development of relational and knowledge resources.

5.1.1 Dialogue Processes

Dialogue processes were cited as an important element of an energy efficient building process by both municipalities (within and outside the region) and industry actors alike. Many interviewees mentioned the need for the municipality to redefine its role, shifting from administrator and regulator to facilitator. This is a process that is clearly already being engaged with by the region's municipalities, to varying extents (see Chapter 3). Transition is, however, always challenging and this redefinition will not necessarily be a smooth process. Speaking about Copenhagen municipality, one architect stated that 'the municipality has an identity problem. Traditionally it has functioned as an administrator of regulations, now it is looking to engage in more dialogue but both the municipality and the clients are not used to working in dialogue' (Interviewee #14). Generally, relationships on the Swedish side of the border were described in more favourable terms than on the Danish side, with the quality of dialogue being mentioned as playing a role in this.

Trust and Risk

Lack of trust was cited as an important issue in relation to dialogue. One architect stated, with reference to Copenhagen municipality, that 'we are a bit afraid of consulting the municipality, afraid they will reject our ideas' (Interviewee #14). The issue of trust is also highlighted in the section on Feedback Processes below and in discussion over the negotiation of risk bearing. As described in Chapter 4, the negotiation of risk bearing between developers and the municipality was seen as crucial in overcoming acceptance barriers in innovative projects and is an important area that can be addressed by improved dialogue (Interviewee #6). Trust is something that takes time and experience to develop but is a vital aspect of dialogue development without which information flows and negotiations will be rendered superficial.

Relations Without Instruction

The use of dialogue in the development of purely relational resources – without the agenda of offering instruction or information – was cited as valuable. One engineer mentioned a positive experience they had had during one development in Ørestad, Copenhagen (Interviewee #10). In this case the municipality ran a 'kick off' session to bring the actors involved in the development together and build relationships; importantly the session was focused only on

interpersonal relations rather than the technicalities of the development. According to the interviewee this session contributed to improved cooperation and collaboration during the project. While such interventions do entail costs on behalf of the municipality, as the interviewee noted, these costs can be considered 'cheap insurance' for attaining a better quality development (Interviewee #10).

Helicopter Dialogue

It was noted during interviews that where dialogue with the municipality occurs it tends to be very project specific. Therefore it was suggested that promotion of a 'helicopter perspective' dialogue could be valuable in which developers and other actors can engage with the municipality in more general terms and contribute towards the shaping of municipal urban development visions (Interviewee #7). This would provide developers with a deeper understanding of what is desired and expected of them but also provide them with a greater sense of ownership over the achievement of municipal visions.

Dialogue and District Heating

DH can make a significant contribution to the energy efficiency of a development (Interviewee #11; Interviewee #12; Interviewee #15; Interviewee #16). However, DH is competing with other energy sources such as heat pumps which can be perceived by developers as a more visible symbol of green building. In cases where energy provision is not provided by the municipality, such as in Malmö, it can also be seen as less cost efficient even if it is more energy efficient (Interviewee #15; Interviewee #16). As the interviewee from Køpenhavns Energi stated 'we have a communications task ahead of us' to ensure developers are aware of the socio-economic benefits of DH and to be creative in the way in which DH is communicated to the end-user (see section 5.1.6 below) (Interviewee #16). Køpenhavns Energi noted that, as a private company serving public interests their credibility and legitimacy becomes increasingly important; developers view them as simply another company selling their services in competition with the heat pump companies so good relations are needed if they are to compete[22].

In Copenhagen, with the establishment of the low energy zones and the waiving of the DH connection mandate, the energy company has to redefine its role in relation to developers. Dialogue between the energy company and the developer becomes increasingly important, as does the municipality's role as facilitator of this dialogue. This is also true for other municipalities outside of Copenhagen. Collaboration between energy companies and developers early on in the planning process could mean that DH could be better integrated into new developments, costs could be reduced and buildings could be designed specifically to optimise this form of heating.

Targeting dialogue

Developers and their clients (the end-user) are not homogenous and the potential for dialogue to succeed will vary depending on the parties involved. Some developers are working more prominently on their green profile than others. This opens opportunities to encourage 'beyond compliance' performance through the setting up of dialogue with interested clients prior to land allocation. In this way the municipality can target those companies that will be more likely to respond to dialogue. The poor economic climate was cited as a limiting factor on the requirements that municipalities (and By & Havn) are able to make in the land allocation process, as demand for land is low. However, one advantage of the current economic climate is that it is mainly larger, established companies that are investing – these

[22] Køpenhavns Energi are municipal owned but still function as a private company.

companies have both a high public profile and the capital behind them to make more ambitious projects feasible (Interviewee #6). This may represent untapped potential in terms of influencing energy efficiency choices of developers.

Where the client or end-user is known before building construction there are opportunities for dialogue with this actor also. In the case of residential buildings the interest of end-users in energy efficiency will be fairly uniform. However, this does not hold true for commercial clients. Clients who work with sustainability in some capacity, for example in the field of science and innovation, may be more inclined to see the value of energy efficiency and may be more responsive to dialogue. For such clients the business case is stronger from a reputational point of view as they can, for example, use the building as an exhibition case (Interviewee #14). There is potential when working with commercial clients to promote energy efficiency as a building characteristic that will add value, not just in terms of energy savings but in terms of the story of the building itself (Interviewee #14). The impetus for this must come predominantly from the developer or other actors such as the architect or engineer as municipalities do not normally deal directly with clients. However, municipalities can work to empower such actors to engage their clients in discussion about energy efficiency options.

The crucial element here is whether or not energy efficiency is valued by the other actors involved – the developers, engineers and architects – as it is by the municipality. Barriers related to acceptance were still a feature of the regime and Section 4.1.3 highlighted that not all actors felt that maximising energy efficiency was the most appropriate strategy. Such actors, therefore, may not be inclined to engage with clients on the issue. With the rise of more integrated planning processes the influence of engineers and architects is likely to grow. It is, therefore, increasingly important that opportunities to drive energy efficiency in potentially responsive clients (both developers and the developer's clients where relevant) are not lost because of reluctance within the actor chain. The municipality needs to ensure the rationale behind energy efficiency as a strategy for urban development is persuasively communicated to the industry.

Feedback processes

So far in this section, dialogue has mainly been referring to interactions in the planning stages. However, closely linked to the issue of dialogue is the functioning of feedback processes post development. There are feedback processes in place in the region's municipalities for urban development projects but, in general, these were perceived as unsatisfactory. The issue of trust is again reiterated. It was noted by one developer that they did not feel comfortable giving honest feedback to the municipality in case it impacted upon their possibilities for collaboration in the future (Interviewee #6). For feedback processes to be valuable and not simply a bureaucratic 'hoop', all parties must feel able to contribute freely and honestly. There are different approaches to planning and development being employed in different municipalities and different projects and, from discussion with the actors involved, it is clear that experiences vary. Therefore, a robust feedback system is crucial if lessons are to be learnt and processes improved. Dialogue presents a new way of working and both the municipality and the other actors in the chain will need to learn how best to work with these emerging processes.

It is also important to note that the impetus to improve dialogue does not just reside with the municipality. It is crucial that developers understand how to work with dialogue processes so that they are able to feel the benefits. Communications on this topic within the developer network should be encouraged so that the industry is aware of how the process can benefit them and how they can get the most from it. Dialogues are still fairly nascent and there is a learning process occurring in the regime. It is, therefore, important that municipalities also

take a dialogue approach to the development of the dialogue process itself. In summary, municipalities must be responsive to what other actors need from the dialogue and facilitate feedback on how processes can be improved from the perspective of both parties.

5.1.2 Networks

Related to the topic of dialogue is the issue of coordination of knowledge sharing within the region and how this can play an important role in raising energy efficiency as a priority in decision-making and addressing barriers related to lack of information. An important objective of Energi Öresund and UTO's work is to create a knowledge sharing platform centred on sustainable urban development and both projects have developed communication channels (Harboe, personal communication, 9th August 2012)[23]. While valuable, such tools could be developed further to make them more accessible and targeted to the different actors that may be interested – industry, public and other municipalities – each of which have different information needs. These existing networks and communication platforms could form the basis from which the knowledge sharing platform expands to involve more actors.

As the niches section described, there are a number of projects in the Öresund Region which are generating valuable knowledge resources on how to effectively govern for energy efficiency in new urban developments. Such projects are, however not region-wide, involving instead individual municipalities, individual projects, individual companies and ultimately individual people and there is as yet no single access point where information on these projects is presented. If organised and communicated in a more accessible manner such information would constitute a valuable knowledge resource for other municipalities and businesses in the region and beyond. This would also help support the landscape by establishing sustainable building as an active and cohesive regional agenda.

Industry Networks

One of the barriers to knowledge sharing between different developers was the fact that companies seek to maintain competitive advantage generated by their knowledge stocks (Interviewee #6). One interviewee discussed how architects are notoriously bad at sharing ideas and like to 'keep their cards close' (Interviewee #14). This holds back learning in the industry and, in a climate in which innovations in design are needed to achieve energy efficiency and the other green building goals of municipalities, there needs to be a culture change. It was suggested during interviews that knowledge sharing between developers might be more acceptable to the industry if it was lifted out of the context of a specific project; cooperation outside of competition (Interviewee #7; Interviewee #14). With regards to this one interviewee cited an example from a Cradle to Cradle conference in Amsterdam where developers and architects set up an agreement to share expertise between competitors on projects where they are not in direct competition (Interviewee #14). During interviews developers brought up examples of methods they had employed in their attempts to influence user behaviour. These included the installation of false thermostat gauges, the adjustment of elevator speeds to be slow so as to discourage their use, and the communication of hot water consumption norms in the building alongside utility bills. A platform for developing and sharing such ideas which do not directly generate competitive advantage could be valuable.

In terms of developers, Gothenburg offers a useful example. Through the Byggherrarna organisation a developer network has been established in Gothenburg. The aim of the

[23] UTO have a website which aims to communicate project work, and is participating the Hållbar Stad (Sustainable City) blog run by the Swedish Museum of Architecture. Energi Öresund has its own website and also communicates through the Gate 21 Sustainable Futures Forum.

network is to bring developers and other actors in the region of Western Sweden together to develop the capacity of the industry through knowledge sharing, seminars and study visits (Byggherrarna, 2012b). The network has a very local focus as opposed to less geographically situated networks such as that of Byggherrarna itself. In the Öresund Region there exists the Interreg funded project *Integration Between Sustainable Construction Processes* (IBSCP) which aims to establish a developer network in the region and integrate the two markets on either side of the Sound. They make use of existing developer networks in the region with a focus on regional integration. UTO have participated in a joint seminar with IBSCP previously and there may be opportunities for further collaboration between regional municipalities and such a network in the future (Karlshöj, personal communication, 27th August 2012).

At present, there is a fair amount of consistency between the actors involved in large projects in Copenhagen and to a lesser extent in Malmö[24]. This consistency and reduced competition presents opportunities. For example, a developer network for the region could be established amongst key players along the lines of the Gothenburg network, to facilitate more general knowledge and ideas sharing in the area of sustainable building.

Municipal Networks

Niches tended to be concentrated in Malmö and Copenhagen and in gathering information for this thesis it was clear that region-wide awareness of the various energy efficiency and green building initiatives within municipalities was in places weak. A case in point is that fact that in correspondence with Kristianstad municipality – an Energi Öresund partner – it became apparent that they had not heard about Miljöbyggprogram SYD. While it is, of course entirely possible that this holds true only in relation to those present in the office at the time of calling, the fact that awareness of such programmes resides only with the individuals directly involved in such projects and had not diffused throughout the relevant municipal departments is a problem in itself. Kristianstad also stated that they did not currently have any procedure in place for influencing developers in terms of energy efficiency, neither in the case of municipal land nor private land. The lack of awareness amongst municipalities of the programmes being run in the region indicates a possible need for stronger communications within the municipal network.

While Copenhagen and Malmö form the core of development in the region there are many other municipalities which could both contribute to and benefit from the knowledge and experience being generated with respect to sustainable urban development. The more municipalities that engage with developers on issues of energy efficiency and sustainability, the greater the pressure placed on the regime as a whole. For example, all municipalities should be making use of the structural mobilisation tools available to them through the process of land allocation to promote high standards; this is not, however, the case[25]. Developer and municipal engagement on these issues should not be unique to the central municipalities but should instead be the norm throughout the region.

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[24] Before the 2007 financial crisis there were many more smaller developers able to get loans and buy land but now only the larger more established companies with capital reserves can afford to develop, thus limiting the pool.

[25] Kristianstad for example stated that they were not as yet taking advantage of this structural mobilisation opportunity (Paulin, personal communication, 2nd August 2012). Helsingborg also indicated that while in the process of adopting MBPS they did not currently have any programmes in place themselves Augustsson, personal communication, 2nd August 2012).

Addressing Motivation

During interviews the municipality as an actor was described both as a 'strong opponent' and a 'toothless tiger' (Interviewee #9; Interviewee #13). This section discusses the different actor perceptions of municipal mobilisation approaches and opportunities within the regime to address motivational barriers.

5.1.3 Strong Opponent or Toothless Tiger

Structural Mobilisation

Beginning with the municipality as 'strong opponent', it was evident from interviews that some actors perceived municipal relations to be quite adversarial; this appeared to be more the case on the Danish side of the Sound than on the Swedish side. This difference can be in part put down to variations in regulatory structure between the countries which results in stricter demands being placed on developers in Denmark, i.e., through Copenhagen's low energy zoning, as compared to in Sweden, where cities such as Malmö have more relaxed criteria. When asked how municipalities could better support the property development industry in achieving higher standards of energy efficiency, one Danish engineer stated that Danish municipalities 'can only use the stick, they have no carrots' (Interviewee #10). The implication here is that raising the standards of the building regulations is the only option available to municipalities in driving towards improved energy efficiency.

Such arms-length approaches, while effective due to their legal backing are not always popular with developers, some of whom perceived them as unrealistic in relation to the competencies available in the industry and as creating an unnecessary burden on companies (Interviewee #1; Interviewee #11; Interviewee #16). Regulatory 'sticks', such as Copenhagen's low energy zoning, were not, however, perceived by all as a burden. Two developers made the point that from their perspective it creates a level playing field, as all developers wishing to build (in this case in Copenhagen) are subject to the same requirements. For these companies regulations present an opportunity to gain a competitive advantage; those willing and able will step up and take advantage of the situation, those unwilling or unable will have to adjust or lose ground to the competition (Interviewee #6; Interviewee #7).

Even if deemed unrealistic, it was noted by one interviewee that this does not mean the regulatory standards should be lowered, but rather that municipalities need to have an understanding that this is a learning curve (Interviewee #16). One interviewee from the developer group who works on both sides of the sound stated that Malmö offers the best support for energy efficiency because they have understood the situation of interdependence 'we need them and they need us' (Interviewee #7). As another interviewee described it 'the municipality needs be more humble' in its approach and promote mutual benefit rather than simply forcing developers to work for municipal goals through regulations (Interviewee #13).

Enforcing Regulations

On the other side of the municipal relations coin there was the 'toothless tiger' characterisation. This observation is twofold. Firstly, it refers to the municipality's limited capacity to enforce regulations. Lack of follow up on project outcomes and lack of punitive measures were cited as an important de-motivating factor in achieving energy efficiency targets, with repercussions for under-performance being considered to be almost non-existent in practice. The strengthening of follow up processes would not only function in terms of increasing the threat of litigation in relation to building codes, but could also serve to drive ambition. In relation to the former, the lack of accountability of the developers is perceived throughout the actor chain resulting, in particular, in a construction sector which feels able to

relegate energy efficiency as a work priority, resulting in poor quality builds. In relation to the latter, lack of legitimacy in green building claims (including energy efficiency) was cited as a barrier to ambition, as developers do not want to make additional investments and take on extra risks if the results are not seen by their customers and by others in the industry as being validated (Interviewee #7).

Secondly, the toothless tiger refers to the lack of positive motivation for both mandatory and voluntary energy efficiency action which was also cited as a barrier within the regime. It was noted that while in some projects a good dialogue had been generated and this had facilitated creativity and ambition, in others, developers felt that the municipality was making significant demands without acknowledgment of the additional input and effort that meeting such demands requires; this left developers wondering 'why go the extra mile?' (Interviewee #1; Interviewee #13). In projects where voluntary agreements are being drawn-up, such as with MBPS, municipalities must be careful to ensure that this 'why' question is addressed if they are seeking to motivate beyond compliance performance. Even in the case where performance is already being required by regulation, such as in Copenhagen's low energy zones, if municipalities wish to maintain a good relationship with developers it is important that the rationale behind the demands or requests being made is communicated as it was clear that acceptance of energy efficiency as a 'good' was not present across the board.

'Carrots' – positive drivers for energy efficiency

While some saw regulation as the only solution other actors were more optimistic about the possibility of 'carrots'. The ability of the municipality to provide financial support was cited, not surprisingly, as a significant driver by both the industry and municipalities (for example: Interviewee #4; Kontio, personal communication, 14th August 2012; Enarsson, personal communication, 6th August 2012). The promise of additional plots in future developments in Western Harbour was also cited by developers involved in the project as a strong incentive for innovation. Working with ambitious actors to plan projects and apply for funding may be a useful strategy. The drive to innovate in terms of energy efficiency does not come solely from the municipality but is also generated within companies. If barriers such as excessive risk and cost can be addressed, forerunners will fill the gap with ambitious projects. In cases where the municipality does have the power to regulate the energy performance of the building they should take full advantage of this and so encourage these more ambitious developers; if it is feasible to combine this with positive incentives the possibilities are even greater.

Alongside stronger enforcement of regulations and financial support, one developer suggested that publicity could be used more effectively as a leverage tool to give agreements and contracts more teeth (Interviewee #7). Such measures are particularly important in relation to voluntary agreements where no threats of litigation exist. Publicity need not be wielded as a stick but can function as an incentive for ambitious performance (although the threat of bad publicity is implicit as a driver also). This is one area that MBPS makes use of and there may be opportunities to build upon this mobilisation tool both within this programme and within other municipal planning procedures when developing large high profile areas.

5.1.4 Reducing Uncertainty

The problem of 'reinventing the wheel' as a result of project based work was brought up repeatedly during interviews (Interviewee #1; Interviewee #2; Interviewee #5). With varying requirements being made between projects, between municipalities and over time, developers find that learning generated from one project is not necessarily applicable to subsequent projects. In a context of planned regulatory tightening with regards to energy efficiency, developers did communicate an understanding that new processes will be required and that getting a head start could generate competitive advantage (Interviewee #5; Interviewee #6).

Key to this system working is ensuring that pre-emptive tightening is consistent with planned national regulatory progressions. Roadmapping is an important tool in communicating policy continuity and promoting the value of being proactive to companies. Being a forerunner is only worthwhile to a company if they are sure they have a head start in the right race. The Danish building code structure is successful in this regard as developers know exactly what will be expected of them come 2020 (or 2015 in Copenhagen) and can orient their innovations and ambitions within current projects so as to contribute towards improved efficiency of company processes with regards to these future targets. Consistency between municipal demands and the energy efficiency requirements of other systems, such as the DGNB certification scheme which Denmark will be shortly launching, would also help to situate municipal requirements within a larger nationally and internationally applicable framework and reduce uncertainty.

5.1.5 Energy Companies and Broken Agency

The role of energy companies in both the infrastructure development aspect, and the consumer facing aspect of energy delivery make them potentially influential in the energy performance of new urban developments. From a business perspective there are a number of ways in which energy efficiency goals and company goals can be aligned. Energy demand is not consistent but has peaks; this holds true for both heat and electricity consumption. Meeting demand during peaks requires additional generation capacity which can be both more expensive and more carbon intensive as backup capacity tends to be fossil fuel based. The result is that demand reduction can be more cost effective than increasing supply. Energy efficiency is also particularly important when taking a long-term view. The future energy system is likely to be characterised by an increase in renewables – particularly wind generation – which will result in increasing intermittence. This is something that energy companies are having to plan for and, as E.on noted, at present energy companies have the choice to either invest in reserve generation capacity or invest in energy efficiency (Interviewee #15). This cross roads presents an important opportunity for municipalities in terms of carbon emissions reduction strategy.

Through collaboration between energy companies, developers and the municipality such alignments of interest can be harnessed. Experimentation with different technologies, business models and service packages can be facilitated and the role of energy companies in promoting the use of communal systems such as DH can be supported. In order for such solutions to be realised the energy company needs to be involved very early in the planning process as innovative systems, such as smart solutions, require integration into the building design and cannot be simply connected at the end of construction as is often the case with traditional energy provision. As one interviewee from the energy company group stated ‘the earlier we are involved the more we can deliver’ (Interviewee #15). The municipality defines the role of the energy company and when they are involved. Developing good energy performance is therefore reliant on the existence of a strong relationship between the municipality and the energy company, and the municipality’s ability to coordinate cooperation between the energy company and developers. This municipal coordination was suggested in interviews as a valuable intervention (Interviewee #2; Interviewee #15; Interviewee #16).

Variable Tariffs

Energy companies have strong competencies in the area of consumer relations which can be harnessed towards energy efficiency goals. They have communication access via the energy service contract and can control energy pricing so as to shape particular behaviours in consumers which can contribute to energy and carbon savings. The use of variable tariffs is one example of how pricing can be used creatively to generate savings for consumers and for

the energy company by smoothing out peaks in demand and reducing the need for costly (and often more carbon intensive) backup capacity. While changing the tariff system for all existing customers would be an impractical solution, new developments present an opportunity for energy companies to pioneer new pricing models. However, in that regard, the basic principle of fair sharing of the expenses for sustaining a common DH system among consumers would also have to be taken into account. (Interviewee #16)

ESCOs

Energy Service Companies (ESCOs) are private enterprises often set up by energy utilities or equipment manufacturers in partnership with public or private property developers to deliver energy services to a building or area. ESCOs were described by Interviewee #11 from the engineer group as a 'brilliant' way to harness investment in energy efficiency. ESCOs enable developers to outsource their energy service requirements. This shifts the responsibility of fronting the capital costs, and also the risk associated with such energy efficiency investments, away from the property owner and onto the ESCO making them an appealing option for developers. In areas where microgeneration is being deployed, energy efficiency can minimise the need to purchase additional energy from the grid and, in certain successful cases, could even allow for excess generation capacity which could be sold back to the grid, again generating profit

ESCOs are interesting from an energy efficiency perspective as they present a business model within which profits are generated through energy savings (Saxena & Hinnells, 2006). Broken agency was identified as a key barrier to energy efficiency investments in the Öresund Region and ESCOs offer one solution to overcoming this barrier. ESCOs generally function through the use of an Energy Performance Contract (EPCs) of some kind. These can take the form of the guaranteed savings model where the customer finances the measure and the ESCO guarantees a certain level of savings; the shared savings model where the ESCO finances the project and receives a percentage of the costs they save their client; or the Chauffage model where the ESCO both finances the investment and retains responsibility for maintenance and operations, selling the service itself (Hinnells & Rezessy, 2006). ESCOs can be used to deliver a number of technological solutions related to energy efficiency such as:

- Energy efficient appliances and lighting: new housing developments are often sold fully fitted with electrical appliances e.g., washing machines, elevators, HVAC, lighting;
- Enhancing the energy efficiency of the home: including installation of insulation and triple glazed windows; heat recovery from ventilation systems; and hot water storage;
- Microgeneration: microgeneration can be installed complimentary to energy efficiency measures to minimise carbon emissions in developments. (Saxena & Hinnells, 2006)

Traditionally, ESCOs have been used as a model for funding energy efficiency measures in renovations. However, the model also has the potential for application in new residential and commercial builds (Saxena & Hinnells, 2006). In particular, the so called community model where the energy services of an area are funded and managed by the ESCO has been identified as the most appropriate for new developments (Hinnells & Rezessy, 2006). In the community model, the ESCO works in partnership with the developer from the early stages of the planning process to deliver energy infrastructure to the building. In the development of an area such as Western Harbour in Malmö or Nørdhavnen in Copenhagen, an ESCO could be set up to deliver to a number of developments. This would require working in partnership with the different developers. In the case of developers who hand over complete ownership of the building to residents upon completion, this model would mean that they could develop very energy efficient buildings without having any assets tied-up in the building once sold. The

ESCO, having made the energy efficiency investment, would then be able to recoup it through revenues generated by energy bills.

The use of the ESCO model in relation to new developments was being discussed within the energy companies interviewed but had not yet gone beyond the idea stage (Interviewee #15). Being still in the early stage of development in the region, there is an opportunity here for municipalities to work with the relevant actors – mainly energy companies and developers – to test the model as a possible intervention to counter the barrier of broken agency. The proposed EU EED requires Member States to take measures to address the issue of 'broken agency', this alongside an increasing funding focus on PPPs through JESSICA make ESCOs an increasingly appealing and feasible option (EC, 2012a).

5.1.6 Landscaping – Telling Stories

Finally, when asked what the municipality could do to better support energy efficiency in new urban developments, one developer stated that the most important action the municipality can take is to inform the public about the value of energy efficiency in buildings (Interviewee #7). Lack of consumer demand came up as a fundamental barrier during interviews – affecting both the financial viability and general acceptability of energy efficiency measures. It is clear that there needs to be a cultural change in people's expectations and values with respect to buildings and energy efficiency. This is, in practice, a landscape issue as it does not address individual projects or actors but rather the ground in which these projects and actors function. While building-up people's technical knowledge may be relatively straight forward (this is static information), changing people's values is a much more complex task.

Identity and Norms

City identities, such as Copenhagen's recently awarded Green Capital status and Malmö's reputation as a green city, can contribute to a city-wide sense of ownership and pride in relation to environmental features and were cited as important in shaping client expectations, particularly with regards to commercial developments (e.g., Interviewee #7). When asked whether they felt involved in the Green Capital status of Copenhagen, it was noted by actors that the main focus tended to be on the transport and DH systems and not on the buildings themselves (Interviewee #11; Interviewee #6). Strengthening the regional identity as a leader in sustainable urban planning – with a particular focus on green building – may be a powerful tool in the process of shaping public values and expectations. Good communication and publicising of best practice within cities and within the region should play an important part of this and ties in with the recommendation in section 5.1.2 on networks above.

One important way of contributing to a nurturing landscape for energy efficiency is to generate norms. This is one of the aims of energy certification in new buildings as required by the EPBD. Such certification systems could be made more prominent in house brokering procedures as a means of raising energy efficiency as a buyer priority – and consequently as a priority for developers also. The overall aim of these communications is to create a situation in which energy efficiency in the home – although maybe not a feature that truly differentiates a building and adds value directly in the way that, for example, location does – is established as an essential element without which value depreciates. Such shifts in expectations have already begun, as mentioned previously, particularly in the commercial sector where the sustainable building story can be quite persuasive. However, there is clearly still a long way to go.

Creative Communication

The concept of telling stories as part of the transition to a more sustainable property development sector was also brought up in a slightly different context with reference to

energy delivery. Interviewee #16, from Køpenhavns Energi, discussed how the company has worked with idea development in the area of creative interaction between infrastructure and public space. One example offered was the development of a district cooling system not simply as a utility but as a feature of an area by designing and displaying it in a visible and aesthetically pleasing way. The idea behind such initiatives is to bring aspects such as energy efficiency out of the technical realm of engineers and utility companies and into the public consciousness by better integrating these energy systems into the city environment and the society that uses them. Through innovative interactions between buildings, technology and society, issues of resource consumption can be meaningfully connected with perceptions of quality of life. This will ultimately influence the values implicit in the regime.

Addressing Practice

These barriers differ from those of acceptance and motivation as they reside not so much in the values or drivers of the individuals or organisations involved, but in the planning, development and use of buildings as they are enacted; even if acceptance and motivation are high, practice-related barriers can still place limitations on the energy performance outcome.

5.1.7 Internal Municipal Communications

The planning process requires consultation with many municipal departments; this is especially true for low energy buildings. One of the issues cited by interviewees was difficulty in navigating the bureaucratic process of municipal urban planning. As one developer said of Copenhagen 'internally the municipality is disorganised, departments do not communicate, the environment department is better at dialogue but they don't communicate with the planners'; conflicts and inconsistency in the information provided and the way in which the planning process was managed were, however, cited as an issue on both sides of the Sound.

When working with innovative building concepts developers lack experience and may not be as familiar or confident with the new processes and requirements (Interviewee #11). In such cases developers may need additional support. Overall there was the sense that better coordination between municipal departments and better clarity in procedures was needed. One solution that has been pioneered by Copenhagen and was cited as successful was the use of 'Star Meetings' at the beginning on the project (see Chapter 3). Municipalities should be proactive in initiating such meetings for all projects and ensuring that communication channels are clear and information is accessible. It was also suggested that it may be useful for the municipality to provide a contact person that could guide developers to the right municipal department and give feed-back on internal municipal communications for a project. This guide to the municipal departments would be particularly useful for smaller developer companies or developers who new to the region.

In addition, the importance of individuals in shaping the success of dialogue processes was cited in four interviews (Interviewee #6; Interviewee #7; Interviewee #10; Interviewee #14). There was the sense from some developers that there can be a lack of engagement with the projects amongst municipal staff (Interviewee #6; Interviewee #7). This was a critique levelled on both sides of the Sound although the sentiment was more pronounced on the Danish side. It should be emphasised that the critique is not that the municipalities as a whole are disengaged – the opposite opinion is in fact held by most – but that there is a lack of consistency between projects with not all staff being knowledgeable or interested in driving innovation. It should also be noted that in collecting data for this thesis there tended to be significant uncertainty on the part of municipal staff as to which department was responsible for dealing with energy efficiency in new urban developments. The departments with which

the researcher corresponded – namely planning, building and environment – tended to pass responsibility to one another until one knowledgeable individual was found.

It was mentioned in Chapter 4, that the municipal drawn area level plans (the *detajlplan* or *lokalplan*) can sometimes be a limiting factor for developers and architects when designing energy efficiency measures into buildings. Within the municipality it may be beneficial to ensure all people involved in the planning process are aware of what constitutes an ideal process and what factors can contribute to energy performance so as to ensure the municipality is not directly responsible for any limitations. As the niche's section illustrates, both Malmö and Copenhagen municipalities are going well beyond traditional administration. However, the fact that these efforts are not always being perceived by developers indicates that the intentions of the more ambitious in the municipality have not necessarily diffused down to other levels.

5.1.8 Showing Your Cards – Communications and Knowledge Sharing

This fragmentation created by the project-based nature of property development (one of the practice related barriers identified in Chapter 4) means there is a risk that the lessons being learnt from these innovative projects will not get transferred into other arenas. There also exists a culture within the property development industry of keeping ones cards close to ones chest. This reluctance to share experience between actors can also serve as a barrier to the development of regional knowledge resources. The diffusion of knowledge from the niches into the wider regime is a cornerstone of transition management. Section 5.1.2 discusses the use of networks as a communication tool in the region. This section looks at how the planning process can be structured so as to ensure that the knowledge resources generated do not remain locked in individual people and projects.

Knowledge Transfer Within Projects

In developments in Denmark and Sweden where several developers share responsibility for public space (such as roads and lighting) it is required that they set up an association to plan this space, collectively. These organisations present an opportunity for sharing of ideas and innovation in terms of public services such as heat, energy and waste. This model was cited by two interviewees involved in the Western Harbour development in Malmö as being very useful in encouraging creativity and innovation (Interviewee #4; Interviewee #13). While collective area planning for shared space was deemed successful, in terms of innovation in the buildings themselves it was noted that the direct competition between developers tended to create a barrier to knowledge sharing on specific projects. Knowledge sharing between developers on a project was not considered normal practice (Interviewee #6).

When building in a large new development area it is in the interests of all developers to ensure the whole area is developed to high quality and will be desirable to buyers. Therefore, there should be incentives amongst developers working in the same project to focus not simply on their own building but also to support one another in contributing to the creation of a desirable area. Speaking about the Fullriggaren development in Malmö's Western Harbour, it was cited by one developer that working closely with other developers encouraged a productive competitive atmosphere in terms of building innovations as each developer wanted to perform well in comparison to the other but also to do something unique as part of their contribution to the sustainability of the area (Interviewee #4). This experience from Western Harbour indicates that, under certain circumstances, knowledge sharing on a project can be successful in driving building innovations. There may also be need for a culture shift amongst the industry in terms of viewing their individual buildings as part of a larger area 'story' centred on sustainability. The municipality could play an important role in creating this story

through area level plan development. Facilitating shared marketing and procurement as in the case of the Constructive Dialogue could assist with this (see Chapter 3).

Synchronising Projects

The ability to share knowledge within projects, as discussed above, is closely linked to the structure of the area's development plan. A key barrier to the sharing of knowledge within projects is the often fragmented development pattern of urban areas. In such cases an area ends up being developed one building at a time over a number of years making knowledge sharing between companies difficult as all the actors are not involved in the development at the same time. This can also lead to a lack of a cohesive story in the area in terms of sustainable building. The example of Ørestad in Copenhagen was brought up in interviews as a case in point. The area was developed in chunks and suffered from a lack of 'soul', making buildings hard to sell (Interviewee #10). Synchronising projects, such as was carried out for each generation of Malmö Western Harbour, not only opens up opportunities for knowledge sharing and creative competition but also benefits the area as a whole.

Integrated Planning Processes (IPP)

Architects and engineers were cited as possessing valuable knowledge stocks and creative competencies in relation to energy efficient building solutions. However, from discussions with these actors it was clear that these resources are not always being exploited to their full potential. In particular lack of communication between consultants was cited as a significant barrier to the optimisation of energy efficiency opportunities (Interviewee #11; Interviewee #14). A more integrated planning process was cited as a solution to such barriers. IPP requires the involvement of consultants very early on in the planning process and encourages the use of architectural engineering where both actors work simultaneously. Such a process requires a cultural change on the part of developers who must be willing to hire consultants earlier and consequently invest more in the design phase. Municipalities can assist in this culture change by establishing IPP as the norm, ensuring such a process is adopted in all municipal developments and encouraging it in development projects across the board.

Creating Continuity Over Time

Creating continuity between projects is also important. This was addressed in the structure of Western Harbour's incentive scheme whereby good performance was rewarded with additional plots in future developments. Here developers could be confident that knowledge being learned could be applied in the near future. Interestingly, it was noted by one developer that the offer of additional plots not only inspired them to be more ambitious but also provided them, as a developer, with leverage within their own production chain to motivate good performance from their contractors. The developer was able to use the promise of additional plots to guarantee the contractor future work based on the achievement of good results. This served to align the incentives of the construction contractors and labourers with those of the developer – and, ultimately, also with those of the municipality with regards to energy efficiency. Identifying the potential for such leverage points in the structure of projects can be important in overcoming barriers related to practice.

5.1.9 Bridging the Skills Gap

Constructing Capacity

The existence of a skills deficit in the construction workforce was highlighted as a barrier in Chapter 4. While, overall, not ranked as one of the most important barriers due to the fact that not all companies are affected, (this was predominantly an issue for companies which hire external construction contractors to carry out building work), in cases where the skills deficit

does come into play it can have a significant impact on the energy performance outcome of the building. Buildings have a long life-cycle and, once constructed, errors are very difficult and expensive to rectify; therefore, every building matters. Capacity development in the local construction industry was an important part Of Växjö's SESAC project to build a low energy multi-story residential low energy buildings and was cited as being 'crucial' to the success of the project (Johansson, personal communication, 1st August 2012). Analysis of the niches indicates that there are currently no programmes specifically targeted at the construction phase of building development; this is a gap that may need to be addressed.

The project managers at the municipality should be able to identify, through dialogue with the developers, the projects where construction quality may present a significant risk to the energy performance outcome and intervene to try and minimise this risk. The municipality is seen as a credible source of information, thus, seminars and educational materials provided by the municipality are generally well received by the industry (Interviewee #5). There are numerous resources available which address energy efficiency in construction to which municipalities can help connect developers and construction contractors. Options include:

- Developing partnerships: partnerships between developers and construction contractors have been identified as one approach to aligning the goals of the two actors in favour of energy efficiency (Interviewee #7; IEA 2010). The EU has published guidelines on partnerships in construction and the organisation Byggherrarna offers support in developing partnerships in construction in Sweden (Byggherrarna, 2012c; EC, 2009b).
- Technical support: Aalborg University runs the Danish Knowledge Centre for Energy Savings in Buildings which has its own telephone hotline as well as offering extensive online resources for construction professionals. While Lund University also offers training courses to developers (Byggherrarna, 2012a).

Providing a Municipal Consultant

Greater municipal involvement was seen by many interviewees as a necessary measure in driving energy efficiency, giving the municipality more influence over the project and helping to align the goals of municipality and the developer through close dialogue. While one angle on involvement frames the municipality as a facilitator of dialogue, encouraging a more integrated planning process through relations building between different actors, the other angle places the municipality in a more formal, technical role. One Danish engineer noted that at present while the municipality monitors the planning stage and requires figures and reports from the developer these interventions do not result in genuine quality assurance from the municipality (Interviewee #11). Such reports are perceived by developers and engineers as purely an exercise in paperwork and are not felt to constitute actual verification of their work.

Following up on similar comments, two additional interviewees suggested that it might be useful for the municipality to provide a consultant in the early planning stages to oversee the process and provide a proper review of the plans and calculations to ensure they are in-line with the municipality's expectations. Such a consultant has been provided in the Fulriggaren and Hyllie developments in Malmö and was deemed successful by those involved. Provision of a consultant would generate a mutual benefit as both parties have an interest in ensuring the planning and development process is efficient and the result is energy efficient. Providing a consultant would of course entail a cost which would have to be weighed against the benefits. One interviewee from the Danish side suggested that the costs could be shared

50/50 between the municipality and the developer as a way for both parties to ensure a good outcome as was the case in the Fulriggaren development (Interviewee #11).

5.1.10 Connecting the End-User

The user-phase was ranked as one of the top three significant barriers to achieving a good energy performance outcome in new buildings during interviews. Yet despite this very little attention has been given to end-user behaviour in new buildings in the niches. The following points discuss options for municipalities and developers, in collaboration with energy companies to connect with the end-user and optimise energy performance in this phase.

Calculation Methods

At present, the energy frames provided by the BBR19 and BR10 do not include tenant or user electricity but only energy required for building operations. With end-user behaviour influencing the final energy demand of the building it seems rational to ensure this area is being addressed if the overarching goal is an actual reduction in energy use and carbon emissions. Both the Constructive Dialogue and MBPS do include tenant electricity use in the energy frame. This forces developers to consider end-users behaviour in their designs and acts as an encouragement to install smart technologies or other behaviour modifying measures which are otherwise not strongly incentivised. While it may not be possible in many cases to mandate the inclusion of tenant electricity use (for example in cases of development on private land where municipal leverage powers are weak), signalling to developers the desired tenant consumption levels and requiring its monitoring and reporting alongside the mandatory reporting of operational energy consumption outcomes can be implemented through voluntary agreements. Although results are not guaranteed, such measures can still be valuable in bringing end-user consumption into consideration during the planning process.

Smart Solutions

Smart technologies were proposed during interviews with developers and energy companies as an innovative and viable approach to energy efficiency. Smart technologies make use of information technology in the delivery of energy services and include:

- Metering of energy consumption (including hot water) at a household and appliance level so as to allow for accurate billing and provide the consumer with financial incentives for energy efficiency to the consumer;
- Visualisation and communication of consumption patterns to the end-user; and,
- Steering mechanisms such as automated temperature and light controls.

Such measures are of interest from a developer's perspective as the investment in the technology can be financed by the energy company, as a cost on top of the standard costs of installing energy utilities, instead of by the developer themselves. Thus, the developer does not have to assume additional costs or risks in developing a building with a superior energy performance.

There remain, however, a number of barriers to smart solutions which were identified during interviews (e.g., Interviewee #15). Firstly, there is still a need for technology development to improve the functionality and competitiveness of smart solutions. Here, demonstration projects such as the Hyllie development in Malmö are invaluable. Secondly, such technologies require the role of the consumer to be redefined. Smart technologies demand a greater engagement of the end-user who is, traditionally, a passive consumer. Thus, there is a need to look at what drives consumers to play a more active role in energy management. Thirdly, the

regulatory system in Sweden and Denmark is not yet strong in incentivising the roll-out of smart solutions. There are opportunities for the municipality to work with energy companies and developers to overcome existing barriers.

Housing Associations

Two niches – Ballerup's Klima-Butler and CLICC in Malmö – have begun working with housing associations as an actor in the area of energy efficiency renovations and behaviour change. This concept of using the building as a focal point could also be applied to new builds. The housing association represents the interests of residents and presents a useful access point to the end-user. Through the housing association, priorities for the management of the building are decided and communicated to residents.

In a new building, energy efficiency can be established as an important element of the building's culture from the outset and information about how to optimise the energy performance of the building can be disseminated. If a building is fitted with smart technology, the housing association could be instructed on how such a system could be used as a tool to achieve good performance results (which may also amount to cheaper energy bills for residents). For example, the housing association may wish to make use of building level energy consumption data to monitor consumption levels and compare this with other buildings in the area; this information could then also be communicated to residents. Residents can also be educated on the most appropriate use of other energy efficiency features, such as HVAC systems, and norms with regard to indoor temperature and hot water use can be established.

Municipalities could support housing associations by providing trained personnel to raise awareness of energy saving behaviours or by providing training to association members to do so. They could also provide online tools and platforms, such as those used by CLICC, to engage residents directly with their energy consumption behaviours. Municipalities can work directly with the housing associations themselves and/or they could encourage developers to undertake this task before they hand over full responsibility for building management to the housing association. Where innovative systems, such as smart metering or weather responsive HVAC, have been installed developers could, for example, provide support to residents on how to get the best from their building in terms of energy performance.

Living Labs

One innovative way in which the building can be used as an access point to end-user energy consumption is through the concept of living labs. Living labs are a model for driving innovation and research and development processes, centred on the concept of user-based experimentation. In focusing on the users' interactions with technology, the living labs model lends itself neatly to the area of energy efficiency in buildings, where user behaviour can be instrumental in contributing to the design and success of technologies. The need for further testing of smart technologies was brought up during interviews. New developments could present an exciting opportunity to explore different approaches to energy saving from the end-user perspective and generate important knowledge on how to optimise user-technology interactions. Examples of the appropriation of this model for such purposes by municipalities can be seen for example in the City Lab Coventry in the UK (ENoLL, 2012), and the Skaftkärr Energi Living Lab in Porvoo, Finland (Nystedt, 2009). The Öresund Region has a strong high-tech industry making it a prime location for a living lab.

Living labs are not just useful in driving innovation but also in connecting issues related to practice with those related to the acceptance of innovations. One barrier identified in Chapter 4 was industry resistance to Passive Houses as a concept (Interviewee #11; Interviewee #12;

Interviewee #13). One of the foundations for this resistance was the fact that Passive Houses require end-users to interact in new ways with their building (a simple example being that they may not be able to open windows) – such changes were assumed to be something that end-users were not enthusiastic to accept. The roots of end-user resistance to Passive Houses, and methods to overcome them could be explored through a living lab approach.

One of the elements of the Skaftkärr project in Porvoo is the creation and involvement of the resident community early on in the project so that they have an input in the design of the project and a community culture centred on energy efficiency is established from the very beginning (Nystedt, 2009). Although requiring a new structure to the development process as traditionally residents are not involved until after building completion, such an approach could be invaluable in terms of integrating end-users into the energy system.

The living labs concept can be used as a framework to bring the different actors in the sector together to develop, test and share ideas and links to the suggestions of network development presented in section 5.1.2 of this chapter. In the example of Skaftkärr, the living lab network is managed by the municipal owned developer company Posintra who coordinates and promotes project activities and connects with new actors. It is possible that By & Havn could for example take on such a role in Copenhagen. Through systematic experimentation, feedback and knowledge sharing, new developments can become not simply static demonstrations of technologies in action but sources of relational capacity building, continual learning and development in the field of energy efficiency innovation.

6 Conclusions

This thesis sought to answer the research question of how municipalities in the Öresund Region can more effectively govern the property development regime so as to ensure that the energy efficiency of new urban developments is maximised?

In addressing Objective 1) this thesis visualises energy efficiency governance in the region within the conceptual framework provided by transition management (TM) theory. TM frames municipal spheres of action in terms of the landscape, regime and niche levels. Each level of the Öresund Region case is analysed with reference to the TM model. Particular focus is given to analysis of the niche level as this is the level in which municipalities are most instrumental.

The first overall conclusion to be drawn from the results of this thesis is that municipalities in the Öresund Region are already executing a very effective governance strategy for the promotion of energy efficiency in new urban developments. Analysis of the niches indicates that a number of tools for mobilising the industry and developing knowledge and relational resources within the local sector are being employed. At present these are focused largely on the design phase as opposed to the construction and operations phases. In terms of the constraining factor that they address, issues related to acceptance and motivation appear to be more comprehensively explored than those relating to practice.

The approach being adopted fits neatly into the TM model with municipalities working at all three levels to drive transformation. This is being done to positive, effect making the Öresund Region a leading example in terms of energy efficiency in new urban developments in Europe. Transition is however not a static state that can be reached but a dynamic process and despite strong governance, the levels of energy performance technically feasible in new buildings persistently fail to be realised. Property development functions as a complex sociotechnical system and the adoption of energy efficiency measures is reliant on the outcome of numerous interactions between different actors and stakeholders – each with their own, sometimes conflicting, interests. As a result energy efficiency in the sector continues to face a number of barriers which serve to limit the adoption and optimization of energy efficiency measures in new urban developments.

In addressing Objective 2) interviews with key actors in the region's property development sector were carried out in order to identify the critical barriers to the adoption of energy efficiency measures in the Öresund Region. From these interviews it was concluded that barriers related to acceptance, motivation and practice continue manifest in the regime; with the three most significant barriers being identified as *risk aversion*, *energy efficiency as a low priority in decision-making* and issues related to the *user phase*. Of course most barriers are heavily interrelated and the significance of some barriers varied greatly depending on the business model of the individual company, and the planning structure being employed. Importantly as the regime progresses some barriers will be overcome – this was evident in interviews in the case of suppliers as a barrier – while other will become more significant such as resistance to very-low energy buildings amongst consultants. These dynamics demand an iterative process of barrier assessment and policy adjustment on behalf of the region's municipalities.

In addressing Objective 3) the gaps identified in Chapter 3 and the barriers identified in Chapter 4 are brought together with themes from interviews and examples of best practice from beyond the Öresund Region to offer recommendations as to how municipalities can more effectively govern for energy efficiency in new urban developments are offered. Objective 3) ultimately serves to answer the overarching research question.

Firstly, barriers related to acceptance are addressed through improvements in dialogue processes between municipalities and developers (as well as other key actors), and the development and strengthening of industry and municipal networks. While good dialogue processes have been initiated in the region these were not yet being applied across the board. Also it was evident from interviews that not all actors knew how to work with these new processes and certain aspects relating to communication and trust were not fully developed. The development and strengthening of networks was also offered as tool for sharing information and experience in energy efficient development, and building up industry awareness and confidence surrounding such measures.

Secondly, barriers related to motivation are addressed through management of the different mobilisation approaches available. To maximize the impact of regulatory measures they must be designed so as to provide developers with certainty and must be supported by the identification and promotion of opportunities for industry learning and mutual benefit. As part of this the potential of energy companies to bridge the gap of broken agency is explored, as are opportunities for initiating cultural shifts in the local landscape through the development of city identities and creative communications. It is concluded that while structural (regulatory) mobilisation opportunities should be fully exploited such as the implementation of a robust follow-up system, it is important that these are delivered in a manner that is non-adversarial. By maintaining good relations between the municipality and developers, self-generated motivation and beyond compliance performance within the industry can be facilitated.

Lastly, barriers related to practice are addressed through suggested changes in the planning and development process. Firstly the need to ensure municipal institutions have the appropriate capacity in terms of knowledge and communications is emphasised. The need to restructure processes so as to facilitate knowledge sharing and learning within projects and from one project to another is then expanded upon. Thirdly options for targeting construction skills development and improving accountability during the construction phase of the development process; this was highlighted as an important barrier and a gap in the niches. Finally the necessity of acknowledging the end-user as an instrumental actor in the energy performance of new buildings is emphasised and possible methods of involving this actor are explored. These include the use of housing associations as an access point to residents, the introduction of smart technologies, the inclusion of household energy use in energy demand calculations, and the adoption of a living lab model as a framework for implementing, testing and learning about energy efficiency innovations as they are used in situ.

The Öresund Region has established itself both within Europe and globally as a leader in terms of governance for energy efficiency and sustainable urban development. The approach of the region fits well within the framework of TM – raising the floor in an already supportive national landscape through regional visions and targets, and supporting this with innovative municipal level projects and programmes to develop the capacity of the regional property development sector. Of course in continually driving progress in the regime there needs to be a continual assessment of the barriers and opportunities that arise in the wake of progressive changes. This thesis aims in part to contribute to this iterative process in offering regional municipalities feedback directly from the sector on their perception of the challenges being faced and the opportunities available to overcome these challenges. It is hoped that these observations will contribute to municipal governance endeavours in the Öresund Region as they continue their transition towards a more energy efficient and sustainable property development sector.

Personal Communications

Interviews

Arcari, Joachim (03/07/12), Project Manager, Botrygg Göteborg AB. Developer Group.

Edlund, Rasmus (19/06/2012) Project Manager, JM Sweden. Developer Group.

Edstrand, Mårten (11/07/12), Project Manager, Wihlborgs. Developer Group.

Grüner, Sannah (09/07/12) Energy Planner, Københavns Energi. Energy Company Group.

Ilsøe, Jacob (12/07/12), Energy and Sustainability Team Leader, Grontmij. Engineer Group.

Jensen Ingerslev, Karsten (06/07/12), Energy Expert, Cowi. Engineer Group.

Justesen, Rita (18/07/12), Project Manager, By & Havn. Developer Group.

Kall, Jacob (06/07/12), Project Manager, JM Danmark. Developer Group.

Moghtadai, Mehrdad (03/07/12), Construction Site Manager, Botrygg Göteborg AB. Construction Group.

Nevsten, Pernilla (06/07/12), Project Manager, HSB Skåne. Developer Group.

Ørsagor, Morten (12/07/12), Erik Møller Arkitekter. Architect Group.

Örtenvik Mattias (21/06/12), Sustainable City Malmö Project Manager, E.on Malmö. Energy Company Group.

Plambech, Carsten Pedersen (10/07/12), Project Manager, NCC Denmark. Developer Group.

Radisch, Niels (12/07/12), Energy Engineer, Ramboll. Engineer Group.

Sundkvist, Henrik (20/06/12), Project Manager Skanska Sweden. Developer Group.

Wikeborg, Mikael (26/06/2012), Head Architect, Wikeborg Arkitectur. Architect Group.

Informal Discussions

Augustsson, Tomas (02/08/12), Building Office, Helsingborg Municipality Sweden.

Christensen, Anne Marie Holt (13/08/12), Climate Strategist, Albertslund Municipality Denmark.

Edberg, Johanna (14/06/12), Environmental Building Officer Lund Municipality Sweden

Egetoft, Annette (Multiple occasions 2012), Special Consultant, Center for Environment, Copenhagen Stad Denmark.

Enarsson, Lisa (06/08/12), Stockholm Municipality Sweden

Herbertsson, Karina (16/08/12), Property Manager, Växjöhem AB.

Harboe, Casper (09/08/12), Project Manager, Energi Öresund/ Urban Transitions Øresund.

Jonhansson, Henrik (01/ 08/12), Environmental Controller, Växjö Municipality Sweden.

Karlshöj, Jan (27/08/12), Project Manager, Integration Between Sustainable Construction Processes (Interreg)

Kontio, Maija-Riitta (14/08/12), City Planning Office, Porvoo Municipality Finland

Lindholm, Karin (Multiple occasions 2012), Energy Advisor, Lund Municipality Sweden.

Mattson, Sofia (02/08/12), Environment Office, Helsingborg Municipality Sweden

Norling, Malin (Multiple occasions 2012), Climate Strategist, Malmö Municipality Sweden.

Paulin, Henrik (02/08/12), Building Office, Kristianstad Municipality Sweden.

Sørensen, Trine Keinicke (29/08/12), Environmental Planner, Roskilde Municipality Denmark.

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Appendices

Appendix 1: Table of barriers used during interviews

Barrier	Summary	Importance
Low priority in decision making	Energy efficiency as a desired quality gets overtaken by other considerations such as cost or appearance when designing.	
Risk aversion	There is still uncertainty surrounding use of new technologies and techniques which have not been extensively demonstrated – to be a leader is risky and thus business as usual prevails.	
Lack of information	Decision makers are not aware of the energy efficiency options available and the potential benefits of making good energy efficiency choices.	
Reluctance from business partners to change building practices	Resistance from other actors in the process such as construction contractors who see new methods as reducing workers efficiency and increasing their costs.	
Unrecoverable costs and 'broken-agency'	The problem that energy efficiency investments are often recovered by savings made during the use phase – developers make the investment and users see the benefit.	
Lack of consumer demand	House-buyers and other customers are not seen to value energy efficiency when making purchasing choices.	
Uncertainty around regulations and planning process	Confusion about what is required in terms of energy efficiency and what will be required in the future.	
Inadequate Enforcement of Regulations	The consequences of not meeting the energy efficiency demands of a contract are not sufficient to drive compliance thus undermining the value of the contract.	
Reliance on suppliers	Supply chain is not mature enough to provide the necessary materials for large scale developments involving innovative energy efficiency measures.	
Skills Gap	Building workers are not trained in energy efficient techniques and technology installation leading to efficiency losses as a result of workmanship.	
Lack of learning	Project based work means different actors are involved each time in new projects so that learning from one project is not necessarily carried into the next	
User phase	Energy efficiency is not optimised due to improper use/maintenance of internal systems and high energy demand from users.	

Appendix 2: Interview briefing

Introduction

I am carrying out this research as part of my thesis which forms the final requirement of the MSc Environmental Management and Policy course, run by the International Institute for Industrial Environmental Economics (IIIEE), Lund University. This research is being carried out in connection with Energi Őresund who are a regional forum consisting of 15 partners from Denmark and Sweden including municipalities, academic institutions and energy companies. This research will feed into Activity II of Energi Őresund's work – Energy for Low Energy Buildings.

Aim of my research

Municipalities in the Őresund region have very high ambitions in terms of the energy performance of new buildings. However, despite the political will and the technical feasibility of near-zero energy buildings, new developments in the region are not achieving their potential. The aim of this research is to investigate how municipalities in the Őresund region can work more effectively with the other actors in the development process to ensure that high energy performance ambitions are maintained throughout the process and finished buildings perform to the highest achievable standard.

Aim of the interview

The aim of these interviews is to gain the perspective of companies which have been involved in new developments in the Őresund region. The interview is designed to identify what the actors involved see as the key barriers and drivers to achieving the highest standards of energy performance in their developments. The interview will be semi structured following the themes laid out below, however additional questions may be added and additional comments are always welcomed.

Structure of the interview

1) Mapping the Development Process:

I will ask you discuss how your company works with the different actors in the planning and development process. Which actors do you communicate with and have influence over? Which actors have influence over you? What are the mechanisms of this influence?

2) Barriers and Drivers:

I will present you with a table of barriers and drivers for energy efficiency in new building developments which have been collected from relevant literature. You will be asked to add to the table any additional barriers or drivers you feel are significant. I will then ask you to rank which you feel are the most important to your company and discuss these in more detail.

3) Opportunities:

In this final stage we will discuss the perceived benefits and limitations of current municipal governance in the planning and development process. If you have worked with Miljöbyggprogram SYD or Bygga-bo-dialogen we can discuss your experiences of these. We can discuss how you think municipalities might work better to support your industry in achieving the highest possible energy performance standards, and what might be most useful from them in terms of overcoming the barriers and triggering the drivers identified above.

Many thanks in advance for your participation,

Rachel

Appendix 3: Energy Öresund Project Summary

The project contributes to fulfilling: Sustainable economic growth

Lead Partner: Lunds Universitet - Öresundsuniversitetet
Partners: Albertslund kommune, Albertslund Varmeværk, Amager Forbrænding, Ballerup kommune, Energikontoret Skåne/Kommunförbundet Skåne, Gate 21, Lunds universitet/IIEE, Kristianstad kommun, Københavns kommune, Lunds kommun, Malmö stad, Vestegnens Kraftvarmeselskab (VEKS), Sustainable Business Hub, Øresundsuniversitetet/RUC, Aalborg universitet København.
Project Period: 01 jan 2011 – 31 dec 2013
Total Budget: 1 256 083 EUR
EU Grant: 628 041 EUR

The climate challenge is a primary issue for the Øresund region. If CO2 is increasingly emitted on the Danish side, the environment on the Swedish side will be affected and vice versa. Thus, the climate problem must be solved through a coordinated effort across Øresund. In order to reduce CO2 emissions, we must make a shared effort to replace dependence on fossil fuels with increased deployment of bio fuels, wind energy, sun energy, and geothermal energy.
Strategic energy planning is about coherent planning for larger geographic areas—across municipal, regional and national boundaries. Strategic energy planning implies that public actors, focusing on mapping energy resources, and energy-saving potentials organize how the energy supply can be developed so that the energy is used as effectively as possible and the potential for conversion from fossil fuels to renewable energy is, at the same time, is optimally exploited.

Strategic energy planning is a cooperative theme for Energy Øresund. In the project, municipalities and energy companies across Øresund implement concrete demonstration projects, which address the challenges connected with integrating renewable energy in the existing energy system. This sheds light on how new city areas with low energy needs can ideally be supplied. Where relevant, private companies and research institutes must also be involved in order to contribute to creating innovative solutions and new models for public/private collaboration, which can further sustainable economic growth in the Øresund region.

Along with the implementation of demonstration projects and as a superstructure, an Øresund-regional forum for idea development and collaboration will be developed, focusing on strategic energy planning, where the challenges connected with cross-border initiatives in the energy area will be addressed.

The partners in Energy Øresund share a vision of the Øresund region as the first CO2 -neutral region in Europe, which—through concrete and innovative solutions—creates growth, develop the region, and visibly strengthen cohesiveness. The vision is politically anchored in the Øresund Committee's development strategy (ØRUS). (Harboe, 2012)

Appendix 4: Urban Transitions Øresund Project Summary

The project contributes to fulfilling: Promote sustainable economic growth
Lead Partner: Lunds Universitet
Partners: Malmö Högskola, Sveriges Lantbruksuniversitet Alnarp, Aalborg Universitet CPH, Københavns Kommune, Malmø Stad, Lunds Kommun, Ballerup Kommune, Roskilde Kommune, Roskilde Universitetscenter, Copenhagen Business School, Copenhagen Clean Tech Cluster, Kunstakademiets Arkitektskole (København)
Project Period: 01 sep 2011 - 31 aug 2014
Total Budget: 2 662 846 EUR
EU Grant: 1 331 422 EUR

The Øresund Region is to be northern Europe's border regional powerhouse for sustainability, innovation and green growth and to become CO2 neutral within 15-20 years. A number of municipalities and regions have, separately and from different perspectives, been engaged in developing and implementing strategies and plans to this end. Therefore, the goal is to promote sustainable growth in the Øresund Region by gathering regions, municipalities, universities and businesses across Øresund in cross-border cooperation.
Urban Transition Øresund will promote sustainable urban development of residential and office buildings in the Øresund Region. This will be accomplished by giving municipalities, regions and companies in the Øresund Region planning methods and innovation skills geared towards adaptation and elevation of the sustainable urban development in the region.

A new, practical customized working method has been developed based on visualising development of physical and material models. The method will be used in case studies from across the Öresund Region. Examples of case studies are: Västra Hamnen, Malmø; Nordhavnen, Copenhagen; Brunnshög, Lund; and, Ballerup Town Center and Røde Port, Roskilde. Specific case themes may be: What has been done to promote green and dense urban development? How does one get projects facilitating lower consumption of energy funded? How can we renovate most sustainably?

The working method will be analysis of case studies – pilot projects, from which essential lessons are drawn and subsequently tested on other projects in order to extract unique, general lessons. The workflow will use cooperation and implementation models, which both provide the framework for the process and are simultaneously developed in the process. The total unique learning achieved in the process will form the basis for new, joint models and tools for the Øresund Region.

By making repeated inquiries, optimizations and comparisons based on different themes on existing and planned buildings in the region – supplemented with knowledge from the region's universities and the innovation power of the region's clean tech sector, developer and construction industries – the project will result in developed tools, models and concrete pilot projects for Planned Processes, Guidelines for Construction and Financing Models.

Of particular focus is the project development process is ensuring that the project retains a continuing life in the form of a communications module and the Urban Transition Forum after the project period ends. This will ensure continued development of the Øresund Region as a full-scale laboratory for sustainable urban development.

Results will be disseminated through workshops, seminars, conferences, meetings, reports and websites and maintained through the development of a course at Aalborg Universitet CPH. Results will also be anchored in the relevant administrations in participating municipalities and the private sector. (Harboe, 2012)

Appendix 5: National Energy Frames Requirements Under the EPBD

Denmark Energy Performance Framework for dwellings BR10	**Sweden Energy Performance Framework for dwellings (Climatic Zone III) BBR19**
Standard Class - 52.5 kWh / m² per year plus 1650 kWh/ year divided by the heated floor area	Standard Class – non-electrically heated 90 kWh/m2 electrically heated 55 kWh/m^2
Low Energy Class - 2015 30 kWh / m² per year plus 1000 kWh/ year divided by the heated floor area.	Low Energy Class – non-electrically heated 67,5 kWh/m^2 electrically heated 41,25 kWh/m^2
Building Class 2020 - 20 kWh / m²/ year	Very Low Energy Class – non-electrically heated 45 kWh/m^2 electrically heated 27,5 kWh/m^2
Denmark Energy Performance Framework for non-residential	**Sweden Energy Performance Framework for non-residential (Climatic Zone III)**
Standard Class - 71.3 kWh / m² per years plus 1650 kWh/ year divided by the heated floor area	Standard Class – non-electrically heated 80 kWh/m^2 electrically heated 55 kWh/m^2
Low Energy Class - 41 kWh / m² per. years plus 1000 kWh/ year divided by the heated floor area.	Low Energy Class – non-electrically heated 60 kWh/m^2 electrically heated 41,25 kWh/m^2
Building Class 2020 - 25 kWh/ year	Very Low Energy Class – non-electrically heated 40 kWh/m^2 electrically heated 27,5 kWh/m^2

(The Danish Ministry of Economic and Business Affairs, 2010) (Boverket, 2011)

Appendix 6: Energy Frames for Niches

MBPS (including household electricity use)	**Constructive Dialogue** (including household electricity use)	**MBA** (not including household electricity use)
Class A Passive 50 kWh/m2/year purchased energy	120 kWh/m2 GOOD temp/ year	Residential - Low Energy Class - 2015 30 kWh / m² per year plus 1000 kWh/ year divided by the heated floor area.
Class B Minienergihus - 70 kWh/m2/year purchased energy		Non-residential - Low Energy Class - 41 kWh / m² per. years plus 1000 kWh/ year divided by the heated floor area.
Class C - 85 kWh / m 2/ year purchased energy		
Class A - Non-electrically heated 80 kWh / m2 per year		
Class B - Non-electrically heated 90 kWh / m 2 per year		
Class C - Non-electrically heated 100 kWh/kvm/ per year		

(Fossum, 2009) (Malmö-Stad, 2012a) (Copenhagen-Kommune, 2010)

Appendix 7: Descriptions of Key Actors in the Property Development Regime

The Developer

In Sweden the developer is referred to as *byggherre,* or *bygherren* in Danish, and is the actor accountable for ensuring regulations and conditions of contract are met. The developer is the actor with the vision for the development and their role is to change the land use of a property by constructing buildings (Kalbro, 2000). They will finance the purchase of the land and oversee the design and construction of the buildings. In some cases the developer will also remain in charge of the running and maintenance of the building once completed such as is the case for HSB and Botrygg, whereas in other companies such as JM and Skanska this responsibility is handed over through the sale of units (apartments or offices) to another actor or set of actors such as a housing association. The developer is also the actor who markets the building to potential buyers and leasers. In the context of this thesis the role of developer is dominated by private property development companies as these are the actors involved in large-scale commercial and residential developments in the region; however the developer can also be a non-profit, a cooperative or a single individual.

The developer is the central decision maker in the project and in theory the energy efficiency ambitions of the building rest in their hands. In the case of the developer as a large company, there are particular implications in terms of energy efficiency. Large development companies such as NCC and Skanska will be running multiple projects simultaneously and therefore try to take advantage of economies of scale. Most companies of this type will have a building template of sorts which they try and develop fairly uniformly as this is an efficient business model. This means that at the individual project level, project developers, who are the actors liaising with the municipality on behalf of the company, may not always have much say over the energy efficiency specifications of a development. The ability of the municipality to influence performance beyond regulations is not only reliant on their relationship with the project manager, but also on the project manager's ability to communicate the value of innovative projects – which diverge from the template – within their own company. Additionally, as Figure 7 illustrates, the developer does not function independently of the wider system and thus their decisions are also influenced by the demands of the market and other stakeholders as well as the work of external consultants and construction contractors.

The Architect

The architect's role is to design the building. This process encompasses decisions relating to the structure, form and materials and thus involves working closely with aspects relating the energy efficiency. Architects can get involved in a project via competitions in which they submit a design usually based on a simple area level plan, or alternatively they can be commissioned by a developer to work on a specified project. It was noted that the architect's ability to creatively work with energy efficiency significantly decreases the later in the design process they are included. Most developers do not have in-house architects but will hire external architectural consultants; although some companies may work consistently with the same consultant on several projects. The architect works from the specifications – including the budget limits – set by the developer. A better energy efficiency performance tends to result in higher upfront costs which can be difficult for architects to justify to developers and so generally the architect has little power to drive energy efficiency beyond the specified levels. This is not however absolute and the level of influence of the architect can vary depending on the particular relationship between the parties. Architects can be more aware of the creative

possibilities for incorporating energy efficiency into the design than developers who are largely from a project management or engineering background. This specialised knowledge can be employed in some cases to influence clients; for example in competitions the architect has an opportunity to sell energy efficiency as part of their design. Conversely it is also true that not all architects will necessarily have experience working with very low energy standards which can require significant specialized knowledge. Thus in some cases lack of knowledge could limit the energy efficiency of designs, however it was assumed that most architects do have the capacity to work with energy efficiency to the degree being currently demanded by developers.

The Engineer

Engineers are normally hired by the developer as external consultants to carry out two main roles. Engineers will be called upon both to assess the structural viability and utility of the architect's designs, and to work to integrate the heating, ventilation, air conditioning (HVAC) and other internal systems such as elevators into the building. This latter role is the most important in terms of energy efficiency as the choice of system can have a significant impact on the final energy demand of the building. The way in which the system is integrated into the building – for example choices on sizing and placement of installations – can also impact the optimisation of that system within the building. Engineers, like architects are limited in their ability to influence energy efficiency by the budget specifications of the developer. The use of life-cycle-costing (LCC) is crucial here in order to communicate to developers the value of more energy efficient systems. This is of course a much more powerful argument in the case of developers who maintain ownership and maintenance of the buildings post completion. Engineers are also usually the actor to carry out the specific energy demand calculations (in line the BBR19 and BR10). The data sets which are input into the calculation tool will shape the estimated energy demand of the building. Depending on the accuracy of the data, the calculation can ultimately play a role in whether or not the building meets expectations.

The Energy Company

Energy companies are not traditionally considered as instrumental actors in determining the energy performance of developments (Ko & Fenner, 2007). Legally the municipality must ensure during the early planning stages that energy facilities will be provided to new urban developments so normally the energy company will work with the area level plan to engineer the provision of energy services to the development but this is focused on provision of basic services rather than advancement of energy performance. However, energy companies have a number of competencies and 'products' on offer which can impact energy efficiency; these include communication channels with end-users, pricing models and provision of smart technology solutions. Also, being often in a position of monopoly in an urban area they can have negotiation power in terms of the choice of energy system e.g., whether or not a development is connected to a DH system; this can significantly impact energy efficiency. The provision of these energy services is funded by the energy companies themselves via end-users rates. Traditionally energy companies are not involved in the design phase of developments and do not work directly with developers except in the final stage when buildings are connected to the chosen system. However, with the growth of smart technologies and microgeneration technologies a more collaborative relationship between developers and energy companies may be required if such solutions are to be integrated into developments.

The Construction Contractor

The construction contractor is in charge of recruiting a workforce of labourers and managing the construction of the building on site. Construction can either be a subsidiary of the development company – for example in the case of Skanska and NCC – or can be hired on a contract by the developer. Currently construction contractors are rarely involved in the design

phase of developments. The construction phase can have a significant direct impact on the final energy efficiency of a building. Low energy buildings can use different materials and require different techniques such as precise sealing around windows and the minimisation of thermal bridges. Importantly such energy efficient measures can require greater time – particularly if labourers are not used to working with them – creating a pressure on the budgets of contractors. This has the potential to result in a conflict of interests between the contractor and the developer where the contractor prioritises costs over energy efficiency outcome. In cases where the construction contractor is in-house there is a greater alignment of incentives as both construction and project development and working towards the company goals. Where contractors are hired, there is the risk that the importance of energy efficiency in the development will not be sufficiently conveyed and workmanship will as a result not be as precise as needed to optimise the building's design. The developer, being the actor responsible for fulfilling regulations and delivering to the end-user tends to be the one to bear the legal and financial costs of errors, thus there is an issue of accountability, or lack thereof, on the part of the contractor (Byggkommissionen, 2002). Developers often hire a commissioner to oversee the construction phase but construction is characterised by many quick decisions being made on the ground which makes it difficult for developers to maintain control.

The End-Users

The end-user can be divided into two sub-groups; those who work on operations and maintenance in the buildings and those who purchase or lease property within the building. End-users affect the energy efficiency both indirectly and directly. Indirectly the desires and demands of the end-user drive the market for energy efficient buildings and heavily influence developers; ultimately developers do not want to build a product that customers are not willing to pay for. Directly, end-users affect the energy demand of a building through their energy consumption behaviour. Operations and maintenance staff also play an important role in optimizing the efficiency of internal systems; thus their knowledge about the installations in an important factor. In cases where the developer maintains ownership of the building post completion, they can continue to have influence over end-user behaviour through the structure of energy billing procedures. In cases where ownership is handed over to a housing association (*bostadsrättsförening* in Swedish, *andelsboligforening* in Danish) this is not the case. How the housing association manages the billing of energy services and how energy efficiency as a priority is communicated to the end-user has the potential to influence energy performance The housing association structure whereby a board of members made up of selected residents manages the running of the building, offers some interesting opportunities for linking developers and municipalities to end-users. This is explored in Chapter 5.

Appendix 8: Description of Niches in the Öresund Region

Inspirational Catalogue (Inspirationskatalog) Copenhagen

Written in partnership between the municipality of Copenhagen and the municipal owned energy company Køpenhavns Energi, the Inspirational Catalogue communicates the municipality's desires with regards to the energy performance of new developments in the city. The catalogue is intended to support developers wishing to build in the new urban areas of Copenhagen in achieving the requirements laid out by the low energy area zoning and also to encourage beyond compliance performance. It has been designed to inspire and inform developers, architects, engineers and contractors by providing recommendations on the technical and process related elements of energy efficient building as well as case studies of good practice from Copenhagen city. Another important objective of the catalogue is to promote the option of DH as the optimal heating choice. The Inspirational Catalogue does not simply focus on the technology aspect of energy efficiency but also dedicates a section to design and construction processes, discussing how a more integrated planning process, can help contribute to the delivery of innovative and cost effective low energy buildings.

Proposed Energi Öresund Green Building Guidelines

Energi Öresund are in the process of developing a set of Green Building Guidelines for municipalities. These seek to develop further the knowledge resources of the region and support municipalities in driving energy efficiency and renewable energy in new urban developments.

Constructive Dialogue (Det Goda Samtalet) Malmö

The Constructive Dialogue is one of a set of initiatives developed under the Swedish national *Bygga-Bo-Dialogen* programme. The vision of Bygga-Bo-Dialogen is to create a 'sustainable building and property management sector' in Sweden by 2025 in line with the objectives of the Miljömal programme (Bygga-bo-dialogen, 2007). This is to be achieved through voluntary agreements made between private actors, and government bodies as opposed to regulatory measures. The first agreement was signed in 2003 by a total of 31 companies and 4 municipalities as well as the Swedish Environmental Protection Agency and the Government. Efficient use of energy is one of the programmes three priority areas alongside a healthy indoor environment and efficient use of resources. While Bygga-Bo-Dialogen is a national level programme, it is practiced at the municipal level by seven municipalities of which Malmö is one. (Bygga-bo-dialogen, 2007)

The objectives of the Constructive Dialogue are to facilitate close cooperation between developers and the municipality, and also between developers themselves as a method of stimulating creative solutions, raising sustainability ambitions and lowering the costs of building production in new urban developments making energy efficient building more appealing to developers. The dialogue sets clear sustainability goals one of which is the achievement of a set energy frame which includes household electricity use (see Appendix 6). These goals take the form of voluntary agreements made between the parties involved. The dialogue aims to make links between quality, costs and energy efficiency so as to align the goals of the municipality with those of the developer. For example, the use of common marketing and procurement is being employed as this can help cut costs for developers and speed up the delivery of projects. The tool uses the method of *communicative planning* which centres on the development of dialogue and the facilitating of knowledge transfer between involved parties (Reimer, Nilsson, McCormick, & Larsen, 2012). Communicative planning is an academic approach which seeks to theorise the inter-personal relationships between actors in the planning arena, approaching planning as 'a decision-making process involving a variety

of actors communicating, negotiating, bargaining and arguing over the 'right' way forward' (Jones, 2002). Through regular meetings over a long period of time (up to two years) the municipality is able to build and maintain a relationship with developers. This enables them to keep connection to the project and guide it more effectively. Since it began in March 2004, the programme has been used by Malmö municipality in the planning of the Flagghusen development in Western Harbour in which thirteen property owners have participated. (Malmö Malmö-Stad, 2012a)

Star Meetings Copenhagen

Copenhagen has a initiated a process called 'Star Meetings' where developers together with all the relevant departments of the municipality can take part in a joint planning process at the early stages of the development. This aims to enhance communications between developers and the municipality but also between municipal departments so that synergies can be taken advantage of and the planning approval process can be as smooth as possible. This relations building tool focuses on the initiation of dialogue with developers and on the development of institutional capacities within the municipality through improved internal communications.

Low Energy Zoning (Lavenergiområder) Copenhagen and Roskilde

Under specific provisions in the Danish planning and building legislation Copenhagen and Roskilde municipalities have been able to designate city areas as low energy areas. Low energy zoning requires that these developments meet the lowest energy class which is at present the BR10 Building Class 2015 (normally a voluntary class); developments taking place after 2015 will be required to meet the Building Class 2020. In Roskilde the municipality requires that DH connection must be carried out where possible, but where DH is not an option buildings must be developed as low energy buildings. In Copenhagen all urban areas involved in the succession plan for urban development are included within the low energy zone. Within designated low energy areas the DH connection mandate given under the Heat Supply Act has been waivered so as to allow developers the possibility to choose alternative systems which may be more efficient for very well insulated buildings. Copenhagen and Roskilde do not have stocks of municipal owned land at their disposal and thus they do not have opportunities to leverage developers through contracts thus low energy zoning is very important in providing the municipality with powers for structural mobilisation.

Environment in Building and Construction 2010 (Miljø i Byggeri og Anlæg) Copenhagen

The Copenhagen Environment in Building and Construction (MBA) is a set of mandatory environmental requirements for new buildings and renovations which apply to all developments in which the municipality is the owner or contractual user. They also apply to developments which are supported by the municipality such as in the case of social housing. In addition they are designed to offer guidance and inspiration to private developers although they have no powers of mandate in this case. In terms of energy efficiency the MBA requires that all buildings meet the current low energy Building Class 2015. The MBA is very prescriptive requiring specific *U values* for windows as well as specifications for lighting, internal systems and connection to the gas grid for cooking fuel and DH for heat and hot water where feasible. By driving high standards in municipal buildings the MBA provides developers, architects, engineers and construction workers with experience of Building Class 2015 and thus helps develop the knowledge resources of the industry. (Copenhagen Copenhagen-Kommune, 2010)

Environmental Building Programme South (Miljöbyggprogram SYD) Lund and Malmö

Miljöbyggprogram SYD (MBPS) is an internet based platform which functions by standardising the energy efficiency (and other sustainability) requirements being inserted into contracts of sale of municipal land. The underlying aim of the programme is to enable Malmö and Lund municipalities to achieve the goal of 'a good build environment' as established by *Miljömal (*the specific objectives of Miljömal are to reduce the resource intensity and environmental impact of the property development sector within the two cities, with a particular focus on climate change mitigation). In terms of energy efficiency the program sets three classification levels – A (best practice), B (good choice) and C (baseline). These classifications specify energy frames which are due to be updated when national regulations tighten in 2015 (see Appendix 6 for details). Classification C is the minimum required to build on municipal land but still represents higher standards than the BBR. Beyond this developers can then choose to raise their ambitions voluntarily to achieve B or A standards if they wish. In the case of non-municipal land the programme is still used to convey the municipality's desires, and voluntary agreements based on the same classification system are used. The drawing up of contracts also serves to encourage a more communicative approach than traditional tendering processes. (Lund Municipality, 2009)

Once the building is completed, developers use the online platform to report the outcomes of the project. Classification is awarded in the form of 'rosettes' which illustrate the initial ambition and the operations results (results must be submitted within 24 months of the building going into service and are verified by the municipality). These rosettes can then be used in marketing and communications by the developer. Best practice cases are also be given the opportunity to present their project on the website. If a building fails to meet the ambitions of the contract the project receives a fail grade which is visible on the project website and the municipal department in charge of land allocation will be notified. This may jeopardise future tenders made by the developer; the threat of being 'black-listed' if the final outcome fails to meet the requirements of the contact enhancing the mobilisation power. (Lund Municipality, 2009)

The Generations of Western Harbour Malmö

Malmö Western Harbour describes itself as a 'national example of sustainable urban development' and has established itself as a niche within which a number innovative projects have been pioneered (Malmö Malmö-Stad, 2012a). The developments in Western Harbour have been executed as a sequence of generations. The first generation at Western Harbour was the Bo01 development (the ecovillages (*ekoby*) developed outside of Malmö in the 1990's are often referred to as the first generation of sustainable building in Malmö, however this section is only discussing the generations of the Western Harbour development and thus refers to Bo01 as the first generation) (Malmö-Stad, 2012d). Bo01 was designed as an ambitious demonstration project and developers were given an extensive 'quality programme' detailing environmental and quality requirements. The niche demonstration projects in Bo01, which took place with the support of funding from the Swedish government (the City of Malmö received 250 million Swedish Kr. - 25 million under the Local Investment Programme)., allowed for developers to experiment with more expensive solutions and gave them the freedom to take greater risks (IEE, 2007) Although the energy demand of buildings turned out to be significantly higher in practice than was estimated, Bo01 still provided a testing ground for several innovative buildings in terms of energy efficiency technologies and served as an valuable learning step (Nilsson, 2003). As part of the Bo01 project the municipality also offered as an incentive for ambitious performance, the promise of priority placing in the allocation of plots in future Western Harbour developments.

Western Harbour's so called second generation of sustainable urban design is that of the Flaghusen development or Bo02. While Bo01 was designed as a demonstration project, the

aim behind Flagghusen has been to streamline down somewhat the sustainability criteria to those that are most cost effective in a bid to standardise solutions so that volume and repetition can be achieved (Dalman, Månsson, & Hansson, 2010; Malmö-Stad, 2012b). The rationale behind this process being that such an approach will generate the most benefits for society in the long run (Malmö Malmö-Stad, 2012a). The third generation is that of the Fullriggaren development or Bo03. With the development set to be the largest assembly of passive and low energy houses in Sweden, this generation aims to build on the experiences of Bo01 and Bo02 to continue to drive sustainability (Malmö Malmö-Stad, 2012b).

E.ON Sustainable Cities Malmö

Hyllie is a new urban development district in Malmö, located along the train line between Malmö Central and Copenhagen making it ideal for Öresundcommuters. In Hyllie private energy provider E.ON has been working in cooperation with Malmö municipality, technology developer Siemens and VA SYD water and sewerage to provide 'smart' solutions to new developments A number of new energy management solutions are available under the term 'smart' e.g., use of information technology to monitor and communicate in real time the energy consumption of a building,; use of automated heating and ventilation systems which respond to atmospheric changes ensuring rational use. This can assist energy providers in managing their resource and encourage behaviour change amongst consumersThese solutions will contribute to an agreement made between E.on and Malmö which indicates that the energy supply in the district will consist of 100 per cent renewable or recycled energy by 2020. The project has been supported by SEK 47 million funds from the Energy Agency and aims to make Hyllie a global showcase of sustainable urban development. Most significantly this is not a municipal lead project but is a concept developed by E.ON and implemented in partnership with the municipality and other companies. By working closely together technology companies, developers and energy companies can design such new energy management solutions into buildings. These solutions connect users to the energy consumption of their buildings, and connect these buildings to the wider electricity infrastructure through smart metering and communications technologies. These linkages allow for the incorporation of energy efficiency into the business models of the energy company and create incentives for both consumers and the energy provider which are aligned in favour of energy efficiency.

Climate Living in Cities Concept (CLICC) Malmö

CLICC is pioneering a method for reducing carbon emissions amongst the public by addressing the carbon footprint of citizens as household occupants. It is this qualifying statement that renders CLICC applicable to this thesis. Currently the CLICC project is collaborating with two residential housing associations to access residents, using the home as a demonstration platform to reach citizens and work with them to reduce energy consumption and carbon emissions. CLICC trains *klimatcheacher* or climate coaches to build relations with residents and inform them about how they can save energy and money through changes in behaviour. Residents are also able to calculate their carbon footprint through the Climate Living web-based tools. (Malmö Malmö-Stad, 2012c)

Climate Butler (Klima-Butler) Ballerup

This project forms part of Ballerup municipality's communication strategy. It aims at creating a dialogue with the public and encouraging their participation in urban planning processes. Appointed Climate Butlers have the role of visiting people at their houses and engaging them with energy efficiency issues. They hand out energy saving devices, offer demonstrations of energy efficiency technologies and share information through discussion. These visits are coordinated with the housing associations of the building. The project is very much focused

on developing genuine relationships with residents rather than arms-length provision of information. Interestingly, from the perspective of this thesis, Ballerup intend to use this programme as a starting point for resident involvement in regenerations projects. Through participation in working groups it is hoped that residents can contribute to the generation of ideas for their building and that this will contribute overall to better energy performance in the developments. (Reimer et al., 2012)