

# **Innovation policy for transition towards Sustainable Renovation in Sweden**

*A Case Study within the OECD Project  
on System Innovation*

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## Foreword

Over the past few decades, innovation policy has seen a gradual shift from primarily addressing rather specific development aims, of typically a technical nature, towards addressing the performance of the overall innovation system as such. The ability of this innovation system to address societal challenges in their very broadest sense, typically under the heading of sustainable development and involving a spectrum of stakeholders well beyond the traditional sense of R&D actors, finds its conceptual framework in the notion of “system innovation”.

VINNOVA, as the Swedish national innovation agency, finds itself in a key role when the Swedish state and society at large seek to find innovative solutions to grand challenges such as an ageing population, increasing health care costs and the need for sustainable housing. In 2011, VINNOVA launched its programme *Utmaningsdriven Innovation* (Challenge-driven Innovation) to step up its efforts in providing solutions to some of these.

The current report aims at increasing the understanding for how an innovation agency may contribute in these complex processes. It addresses the latter of the few examples mentioned above as it explores the need for a fully new approach when renovating and upgrading the large-scale suburban apartment areas – present in many European countries - built from the 1950s through to the 1970s. (In Sweden labelled “the Million Programme” from the Swedish government’s 1960s pledge to construct a million new dwellings in a decade). Doing this requires a rather broad knowledge of specific sectors of society, often beyond the typical level for an innovation agency, as well as the understanding of a wide spectrum of stakeholder viewpoints. The report at hand should therefore be seen as part of a learning process and not primarily as an end in itself.

The report is the VINNOVA contribution to an OECD project aimed at exploring the concept of system innovation and supporting the efforts of national innovation agencies in formulating their roles in this process. Insofar, the current project places itself in a tradition of OECD initiatives providing decisive impetuses for Swedish innovation policy.

At VINNOVA, the report has been prepared by Liselott Bergman (project leader) and Lennart Stenberg with contribution also from Karla Anaya-Carlsson, all in the Analysis and Evaluation Department, Operational Development Division. The team has greatly benefitted from discussions with colleagues in other departments at VINNOVA. The broad scope of the report has also implied a strong need for interaction with a broad range of stakeholders and several governmental agencies. This pertains especially to the Swedish Energy Agency (Energimyndigheten), Formas, the Swedish Research Council for Sustainable Development and the KTH Royal College of Technology. VINNOVA is grateful for their contributions to the report and their scrutiny of drafts of it. Needless to say, the responsibility for the content of the final report rests with VINNOVA.

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## Summary

The overall aim of this VINNOVA-case study is to explore the usefulness of the conceptual framework of System Innovation for the development of innovation policy and measures in Sweden. The report is the contribution of the Swedish Governmental Agency for Innovation Systems, VINNOVA, to an OECD effort to concretise and define what system innovation implies for the innovation policy community today.

Sustainable renovation of multi-family residential areas built during the 1960s and 1970s in Sweden, the so called *Miljonprogrammet* (The Million Programme), has been studied as an example of a system transition using the System Innovation conceptual framework, with the objective to explore and identify the role that research and innovation policies and measures have played so far in this transition and to reflect on how their contribution could be enhanced and boost the momentum of a transition.

Renovation of the *Miljonprogrammet* residential areas is becoming increasingly urgent and represents a major window of opportunity for the development of more sustainable cities in Sweden in social, ecological, and economic terms. As the physical deterioration of the *Miljonprogrammet* buildings proceeds, some degree of renovation will be required to address the most pressing needs. To the extent that renovation will stop at this, the window of opportunity for a transition towards sustainable renovation will gradually close.

The transition towards sustainable renovation is still in a very early phase and it is by no means certain that a full-scale transition towards sustainable renovation will occur. There are still very few examples of truly sustainable renovation projects in Sweden. No extensive, co-ordinated, large-scale policy initiatives have yet been taken and at present, there are no clear indications that a take-off in transition is imminent. Despite great need, an obvious market and the potential for innovation in this area, the pace and depth of renovation is much slower than what would be desirable.

Major bottlenecks are suitable incentives, financing models and arrangements. The renovation of *Miljonprogrammet* housing highlights the need to understand where benefits arise and to find approaches for co-financing. This requires an understanding of where the public benefits from renovation occur, both in the short- and the long-term. From a systems perspective, it is crucial to also understand the long-term value of investments in social innovation and in measures to improve the attractiveness of housing and residential areas. It would be fruitful to find ways to both follow up investments and to measure their direct and indirect effects, which show how social investments and investments in improving the attractiveness of housing have a clear contribution to growth and competitiveness in the long-term.

Another major aspect of accomplishing sustainable renovation is drastically reducing energy consumption, where a singular focus on energy efficiency has increasingly come to be seen as both inappropriate and unworkable.

In recent years, efforts in Sweden to promote sustainable urban development, which long focused almost entirely on ecological sustainability, have begun to put increasing weight on issues of social sustainability. This also means that the perspective is broadened from technical renovation of individual buildings to revitalization of residential communities. Replacing fossil fuels with biomass and household waste in district heating systems has allowed the carbon footprint of buildings to be reduced without significantly improving their

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energy efficiency. As this potential is nearly exhausted, energy efficiency in buildings is likely to be perceived as more important than before.

Reducing costs in the construction process, translation of knowledge from new construction to renovation projects and securing a sufficient supply of craftsmen with up-to-date knowledge of best-practice renovation methods will also be crucial for a transition to take-off and for it not to lose its momentum once it takes off.

There are many stakeholders involved in renovation projects. While the owners of residential buildings have the ultimate responsibility for decisions to invest in renovation, municipalities with their multiple roles and capacities in relation to the development of a city are also major stakeholders. The City of Malmö has taken the lead in organizing a consortium of such actors through an Innovation Platform, partly financed by VINNOVA, to pursue renovation and rejuvenation of a section of the south-eastern part of the city in a comprehensive way. The effort builds on a number of earlier, more narrow projects. A key aspect is to develop concrete investment models which integrate social costs and benefits in the investment calculus for renovation projects. While strategic co-operation with external actors is a central aspect, integration of strategies, policies, and measures across different sections of the city administration presents its own challenges.

Urban development and the construction sector were generally given low and declining attention in Swedish research and innovation policy during the first decade of the new millennium. As cities have come to be seen as major arenas for realizing sustainable societies, the support for research and development related to the built environment has increased in recent years and is expected to continue to increase further. As a result, the research community dealing with built environment is being strengthened through funding from the Research Council Formas and the Swedish Energy Agency. This includes both engineering fields and social sciences. While many research projects benefit from contacts with industry, government support for industry-led development projects is very limited. As the overall support for built environment related research and innovation has increased in recent years, so has research on issues of renovation, although it remains fairly modest. Particularly noteworthy is the establishment of a new National Renovation Centre in 2014 at Lund University and subsequent major funding by Formas of research with close links to the centre. Municipalities have traditionally not been engaged in research and innovation activities. As cities are increasingly regarded as important innovation arenas, this is beginning to change. A very active participation of municipalities in the VINNOVA's programme Challenge-Driven Innovation is a good example of this.

The development towards more sustainable cities and society entails a number of different system transitions with strong interlinkages. Renovation of residential areas has to compete for political attention with other system transitions and so far has not been given a high priority at the national level. The pressing shortage of housing in major cities makes new construction of housing a high priority and may continue to make it difficult for renovation to receive the attention it needs.

There are no obvious individual policy measures or actions which would ensure a take-off in the transition towards sustainable renovation. An integrated approach with key actors represented of the kind attempted through the Innovation Platform in the City of Malmö appears to be a necessary prerequisite. Individual niche projects are unlikely to effectively contribute to the start of a system transition unless they are conceived and performed within a larger long-term framework that places the individual projects in an organized learning loop and gradually moves the cost-performance of integrated solutions to a level where



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large-scale implementation can be achieved on a routine basis. While individual projects will be performed in local contexts and sharing of experiences and specific technologies internationally will be important, the organizing framework will most likely have to be established on the national level. Whether this would best be accomplished through a bottom-up joining of forces among some cities or through a top-down national initiative is by no means a foregone conclusion. Whichever way is chosen, a core of group of committed major cities must be engaged.

For VINNOVA, one conclusion is that the Innovation Platform part of the Challenge-Driven Innovation (CDI) program appears to serve a very important function as a complement to the highly focused innovation projects that form the bulk of the program. It could even be argued that more of the resources in the CDI Program aimed at the challenge Sustainable, Attractive Cities should be devoted to initiatives for “systemic action design and experimentation”. More attention also needs to be given to the inter-linkages between different urban subsystems and to the interplay between social, economic and engineering aspects. This suggests that VINNOVA, the Swedish Energy Agency and the Research Council Formas could benefit from working more closely together.

There are many ways in which the national government could facilitate the transition towards sustainable renovation. First of all, its priority needs to be established much more clearly and strongly than has so far been the case. Co-ordination among different ministries and agencies would of course be desirable, but for such co-ordination to be productive it needs to be based on a shared vision of the main features of the transition towards sustainable renovation. Such a roadmap would need to allow for uncertainties, for example, in terms of energy prices and the potential for developing more cost-effective construction methods and other technologies. A predictable long-term schedule for minimum energy standards of renovated buildings would also be helpful. Finally, more direct economic incentives for sustainable renovation, in one or another form, may be needed to align private and societal priorities.

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## Brief Background and System Selected for Study

Innovation policy has over the last few decades undergone a series of decisive developments. One of these implies a shift of focus from the single innovation project, typically manifested in a rather prescriptive way of working on behalf of national R&D funding agencies, to a focus on the overall performance of the innovation system as such. The ability of this innovation system to address societal challenges in its broadest sense, involving a spectrum of stakeholders well beyond the traditional sense of R&D actors, finds its conceptual framework in the notion of “system innovation”.

This report is the contribution of the Swedish innovation agency, VINNOVA, to an OECD effort to concretise and define what system innovation implies for the innovation policy community today and what practical support it may provide for policy practitioners.

Chapter 1 presents the report's aim, objective and method and describes in brief the case selected by VINNOVA as an empirical example of the dynamics of system innovation. It presents the focus for the study "Sustainable Renovation of *Miljonprogrammet*", the motivation for the choice, the method used and the limitations of the study. It also places the VINNOVA contribution in the context of VINNOVA in the past few years seeking to face up to the challenges of addressing innovation policy in a broader and more open manner than has typically been the case in the past.

### 1.1 Aim and target group

The overall aim of this report is to contribute to an increased understanding of the requirements that more sweeping, innovation-driven changes in society (referred to as 'system innovation') place on innovation policy. The report is intended for use as part of the supporting material for an OECD report aimed at increasing understanding of the System Innovation conceptual framework. This report is also an effort by VINNOVA to increase our own understanding of and ability to address broad societal challenges from a system perspective. This requires a rather broad knowledge of specific sectors of society, possibly beyond the typical level for a generic innovation agency, as well as the understanding of a wide spectrum of stakeholder viewpoints. The report should therefore be seen as part of a learning process.

The report presents the results of a case study conducted as part of the abovementioned OECD study. The case study investigates the preconditions for the sustainable renovation of multi-family residences built in Sweden during the 1960s and 1970s which is called “miljonprogram”. (Named so from the Swedish government’s 1960s pledge to construct a million new dwellings in a decade.) Its ambition is to describe how innovation policy and its tools relate to the system under study, which, in itself, encompasses many sub-systems. One important aspect of the report is its identification and analysis of the barriers to and drivers for retrofitting as perceived by key actors in the system under study. Special attention is paid to Malmö, Sweden's third-largest city, and to the VINNOVA-funded project Innovation Platform Malmö. Innovation Platform Malmö aims to use the transformation of existing buildings and urban environments as an engine for creating a sustainable, attractive and smart city.

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### 1.1.1 Background to and motives for VINNOVA's participation

During the period 2011-2012, VINNOVA implemented a comprehensive strategy process aimed at reducing fragmentation and increasing the innovation impact of its programmes. As a result, VINNOVA's programme portfolio was restructured into 11 Strategy Areas. Two major new programmes were initiated: Challenge-Driven Innovation (CDI) and Strategic Innovation Areas (SIA). In early 2013, VINNOVA decided to continually analyse the progress of these two new initiatives.

In the past, the OECD has played an important role in providing a platform for the exchange of information and experiences between member countries concerning research and innovation policies and in supporting such exchanges through the development of tools for the formation, analysis and evaluation of policies. Of particular significance has been OECD's role in the development of the concept of Innovation Systems and related policy analysis. This work was important in the establishment of VINNOVA in 2001, which resulted from the merger of parts of three existing Swedish government agencies involved in supporting research and innovation.

By including the concept of System Innovation in its analytical repertoire, the OECD's Working Part on Innovation and Technology Policy (TIP) is providing a new vantage point from which to consider innovation policy, especially its interconnections with policies in other areas. Thus far, the concept of System Innovation has primarily been developed through historical studies of various system transitions by the academic community.<sup>1</sup> The issues that confront policy makers in the midst of (or, more often, in the early stage of) a system transition are naturally quite different from the issues that become apparent after a system transition has run all or most of its course.

For VINNOVA, the OECD project on System Innovation is a valuable attempt to narrow the gap between academic studies and the reality of practical policy-making as well as an opportunity to engage in an exchange of ideas and experiences with policy practitioners and scholars concerning the application of the System Innovation framework.

The OECD initiative is timely both for VINNOVA and for Sweden in general. The importance of global societal challenges as driving forces for innovation is widely recognized in Sweden. This recognition was the central message of the *Lund Declaration*<sup>2</sup>, adopted at the main conference on research and innovation held in July 2009 during Sweden's EU Presidency, and has since become a cornerstone of the EU's new Horizon 2020 programme. The Swedish Innovation Strategy, adopted by the Swedish government in October 2012, embraces a broad concept of innovation and innovation policy that is, in general terms, well in keeping with the requirements for System Innovation.<sup>3</sup>

As noted previously, through its new Challenge-Driven Innovation (UDI) programme, VINNOVA has made responding to societal challenges an important pillar of its programme portfolio. Furthermore, societal challenges play a key role in several of VINNOVA's other strategy areas, most notably Innovation Capacity in the Public Sector, Health and Healthcare and Transportation and Environment.<sup>4</sup> Clearly, it is worthwhile reflecting on activities in these strategy areas through the lens of System Innovation. The link to System Innovation is

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<sup>1</sup> See, for example, Geels, 2002; 2004.

<sup>2</sup> Vetenskapsrådet, 2009

<sup>3</sup> Swedish Government, 2012

<sup>4</sup> Activities related to health, transportation and the environment are not limited to the two latter strategy areas, but are found in most of VINNOVA's other strategy areas as well, not least of all in the Challenge-Driven Innovation programme and the strategy area Innovation Capacity in the Public Sector.

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less straightforward for VINNOVA's other major new programme, Strategic Innovation Areas. In its basic logic, this programme is closer to traditional innovation policy in its emphasis on strengthening innovation capacity in multi-sectoral fields perceived to be strategically important for Sweden. The extent to which challenges facing society might influence the definition of such fields is still an open question, as will be discussed later in this report. Even with a focus on industrial dynamics, the concepts of System Innovation and System Transitions may prove useful in relation to issues like increasing resource efficiency and the replacement of fossil raw materials with renewable resources.

For VINNOVA, the appeal of the System Innovation framework particularly lies in its potential use in situating VINNOVA's initiatives in their broader contexts, that is, in relation to initiatives by other actors and initiatives within the traditional area of research and innovation policy as well as to actors and initiatives in other policy domains at various levels of governance.

### 1.1.2 The renovation of housing to create sustainable and attractive cities, with a focus on Malmö

A number of aspects were taken into consideration when selecting a theme for the Swedish case study. One of these was comparability with other countries' case studies. In an early stage of the process, the majority of countries included in the group working together on this question indicated that they intended to include some form of sustainable urban development perspective in their respective case studies. A review produced by VINNOVA of important policy measures concerning sustainable urban development in Sweden in recent decades identified four (partly interconnected) primary areas of interest: 1) clean air and noise, 2) lifestyle and consumption habits, 3) urban mobility and 4) energy-efficient, sustainable housing. Of these, the latter two (urban mobility and housing) were most suitable as subjects for a case study. Both areas were well represented in VINNOVA's programme – another important consideration in selecting a theme.

As part of its Challenge-Driven Innovation programme, VINNOVA contributes to the development of what referred to as 'innovation platforms for sustainable and attractive cities' in four Swedish cities: Gothenburg, Borås, Lund and Malmö. These innovation platforms aim to support the integration of and links between innovation-related projects in these cities. In Malmö, the innovation platform focuses on the renovation of housing in the city's south-west, a challenge and project in which the systems perspective is distinct.

Based on the above (alongside more specific selection criteria as presented below), a renovation of housing built in the 1960s and 1970s with a particular focus on the innovation platform and development in Malmö was selected as the theme for the Swedish case study. The following factors were also taken into consideration during the selection process:

- the issue is of major importance for society and includes all three dimensions of sustainable development;
- the particular challenges that the issue involves have perhaps not received sufficient attention, for example within research and innovation policy;
- a systems perspective seems necessary to achieve the desired development and result;
- Sweden's capacity and competencies within the areas related to housing renovation are likely highly comparable with those of other countries, although there is both a

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need and room for improvement/learning. Renovation could create an important export growth market for the Swedish wood goods manufacturing industry;

- the issue requires political commitment and governance at multiple levels: local, regional, national and international (particularly at the EU level). The challenge involves different layers of various systems – social, technical, industrial and economic – and development is dependent on partnership between public and private actors;
- the issue requires political backing and support from stakeholders.

## 1.2 Method and limitations

This report is based on an analysis of the content of large quantities of supporting documentation, reports and interviews that have been judged useful in understanding and covering the different layers and actors involved in this complex issue. It has incorporated extensive analyses of VINNOVA's own projects, together with a general analysis of projects financed by other actors in the area under study.

In total, more than fiftie interviews and conversations were held using a qualitative, semi-structured method. A closer, more continuos dialogue has been held with politicians, civil servants, organisations and representatives from business and industry who are involved in Innovation Platform Malmö. The interviewees were chosen based on their knowledge and experience in the field at the local and/or national levels, and for the purpose of gaining a broad and nuanced understanding of the complex of problems and its multilevel perspective. A majority of those interviewed were representatives from one of Sweden's three major cities (Stockholm, Gothenburg and Malmö), while the others came from research settings and other organisations working at the national level. A supplementary seminar was conducted with researchers from the Swedish Royal Institute of Technology (KTH), who study the question of renovation from various perspectives in other contexts.

Research during the project period has involved the on-going reading of a long list of relevant reports, literature and websites as well as the sourcing of information about completed and on-going projects.

### 1.2.1 Limitations

It should be stressed that this study aims to produce a general understanding of how innovation policy and its tools relate to the system under consideration. The System Innovation framework has served as a basic frame of reference for the study, in which the system under study has been examined from a multi-level perspective. This perspective allows a description of how radical innovation can be developed and emerge in protected project areas at the niche level. This allows the formation and testing of new technology, working models, rules and regulations, and structures on a smaller scale, after which they can be scaled up and contribute to triggering a transition at what is known as the regime level. According to the multi-level perspective, one important precondition for success at both the niche level and for upscaling is governance<sup>5</sup>. Governance that facilitates mutual learning through co-operation and that encourages individual actors to re-assess their current

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<sup>5</sup> Schot & Geels, 2008; Hendriks & Grin, 2007.

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goals, roles, work structures and relationships is needed. Or, as Grin (2009) puts it: 'everything that is taken for granted'.

This report has studied the renovation of multi-family residences built between the 60's and the 70's as part of Sweden's *Miljonprogrammet* and using Innovation Platform Malmö project as a location-specific case that provides a concrete, local example of how the different levels (niche, regime and landscape) interact. The renovation issue is sizeable and complex, however, and referred to as a 'wicked problem'. Using System Innovation as a frame of reference, in this study we paint a broad outline of the factors that we perceive as most important for developing sustainable renovation of multi-family residences in Sweden. These factors may be economic, institutional, organisational, knowledge-related, social, cultural or political.

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## 2 Background to the Case Study

Chapter 2 explains the background to the theme for the case study: the renovation of buildings constructed in Sweden during the 1960s and 1970s which is called *Millionprogrammet* (in english the Million Programme). The chapter is based on background information and, to some extent, on what was learned from the interviews that form part of the supporting material for this report. The aim is to present a few of the major issues surrounding the societal transition involved in mass renovation of much of the multi-family residence housing stock. These are developed in more detail later in the report.

### 2.1 The challenge: The need to renovate housing from *Miljonprogrammet*

Like many other countries in Europe, Sweden experienced a boom in housing construction during the 1960s and 1970s. *Miljonprogrammet* is the colloquial name for the housing construction carried out in Sweden during this period that followed a parliament (Riksdag) decision in 1965 to build one million residential dwellings in ten years period and to improve housing standards in Sweden. At the time, there was a severe housing shortage in Sweden as a result of migration to cities, at the same time as many Swedes born in the 1940s were moving away from their parents and starting families of their own. According to Statistics Sweden, 1,006,000 new apartments were actually built during the period 1965-1974, including 110,000 apartments in 1970 alone.<sup>6</sup>

#### 2.1.1 Acute need for technical renovation

The technical lifespan of buildings on which no significant maintenance or renovation has been carried out is calculated to be 30-50 years. A large proportion of the multi-family residences built during the *Miljonprogrammet* has not undergone any major renovations or significant maintenance since construction and they are now in acute need of renovation.<sup>7</sup> Thus far, fewer than 20 per cent of these apartments have been modernized and an even smaller percentage currently meet requirements for future energy efficiency.<sup>8</sup> Within the next decade, approximately 650,000 residences will need extensive technical renovation and approximately two million residences will need renovation over the next 40 years.<sup>9</sup> This means that an average of 50,000 apartments will need renovation each year, which far exceeds the current pace of 20,000 apartments per year.<sup>10</sup>

The more time that passes, the more extensive the renovations required, and if deficiencies are not rectified, the buildings will slowly fall into disrepair. Dilapidated buildings also tend to foster social segregation, which can hasten the further deterioration of both buildings and the social environment. This obvious need for technical renovation also opens a window of opportunity for more extensive renovation that is now due. The current speed of retrofitting

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<sup>6</sup>Statistics Sweden, SCB Byggande- och bebyggelsestatistik (www.scb.se/BO0101).

<sup>7</sup>Swedish Energy Agency and Swedish National Board of Housing, Building and Planning, 2013.

<sup>8</sup>Industrifakta AB, 2008.

<sup>9</sup>IVA (Royal Swedish Academy of Engineering Sciences), 2012.

<sup>10</sup>Hellström, Sandkvist, 2010.

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needs to be substantially increased and the window of opportunity of due renovations of the building material has to be utilized.<sup>11</sup>

### 2.1.2 Energy and housing

In addition to technical renovation, a shift to more environmentally-friendly energy solutions is also required. The EU's *Energy Performance of Buildings Directive* establishes the ambition to reduce energy use in European buildings.

According to a parliament decision, total energy supply in Sweden must be reduced by 20 per cent by 2020 (as measured in energy use intensity) compared with 2008 levels<sup>12</sup>. At the same time, Sweden's total greenhouse gas emissions in the non ITS-sector must fall by 40 per cent compared with 1990 levels.<sup>13</sup> Energy policy potentially has a major impact on the building sector which, in turn, is of major importance for the country's long-term energy use. In Sweden, the residential sector account for 40 per cent of all energy use and their active co-operation in reducing energy consumption is a prerequisite for achieving the environmental targets set by the government.<sup>14</sup>

To succeed in reducing energy use in Sweden's housing in line with the above-noted targets, it is not enough simply to build new, energy-efficient houses. Instead, energy performance of existing buildings need to be radically improved. Buildings erected today have better energy performance across the board than those built 40 years ago, as the materials and designs used earlier have an inferior energy performance. From an energy standpoint, common deficiencies found in buildings constructed during the 1960s and 1970s are natural ventilation systems that are obstructed or closed, leaky ventilation ducts, leaky roofs, façades and issues with damp.<sup>15</sup> On average, *Miljonprogrammet* buildings use approximately 210 kWh/(m<sup>2</sup>·year), including household electricity, compared with the Swedish National Board of Housing, Building and Planning's requirement for new buildings in southern Sweden of 110 kWh/(m<sup>2</sup>·year) (further reductions will be made in 2015), or the ambition for passive houses of 45/kWh (m<sup>2</sup>·year).<sup>16</sup> Moreover, thanks to modern technology, indoor climate and comfort can be improved at the same time as energy use is reduced. However, each building is unique from both climatic and architectural perspectives, and the amount of energy that can be saved depends of the building's status and on what measures are implemented. Renovations and energy-conservation measures also influence one another; if a number of measures are implemented in the right order, there is the potential to save more energy for the same price.

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<sup>11</sup> Warfvinge et al., 2012

<sup>12</sup> Swedish Energy Agency, ER 2013:05.

<sup>13</sup> <http://www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Uppdelat-efter-omrade/climate/Klimatpolitik/>

<sup>14</sup> Swedish Energy Agency, ER 2010:37.

<sup>15</sup> VVS Företagen, 2012

<sup>16</sup> Burke and Lindhe, 2010



Figure 1 Different levels of energy conservation

<b>Small – Save 10-15%</b>
Foundation, external walls, outer surface and roof renovated. Pumps and fans are replaced, reducing the building's electricity use by 50 per cent. Condenser tumble dryers are installed in common laundry rooms, lighting in public spaces is made more efficient.
<b>Medium – Save 30-40%</b>
Measures included in the small level are supplemented with additional insulation for the roof and the installation of heat recovery and ventilation systems (FTX).
<b>Large – Save 50-60%</b>
Measures included in the small and medium solutions are supplemented with the measures that provide the greatest energy saving, e.g. new windows, additional insulation for façades and gables and individual hot water metering.
<b>Passive house</b>
Today, there are also examples of renovations that achieve a passive-house, zero-energy, or plus-energy building level, which consume less than one-quarter of the energy used by a standard building. Such buildings are heated using energy generated by the building itself. They have no separate heating systems over and above ventilation and heat recovery.

Source: *Renovera Energismart*, Energimyndigheten (Swedish Energy Agency), 2011.

Although effective technology and methods currently exist for achieving significant energy savings in existing buildings, which calculations also show are profitable in both the short- and long-term, the pace of development remains slow. According to interviews held with representatives from the Swedish Association of Public Housing Companies and with property owners, most current renovation consists only of the most necessary technical measures, in some cases combined with simpler energy-efficiency measures that provide a quick ROI and an energy-efficiency improvement of approximately 20-30 per cent. Conversely, few renovations that aim to reduce energy consumption by 50 per cent or more are carried out (a level considered necessary to reach existing energy targets and that is also entirely possible with the right measures).

### 2.1.3 Increased segregation

Dilapidated buildings tend to contribute to increased social segregation and decreased well-being among residents. Increasing segregation and alienation, particularly in large cities and often connected with *Miljonprogrammet* areas, are issues that have attracted increasing attention in recent years. Social problems thus require the renovation of and investment in *Miljonprogrammet* districts, as they risk becoming slums otherwise. The acute need for technical renovations and the necessity of implementing energy-efficiency measures in much of the multi-family housing stock could be used as an opportunity to achieve a necessary and more comprehensive 'redesign of urban communities'. Extensive renovations of the *Miljonprogrammet* areas could also generate many new green jobs, which would be welcome in times of high unemployment.<sup>17</sup>

Placing the cost of renovation on residents risks exacerbating alienation even further, as people who lack the means to remain living there may be forced to leave their residences and move to other areas, often farther removed from the city centre. Certainly, examples exist of renovating areas marked by segregation leading to more residents able to support

<sup>17</sup> 'Additionally the endeavours for more environmental sustainability through increase of energy efficiency are often discussed to cause negative consequences from a social sustainability point of view, such as gentrification and displacement.' (Faerber & Flecken, 2011 from Landwehr, 2013).

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themselves moving into the area, which could be a positive development. Thus far, there are examples of both types of outcomes. However, placing the cost of an extensive renovation on residents who often have very low gainful employment rates is not a viable alternative at present.

#### 2.1.4 Weak financial incentives for energy-efficient renovations

One central question is why an extensive renovation of *Miljonprogrammet* housing and the implementation of energy-efficiency measures there have not already been carried out. The situation in Sweden is hardly unique and is a problem shared by many other countries.<sup>18</sup>

The key to a measure's success is whether it is perceived as profitable for and relevant to those who will implement it and those who will be affected by it, respectively. The financial aspects of renovation are complex and are affected by various rules for the property market. According to the supporting material for this report, poor profitability and a lack of financing opportunities coupled with uncertainty about future energy costs and the difficulty of obtaining a reasonable ROI are the most common explanations for not implementing energy-efficiency measures despite loftier goals and ambitions.<sup>19</sup> Presently, there is a widely-held belief that it is not financially viable for property owners to implement extensive measures for improving energy efficiency. From a business perspective, it is currently considered worthwhile to improve energy use by perhaps 25 per cent, while from a national economics perspective, it is considered worthwhile to reduce energy use by 50 per cent or more.<sup>20</sup> A number of studies on the value of various renovation projects claim, however, that the value of energy-efficiency measures is often underestimated and that the financial benefits need to be better promoted. Both the majority of sources and several interviewees point out that there are currently too few facts, evaluations and supporting documentation on suitable technical measures, energy-efficiency measures and the potential and value of renovations to draw any certain conclusions.<sup>21</sup>

## 2.2 Malmö – a City Facing Major Challenges

Malmö, Sweden's third-largest city, includes 30,000 *Miljonprogrammet* residences in acute need of renovation. These residences lie in suburbs with large immigrant populations where unemployment is high and which are often described as unsafe environments plagued by crime. As a city, Malmö has undergone radical changes in the last 20 years. Up until the 1990s, Malmö's identity was strongly linked to heavy industry and especially to its shipyards, which symbolized work, security and income. For this type of industrial city, the 1970s oil crisis, which brought higher energy prices and globalisation with competition from low-wage countries, had a major and lasting impact. When the shipbuilding industry and the demand for tankers disappeared in the mid-1980s, almost overnight it proved to be the knock-out blow for an already weakened economy. Shipbuilding operations closed in 1986 and were replaced by a short-lived automotive factory. Unemployment increased and tax revenues decreased dramatically as a result.

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<sup>18</sup>While energy-efficient retrofitting is urgently needed, many obstacles to ambition and practical realization can be identified, from financial, organizational and inter-organizational perspectives.' (Hoppe, 2012).

<sup>19</sup> Swedish National Board of Housing, Building and Planning, 2013.

<sup>20</sup> Swedish Society for Nature Conservation, 2013.

<sup>21</sup> This observation recently led to the establishment of a national renovation centre (*Renoveringscentrum*) in Sweden, which is discussed later in the report. (See Section 5.3.7.)

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In the mid-1990s, municipal politicians Ilmar Reepalu and Percy Liedholm wrote a letter to the Swedish government describing Malmö as at risk of suffering an economic meltdown unless the state stepped in. At the same time, the City Executive Board launched its vision of *Kunskapsstaden Malmö* (trans.: Malmö, City of Knowledge) aimed at changing ingrained views of the city as an industrial city and refashioning it into something new. The opening of Malmö University in 1998 was an important step in this effort. The university was intended to form part of a strong research and development region around the Öresund strait.

Other contributing factors that have improved Malmö's attractiveness and hastened this shift in identity are the construction of the Øresund Bridge in 2000 and the opening of the City Tunnel in 2010, which has made commuting within, to and from the region simpler.<sup>22</sup> Malmö's hosting of the European Housing Expo, Bo01, in 2001, with its focus on sustainable construction, contributed to modifying Malmö's competencies and internal and external perceptions and led to, among other things, an acceleration in the construction of its Västra hamnen district.<sup>23</sup> (A former industrial harbour area exploited for housing developments aimed primarily for a higher income segment than what is the case in the Miljonprogrammet areas.)

Today, Malmö faces major new economic and social challenges on its road to becoming a sustainable, smart and attractive city, and the renovation of *Miljonprogrammet* areas is seen as a central issue in its work to achieve this. Malmö's *Miljonprogrammet* areas have gradually become increasingly run-down, at the same time as major investments have been made in central Malmö. In 2008, one of Malmö's *Miljonprogrammet* areas, Rosengård, attracted international attention when images of burning cars set alight by unemployed youths were broadcast in the world's media. Although the riots dissipated relatively quickly, the problems that caused them remain, even if a number of initiatives aimed at creating better conditions for residents in these areas have been taken since that time. According to several interviewees, increasing social challenges have been a contributing factor in Malmö's now more explicit focus on social issues, as manifested in the city's *Commission for a Socially Sustainable Malmö* (see also Section 5) However, major improvements to Malmö's *Miljonprogrammet* areas are only considered possible (financially and technically) as part of larger renovation projects. A key question in connection with this, however, is who will cover the cost for this extensive renovation work. If we assume that each residence will cost approximately SEK 500,000 to renovate, the total investment for Malmö's *Miljonprogrammet* areas will total approximately SEK 15 billion.<sup>24</sup> If energy-efficiency measures are implemented, the initial costs can be assumed to be even greater. These costs cannot be passed on to residents, for whom rates of gainful employment in some of these areas are as low as just 17 per cent.

### 2.2.1 Progress towards a platform

Malmö has long worked actively to become a sustainable and attractive city, making use of available public funding for promoting sustainable development. In Sweden, a broad initiative for public efforts to pursue ecologically sustainable development took shape in 1998 in the form of Local Investment Programmes (LIP). At that time, the Swedish parliament passed a resolution to set aside SEK 6.2 billion in funding to support LIP. The initiative was intended to use Sweden's municipalities to drive an increase in the pace of

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<sup>22</sup> Möllerström, V., 2011.

<sup>23</sup> Malmö stad, 2013-11-13

<sup>24</sup> The final cost will be determined by the measures taken, the technology chosen, and so on. As such, estimates of the cost of renovations vary greatly depending on their source and the interviewee.

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transition to ecologically sustainable development. The programme was also intended to help increase employment. As part of the programme, municipalities were given the authority to identify and prioritize local environmental problems and to apply for funding for the solutions that the municipalities considered effective.

The growing interest in climate change provided a reason to focus state grants on measures that reduced greenhouse gas emissions. In 2002 Sweden's national parliament decided to discontinue LIP and instead replace it with a system of funding for measures that reduce greenhouse gas emissions, i.e. what were known as Climate Investment Programmes (Klimp). In total, SEK 900 million were earmarked as funding for Klimp.<sup>25</sup>

Klimp's purpose was to encourage municipalities, businesses and other actors to make long-term investments that reduce environmental impact and to encourage local involvement and local initiatives. Klimp was a tool used by Sweden in its efforts to achieve its climate targets. In total, 2,700 projects were granted funding within the frameworks of LIP and Klimp during the period 1998-2012. An evaluation of LIP and Klimp conducted by the Swedish Environmental Protection Agency in 2010 revealed that they had helped to reduce emissions of greenhouse gases by close to one million tonnes of carbon dioxide annually. Other important achievements included co-operation and the dissemination of knowledge.<sup>26</sup>

One of the more interesting projects to receive funding under LIP back in 1998 was an innovative surface water system located in Malmö's Augustenborg district, which has resulted in a reduced impact on the recipient, reduced energy use in the purification plant and increased biological diversity. A renewable local energy system, improved conditions for bicycle traffic, electric-powered public transport, the remodelling of squares, courtyards and traffic environments with sustainable development in mind and the involvement of local residents are additional examples highlighting Malmö Municipality's focus on sustainable thinking in its city planning that goes as far back as the 1990s.

As a continuation of national initiatives promoting sustainable urban development, the Swedish government established a special *Delegation for Sustainable Cities* in 2008. The delegation was the result of the identified need for a co-ordinated strategy at the national level and for continued dissemination of experience related to the development of sustainable cities gained within LIP and Klimp projects. The delegation was appointed for the period 2008-2010, and later had its tenure extended until 2012. The task given to the Delegation embraced a broad concept of sustainability in which economic growth and social cohesion were placed on par with environmental objectives. It was tasked with promoting the sustainable development of cities, urban environments and housing areas. In co-operation with Swedish municipalities, market stakeholders and other parties, the delegation facilitated and promoted efforts to achieve well-functioning and attractive urban environments where quality of life goes hand-in-hand with a better environment, economic growth, social cohesion and minimized environmental impact by means of integrated, multi-sector planning, increased levels of ambition and the use of technology.<sup>27</sup> Although this was only one of the activities of the Delegation, it distributed around SEK 380 million in grants to around 100 projects, of which nine sizeable "investment projects" accounting for more than half. In February 2014, the government gave a commission to five agencies, with the Swedish National Board of Housing, Building and Planning as the co-ordinating body, to

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<sup>25</sup>The amount of state funding for climate investments allocated within Klimp ultimately totalled SEK 1.175 billion.

<sup>26</sup> Swedish Environmental Protection Agency, 2009; 2010; 2013.

<sup>27</sup> Swedish Ministry of the Environment, 2008.

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establish and maintain a “platform for questions about sustainable urban development”. Together with the Swedish Environmental Protection Agency, the Delegation for Sustainable Cities has created a website showcasing good examples and projects within the field of sustainable urban development (<http://www.hallbarstad.se/>). The website is currently run by the Stockholm architecture and design centre (Arkitektur- och designcentrum) and is intended to serve as a platform for discussion and the exchange of knowledge about sustainable urban development.<sup>28</sup>

Among other funding received through the Delegation for Sustainable Cities, Malmö received support for its Fullriggaren project at Västra hamnen, which aimed to build the largest coherent residential area consisting of low-energy and passive housing and where organic waste is processed and used to fuel the area's biogas-powered car fleet. In the interviews conducted as part of the supporting material for this report, a couple of interviewees related how work on the Fullriggaren residential area strongly contributed to the utilisation of experience gained at the Bo01 housing expo. The dwellings built for Bo01 did not at all meet requirements for energy-efficiency measures. As such, prior to starting work on Fullriggaren, the municipality took the initiative to assemble the actors involved so that they could together learn from the experiences from the expo and accumulate the necessary facts, relevant knowledge and competencies by studying good examples from other parts of the country. The Fullriggaren project was a success and the new constructions and measures had significantly better energy performance than those of Bo01. The experience and knowledge gained through Fullriggaren has since been used for other new construction projects in the city. Today, Fullriggaren is a city district where the concept of sustainability guides development and, in the eyes of the City of Malmö, the Västra hamnen district is a symbol for sustainable development.

### 2.2.2 Innovation Platform Malmö

Through a call for proposals entitled *Development of Innovation Platforms for Sustainable, Attractive Cities*, VINNOVA is funding constellations of actors in cities that are developing innovation platforms. The concept of innovation platforms implies 'formalized co-operation between actors (businesses, public organisations, research institutes, universities etc.) involved in research and innovation, with a focus on innovative solutions for the administration, renovation and improvement of existing areas and/or the development of new urban districts'.<sup>29</sup> The project funds stem from the Swedish government's environmental technology strategy (*miljöteknikstrategi*); an investment of approximately SEK 100 million annually for the period 2011-2014. A secondary aim of the government's strategy is to strengthen the development of innovation milieus with an urban focus, co-operation between actors and renovation. Innovation Platform Malmö will receive funding from VINNOVA totalling SEK 10 million over a two-year period (June 2013-June 2015).<sup>30</sup>

Malmö's innovation platform aims to make existing buildings and urban environments smart and sustainable. This will be achieved by utilising the knowledge and collaborative competencies that have been gained over more than a decade, in the pursuit of creating a

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<sup>28</sup> *SOU M, 2011:01 (Final report: Activities of the Delegation for Sustainable Cities, Delegation for Sustainable Cities, 2011:01).*

<sup>29</sup> VINNOVA, 2012.

<sup>30</sup> *In addition to Innovation Platform Malmö, an additional three platforms will receive funding over a two-year period: Lund, Borås and Gothenburg.*

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dynamic innovation system. Several of the projects initiated in Malmö under the LIP and Klimp programmes form the foundation for Innovation Platform Malmö. Through a number of projects, both large and small, the City of Malmö has purposely tested and evaluated new, innovative solutions over the past decade, the impetus for which has come from different levels: city employees, residents, companies, special interest groups and higher education institutions in the surrounding area.

Both the Malmö's LIP and Klimp projects aimed to achieve scalability, to disseminate knowledge and experience and to involve residents. One previous LIP-funded project was a co-ordinating umbrella project, which, like Innovation Platform Malmö, aimed to co-ordinate other projects that had received support under either LIP or Klimp.

Experience gained from work undertaken in previous decades to make Malmö a sustainable city has both illuminated and cemented the city's understanding of the need to co-ordinate and further improve co-operation and to systematize innovation efforts. No single actor has the ability to achieve the required change. Existing work methods and models cannot address today's broad social challenges. More innovative models are needed. Innovation Platform Malmö aims to develop these types of models.

The innovation platform focuses on the existing collection of buildings in Malmö Sydost, including districts like Rosengård, Holma and Lindängen. Presently, around 80,000 people live in this area and it includes approximately 25,000 of the apartments in acute need of extensive renovation, given that the need for property improvement there has essentially been overlooked entirely up to this point. The apartments in question are divided among different categories of property owners according to the following: 50 per cent are apartments held within apartment-owners' associations, 25 per cent are apartments located in privately-owned apartment buildings and 25 per cent are apartments managed by municipal-owned property companies.

Through its innovation platform, Malmö wishes to use the physical renewal of *Miljonprogrammet* housing to spur a broader change process. Innovation Platform Malmö co-ordinates a number of projects within the framework for six separate work packages: 1) *the technical development of buildings*, 2) *the physical development of residential areas*, 3) *social and economic development for residents*, 4) *organisational development – Handling i Samverkan*, 5) *new financing and business models* and 6) *urban global innovations arena*.<sup>31</sup> A number of the projects co-ordinated through the platform rely on financial support, including projects that receive VINNOVA financing through the Challenge-driven Innovations programme.

In the short-term, work performed as part of the platform will focus on the development of new technology and services and on the creation of local jobs and increased well-being in Malmö's *Miljonprogrammet* areas. The joint efforts made to achieve this will drive the focus on achieving long-term environmental targets and improved development of the business sector. The long-term goal is to base economic development in the city on the need to solve tomorrow's social challenges through creative processes where the private and public sectors, research and those with specific needs co-operate. Another long-term goal for the platform is to create a model relevant for other cities and countries that supports a transformative social development process and that drives the introduction of energy-efficiency measures and for socio-economic development. The City of Malmö's Environmental Department (Miljökontoret), runs and organizes the platform's work, in

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<sup>31</sup> Malmö Stad, 2014. *Innovation Platform Malmö Sydost*.

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which politicians, the private sector and academia play active roles. An on-going evaluation of the innovation platforms' work will be conducted in the cities during these years. (Read more about the Innovation Platform in Section 4.2 and 5.4).

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## 3 Housing in Smart and Sustainable Cities

Chapter 3 describes housing, energy policy and sustainable urban development in Sweden. The description is intended to provide a general understanding of the driving forces that may affect development and contribute to a transition within renovation.

### 3.1 Housing and energy policy

In 1965, the Swedish parliament passed a resolution to remedy the country's housing shortage by building one million residences and improving housing standards in a short period of time. As a result, public housing corporations grew to become Sweden's largest administrators of multi-family residences. In the early 1970s, Swedish housing policy experienced a crisis.<sup>32</sup> Sweden experienced a net decrease in population due to migration, primarily caused by the oil crisis and industrial decline, which contributed to a large number of vacant residences. This caused a crisis for public housing corporations.<sup>33</sup> State expenditure on housing-related subsidies and interest subsidies increasingly became a significant percentage of the national budget, an increase for which there was no room during the prevailing economic crisis. In connection with the end of the long-time rule of Sweden's Social Democratic Party in 1976, a period of deregulation and privatisation began within the housing sector that intensified during the 1980s and 1990s.<sup>34</sup>

The 1990s was characterized by the loss of the advantages formerly held by the municipal housing corporations when state housing loans were discontinued. Municipal and private housing corporations were now treated equally with regard to financing, subsidies and tax regulations. A municipality was not allowed to discriminate against other landlords in favour of its own companies by waiving interest on share capital, for example, as this would mean that tax payers would pay part of the tenants' capital costs. Today, housing corporations are subject to the Act on Public Utility Municipal Limited Liability Housing Companies (2010:879), or the 'Allvill Act', which states that the public housing sector must be run strictly on business terms. Since the 1990s, the majority of public housing corporations have become independent from the municipalities and are organized as limited companies. Some municipalities have chosen to sell either parts or all of their housing assets.<sup>35</sup>

In general, it can be said that housing policy in Sweden has followed the trend seen in other Western countries. To reduce its expenses, the state has reduced its subsidies for production, shifting its focus to subsidising the consumption side instead. While this reorganisation has reduced state expenses, it has increased the cost of housing. The removal of subsidies for housing construction has also transferred the financial risk from the state to developers and investors, which, in turn, has contributed to sharply increased rental fees. Construction has declined markedly and the new buildings that have been constructed consist primarily of more expensive housing in attractive locations that is subject to ownership or tenant-ownership rights.<sup>36</sup>

At the same time, housing and work for everyone in the community are important goals for Swedish cities of today, and there is widespread discussion about the challenge of providing

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<sup>32</sup> Holmqvist, 2009.

<sup>33</sup> Swedish National Board of Housing, Building and Planning, 2008.

<sup>34</sup> Holmqvist, 2009.

<sup>35</sup> Swedish National Board of Housing, Building and Planning, 2008.

<sup>36</sup> Holmqvist, 2009.



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everyone with housing in the country's expanding major cities. Both public debate and policy concentrate primarily on new construction and densification as the solution to the housing problem. Very little is said about possible connections between new construction and the renovation of existing residential areas.

### 3.1.1 Energy and housing

Energy-efficiency measures are often mentioned in the debate as an aspect that, in addition to technical needs, should necessarily be taken into consideration when renovating in order to achieve established energy targets. Since the end of the 1970s, energy use in Sweden's residential sector has fallen when measured per square metre. This is primarily due to technological developments and is most clearly seen in new buildings, which are better insulated and make better use of waste heat. However, some of the improvement is due to the transition to district heating, which has shifted conversion losses from buildings to district heating plants. (The expansion of district heating is described in Section 3.1.2). This, together with policy measures, market-driven developments in the form of sharply increased energy prices, and stricter requirements on energy performance in new buildings, has seen the total energy used by Swedish buildings fall by eight per cent between 1995 and 2011. From a European perspective, Sweden's buildings are considered energy efficient. However, more can be done to make buildings more energy efficient, particularly existing buildings, where it is calculated that 20-50 per cent greater energy savings are possible.<sup>37</sup>

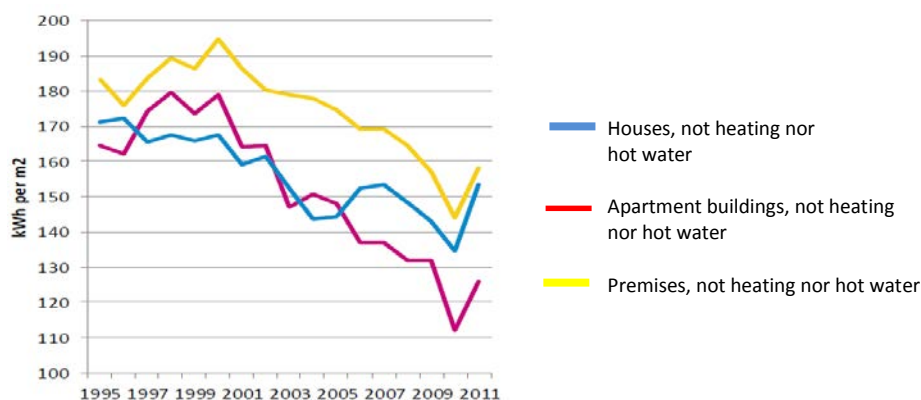
Energy use per square metre is significantly higher for multi-family residences than for single-family homes. This is true both for the use of bought energy for heating and hot water and for energy bought for other purposes (in multi-family residences this includes household electricity and electricity used by the building). While the use of energy for heating and hot water in multi-family buildings shows a downward trend, electricity use for other purposes has increased sharply in recent years, with the result that total energy use per square metre in multi-family buildings in 2011 was only marginally lower than that in 1995.<sup>38</sup>

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<sup>37</sup> Swedish Energy Agency and Swedish National Board of Housing, Building and Planning, 2013.

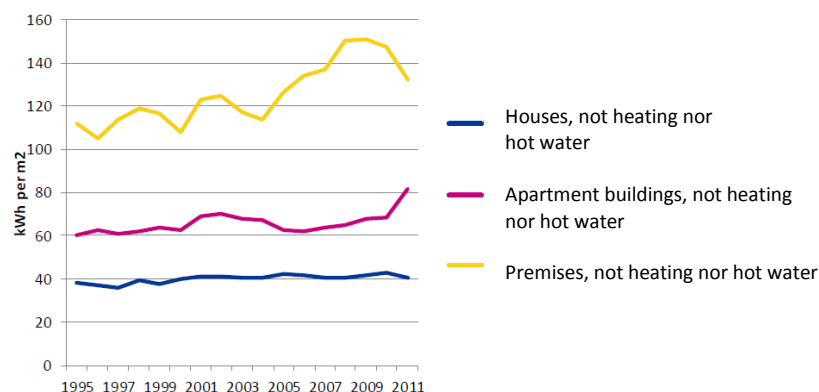
<sup>38</sup> It should be noted that a significant number of heat pumps have been installed in multi-family residences since 1995. The increase in electricity consumption by these pumps has resulted in a many times greater reduction in the amount of energy used for heating and water. This means that, in other respects, energy-efficiency measures in multi-family buildings have amounted to even less than what is shown in Figure 2 and Figure 3. The value refers to the temperature-corrected use of bought energy. Both 2010 and 2011 were years with extreme weather conditions, which makes temperature-correction for these years uncertain. This is illustrated by temperature-corrected energy use for 2010 being shown as 13 per cent lower than that for 1995.

Figure 2 Temperature-corrected energy use for heating and hot water per square metre in residences and property, 1995-2011.



Source: *Energy Indicators 2013, Follow-up of the Swedish energy policy objectives*, Boverket (Swedish Energy Agency), ER 2013:05.

Figure 3 Energy use per square metre other than for heating and hot water, 1995-2011.



Source: *Energy Indicators 2013, Follow-up of the Swedish energy policy objectives*, Swedish Energy Agency, ER 2013:05.

This report's supporting documentation indicates that, alongside reduced impact on the climate, the cost of used energy is the largest single reason for implementing energy-efficiency measures for the majority of property owners. But achieving energy-efficiency requires investments. With a ROI of between three and 30 years, making these investments is not immediately obvious, at least not for measures with longer-term ROIs. Two important factors affecting the profitability of energy-efficiency measures are the price of energy and the assumptions behind cost analyses. One problem is that it is difficult to estimate future energy prices. Over the past decade, the price of district heating for multi-family residences has increased by around 35 per cent, with significant disparities between different municipalities.<sup>39</sup> Over the same period, the consumer price index (CPI) increased by 12 per cent. Available prognoses do not suggest any significant energy price increase in the

<sup>39</sup> The Swedish district heating association, 2014: <http://www.svenskfjarrvarme.se/statistik--pris/fjarrvarmepriser/> (Swedish only).

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foreseeable future, which, simply put, means that energy-efficiency measures cannot be justified directly by expected increases in energy costs.

The conclusion drawn by several interviewees is that, at today's energy prices, energy-efficiency measures are not sufficiently profitable. As such, additional financial or other incentives are needed before property owners will be willing to make the investments.

### 3.1.2 The success story: district heating facing new transitions

The expansion of district heating in Sweden can be seen as a good example of a transition that is central to the concept of System Innovation. District heating has been important for Swedish cities. Above all, it has contributed to a radical improvement in the quality of their air because local heating solutions that used oil boilers to heat buildings have been replaced. By producing heat centrally, the effective scrubbing of flue gases is made easier. In recent decades, an additional transition has occurred in that district heating plants have also completely phased out oil and coal as fuel sources in favour of biomass, household waste and industrial waste heat. This has dramatically reduced the emissions of greenhouse gases associated with the heating of residential and other buildings.

Today, district heating provides over 90 per cent of all bought energy for heating and hot water in multi-family residences<sup>40</sup> and for more than half of all building heating in Sweden.<sup>41</sup> Multi-family residences and other buildings comprise 80 per cent of the customer base for Swedish district heating systems. The expansion of district heating in Sweden and the transition made in its energy sources has rightly been described as a success story. Sweden has assumed a leading role internationally in the field of district heating. This has played an important part in the marketing of the Swedish planning model abroad, which is characterized by a holistic approach. There are many accounts about this success story, including an informative retelling produced by the district heating industry itself.<sup>42</sup>

However, most indications are that the district heating system and the energy companies that provide district heating now face another major transition. One important factor is that energy use for heating and hot water in multi-family residences is expected to decline. Because district heating currently dominates this market, deliveries of district heating to multi-family residences would likely also decline. As touched on in other sections of this report, the introduction of energy-efficiency measures in existing housing may occur in a number of ways. Major renovations and the use of various IT solutions that give individuals greater opportunity to influence their energy use are two important examples. The need of purchased energy in multi-family residences may also be affected by the increased use of heat pumps and the installation of solar panels on roofs or façades. In Sweden, the latter has occurred to a remarkably minor extent, particularly as compared with Germany. There are differing opinions about whether replacing bought district heating with electric-powered heat pumps or locally produced solar power increases ecological sustainability.

Changes affecting the district heating sector are also occurring with the energy raw materials. It is almost impossible to predict the final result, given that development in the fields are interconnected. Firstly (at least in the medium-long and long-term), a reduced proportion of organic waste will likely be supplied to district heating plants for incineration. In a report from 2012, the Swedish Environmental Protection Agency writes: 'According to the policy

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<sup>40</sup> Swedish Energy Agency, *ES 2013:03*.

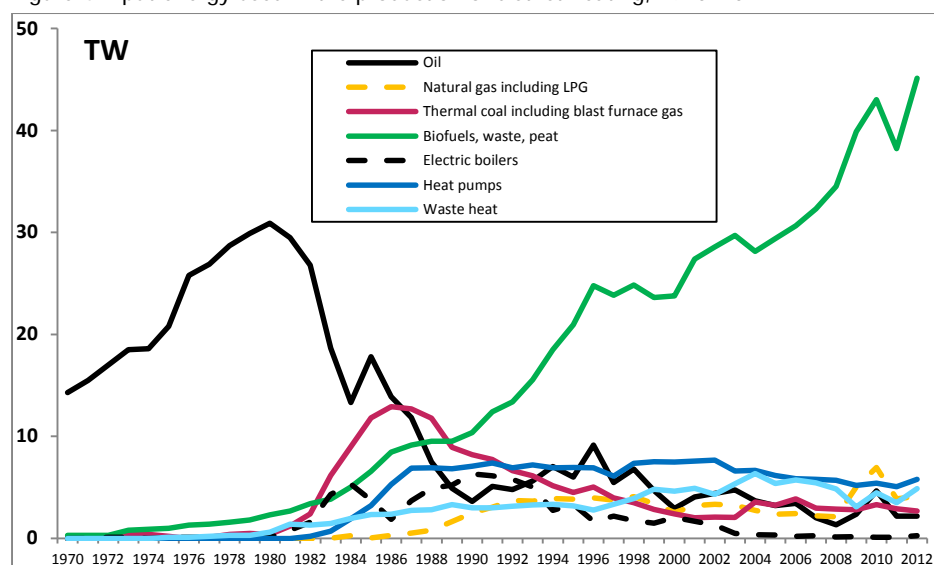
<sup>41</sup> The Swedish District Heating Association, 2009.

<sup>42</sup> The Swedish District Heating Association, 2009:4.

promoted at both the EU level and national level in Sweden, the handling of organic waste should follow what is called the “waste hierarchy” as far as possible. If Sweden succeeds in realising this policy, our assessment is that capacity for the digestion of organic waste and different kinds of materials recycling will need to increase significantly over the coming 10-20 years, while the need for incineration capacity for Swedish waste will not increase from current levels.<sup>43</sup>

Potentially, biomass has a host of alternative uses. The term bioeconomy usually refers to an economy that replaces a significant amount of the fossil raw materials it uses for energy and materials with biomass. This transition is still in a very early stage, and its actual impact in terms of both scope and time is difficult to assess. For Sweden, with its extensive forest resources and large forestry industry, the transition to a bioeconomy is of major importance. The shift in the energy raw materials in recent decades can be seen as part of the early phase of this transition. The forestry industry is currently the largest consumer of biomass from forests. Parts of the forestry industry, more specifically the printing and newsprint industries, have found it increasingly difficult in recent years to compete in a shrinking market, while paper- and cardboard-based packaging materials are currently favoured in the recyclable smart packaging field and other areas. The problems within the pulp and paper industry have prompted companies in Sweden and other countries to try to develop new business areas, partly in co-operation with the chemicals industry and textile fibre and textile industries and their customers (more information later in the report). New concepts for biorefineries that integrate material flows with different volumes and values, have been built on a small scale. Integrated biorefineries that can process material for specific purposes are expected to eventually replace the current separate plants.

Figure 4 Input energy used in the production of district heating, 1970–2012.



Source: *Energy in Sweden 2014 – Facts and Figures*, Energimyndigheten (Swedish Energy Agency) (website).

<sup>43</sup> Swedish Environmental Protection Agency, 2011/4

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One possible growing area of use for biomass is the production of biofuels, including biogas. This area has already seen strong growth in Sweden. A review of different processes for the production of biofuels shows that many of these create waste heat that needs to be disposed of and, at present, district heating stands out as the most natural use of this heat.<sup>44</sup> At the same time, it is noted that this solution is not unproblematic, given the prospect of the district heating market contracting in the future.

The above review was carried out to illustrate the highly complex and difficult-to-assess situation facing Sweden's district heating sector in the future, as characterized by very strong systemic dependencies between (among other things) improved energy-efficiency in buildings, the development of existing and new branches of the fibre-refining industry, waste management and a possible increase in the use of biofuels in the transport sector. As noted previously, to these factors can be added the increased use of heat pumps, the expansion in the production of local solar power and increased resident participation in improving energy-efficiency, not least of all through the opportunities provided by new IT-based services. There are also strong potential connection to the development of smart grids and to the construction of charging infrastructure directly adjoining residences.

The overall outlook for district heating suppliers undeniably includes many challenges, but also many opportunities to develop new roles, business areas and business models. Examples of development in this direction are already in evidence.

## **3.2 Sustainable and Attractive Cities**

Over the last two decades, urban development has taken on a new focus for social development and policy. An important factor has been the growing realisation that the key to moving towards more sustainable communities lies in how everyday life and supply systems in cities are organized.<sup>45</sup> Continued urbanisation (as of 2008, more people live in cities than in rural areas worldwide) strengthens this relationship. In itself, the compact nature of cities is also believed to provide the best conditions for achieving sustainability.

Although cities include a large portion of many social functions, social processes obviously exist that are spread over a much wider geographic area. For example, industrial operations and financial services are increasingly organized within the framework of global systems. Parts of transportation and communications systems primarily connect cities, as opposed to serving intra-urban functions.

In practice, growing international competition for capital, investments and people also drives competition between cities and their offerings, where the combination of quality of living environment, business environment and educational facilities ultimately determine how attractive an offering in a certain city appears. Today, Sweden's three major urban regions, in particular, see themselves as very much engaged in international competition to attract value-adding corporate divisions and talented individuals. At the national level, similar competition between Sweden's own cities also exists.

There are no clear-cut, unambiguous and exhaustive definitions of what characterizes sustainable and attractive cities, respectively. Moreover, an attractive city is not necessarily sustainable and vice versa. However, today, a clean environment and low environmental

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<sup>44</sup> Börjesson, LTH, 2013

<sup>45</sup> Schulman, M., 2000.

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impact are generally considered key features of a city's attractiveness. This, in itself, motivates cities to initiate improving the quality of their environment, such as by improving energy efficiency in existing housing. There are also expectations that these kinds of initiatives will contribute to the development of business activities in the city through what is known as green growth.<sup>46</sup>

Swedish municipalities operate with a high degree of autonomy, particularly in spatial planning, due to a municipal planning monopoly in place since 1947 that is now regulated under the Swedish Planning and Building Act (PBL). PBL was introduced in 1987 and introduced both decentralisation and greater citizen participation compared to the previous Building Act, under which the state had greater powers of control. At the same time, Comprehensive Development Plan and Detailed Development Plan were also introduced as planning tools. Since 1996, PBL has included sustainable development as an objective and the comprehensive development plans of Swedish municipalities now often include sustainability as an overarching objective.

Work performed at the regional level also affects urban development, both within the county administrative boards and within the county councils or regional boards. Sweden's county administrative boards are state-run agencies operating in each county on behalf of the national government. Their most important task is ensuring that the objectives established by the national parliament are achieved while taking into consideration the individual county's circumstances. The county administrative boards co-ordinate action and mediate knowledge in a broad range of fields, including infrastructure planning, sustainable urban planning, integration and energy and climate issues. In recent years, responsibility for regional development has gradually shifted to popularly-elected local authorities, such as the Skåne Regional Council (Region Skåne). The majority of counties have their own regional co-operation agencies (which are associations of municipalities within the county, e.g. the Regional Council in Östergötland County) that are responsible for regional development. In a handful of counties the responsibility for regional development remains with the county administrative board, such as in Stockholm County.

County councils are politically-controlled organisations that are primarily responsible for healthcare, but also for public transport, long-term planning and matters concerning business and culture. In matters concerning sustainable development, the organisation of co-operation between the county administrative board, county council and municipalities (for example) can differ between the regions.

Nationally, there has been no explicit strategy supporting the work of local authorities towards more sustainable cities, even if LIP and Klimp (see Section 2.2.1) have provided support for municipalities' sustainable development. The national government has also established an over-arching objective for urban planning, the housing market, construction and surveying activities. That objective is 'to provide all citizens with a satisfying living environment, where long-term sustainable use of energy and natural resources are promoted and where housing construction and economic development are facilitated'<sup>47</sup>. Several interviewees point out the importance of national-level support to help municipalities develop into sustainable cities. In this context, a number of interviewees mentioned the Delegation for Sustainable Cities (active from 2008 to 2012) and its role of assembling

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<sup>46</sup> OECD, 2013.

<sup>47</sup> [http://www.boverket.se/Vagledning/PBL-kunskapsbanken/Teman/Nationellamal/Bebyggelse/Bebyggelsutveckling-och-planering/\\_2013-11-28](http://www.boverket.se/Vagledning/PBL-kunskapsbanken/Teman/Nationellamal/Bebyggelse/Bebyggelsutveckling-och-planering/_2013-11-28) (Swedish only).

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stakeholders to stimulate sustainable development as an important national initiative for contributing to a national umbrella and support for efforts made within the field of sustainable urban development.

### 3.2.1 Social sustainability in the spotlight

By law, social considerations should constitute one of the starting points for municipal planning, and PBL establishes that the law's provisions are intended to promote social development characterized by good and equal social living conditions. In the interview study, a number of interviewees noted that there is a perception that, up until now, there has been an explicit focus on the ecological aspects of sustainability. Several respondents, however, mentioned that a clear shift is under way. Politicians and civil servants are now placing increasing emphasis on social sustainability, not least of all within urban planning, so as to plan and build good environments in which to live and work, for example. Multiple respondents believe that the social sustainability perspective should be viewed as a key issue in the renovation of residential areas and stressed that the social perspective involves ecological, economic and social considerations. By emphasising social needs and solutions, the issue is expanded and more stakeholders become involved.

## 3.3 The Smart City

Understanding and appraising important technology trends is key to drawing the right conclusions about future development. According to Geels, in many cases new technology plays a central role during regime changes by creating new possibilities. New possibilities force the creation of new business models, which alter conditions and, often, pricing, thereby creating the preconditions for radical innovation and for innovative advances. In this way, in combination with innovations related to products, services and organisational and business models, new technology helps to create a competitive offering.<sup>48</sup>

Today, an important technology trend radically influencing and being influenced by current development is the emergence of the smart city. The term is used as a catch-all for the greatly increased and more sophisticated use of information and communication technologies within a city, so that its network properties are improved in different ways. This might involve streamlining within different types of supply systems, but also the interconnection and reconnection of previously isolated systems.

Among other things, conceptions of the smart city are based on a combination of three Internet phenomena: 1) information transfer between machines (Internet of Things), 2) the development of cloud computing (i.e., large server parks for processing and making available data) and 3) methods for analysing and interpreting large quantities of data (Big Data). These phenomena make it possible to collect, link and visualize data, which, in turn, creates new opportunities for analysis, action and follow-up. As the cost of sensors and of storing and analysing measurement data falls, access to current and relevant information increases. This potentially creates new opportunities for developing information-based services, like those that can promote more efficient energy use.

Smart solutions can contribute to sustainability through more efficient management of flows and systems and reduced waste and are clearly associated with system dependencies. For example, it is currently being built into new buildings and city districts. The likelihood of a

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<sup>48</sup> Geels, 2002; 2004; 2005.

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smart city being more energy-efficient and climate-smart than today's cities is very good. However, social and organisational changes in combination with behavioural changes at the individual level are needed.

### 3.3.1 Smart electric grids

One important aspect of smart cities is electrical energy systems, which include smart electric grids. In addition to electric grids, electrical energy systems can include electricity production facilities, electrical installations in residences, buildings and industry, and electric-powered equipment within the electrical energy systems.

In Sweden, district heating will dominate the energy supply market for multi-family residences for the foreseeable future. The need to be able to dynamically regulate the interplay between district heating supply, electricity supply from different sources (including locally produced electricity and the use of heat pumps), ventilation equipment and various electrically powered devices will increase, however, and will be a complex and important issue for smart electric grids to address in a broad sense.

Smart electric grids may mean that electricity use is automatically adjusted based on electricity prices (e.g., per hour). This could be achieved by using technology that sees to it that electric cars are recharged when there is good access to cheap, renewable electricity. In this way, wind power can be better exploited during those hours when it is very windy. Another example is control systems that automatically help industries to suspend low-priority manufacturing processes when electricity prices are temporarily inflated. One such time might be on winter mornings when the weather is cold.

The development of smart solutions has a great impact on advances in renovation and energy efficiency, where traditional expertise meets IT. This applies to the development of technology for the buildings themselves (materials, electronics, etc.); processes for designing, building, maintaining, renovating and demolishing, for example; information, communication, feedback and control systems; and systems for supplying energy.

In 2012 the Swedish Coordination Council for Smart Grid was appointed to work to promote clear rules for the market, greater influence by customers and favourable conditions for the development of smart grids in Sweden. The council consists of 15 members from public authorities, organisations, the business community and various research settings. In the autumn 2014, the council proposed a national action plan for smart grids.<sup>49</sup>

## 3.4 Construction Processes for Renovation

Construction processes are an important factor affecting the financial conditions for undertaking renovations. The construction industry has generally been characterized by slow improvements in productivity. In recent years the industry has come to a consensus that a paradigm shift in the organisation of construction processes is necessary if better productivity is to be achieved. This can be seen in the development of a joint research and innovation agenda by a broad collection of stakeholders within the construction industry. It is entitled: *Smart Built Environment – Processes and information management in construction and facility management*.

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<sup>49</sup> <http://www.swedishsmartgrid.se/>.



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This desired paradigm shift requires that the strict focus of construction processes on individual construction projects be abandoned and that efforts be made on developing solutions that can be easily applied across different projects. The objective is to be better able to imitate the way industry works to a greater degree. 'By industrial processes for construction and facility management we mean that the processes are standardized and that platforms, products, services and information support are disconnected from construction projects...and are developed independently from a life-cycle, sustainability and customer perspective, then applied during construction, facility management and maintenance.'<sup>50</sup> By standardising construction components and sub-processes within the construction processes, this allows economies of scale, which, in turn, create entirely new opportunities for development work and learning than any other construction process to date.

Thanks to the opportunities that today's information and communication technologies offer, standardisation at the component and sub-process levels can be combined with a high level of customisation in individual constructions. A key element in this context is the use of what is known as Building Information Modelling (BIM). To be fully effective, BIM needs to be used by all actors involved in the value chains incorporated in building construction and facility management and maintenance. This development will necessarily take time and will only be able to be realized gradually and piecemeal.

The ambition is that industrial processes should enable large-scale, mass-produced construction with minimal storage costs through co-ordinated purchasing, individual solutions and an understanding of complex needs. In the long run, this will facilitate production regulated directly by demand for things like kitchen equipment, bathroom fittings, lighting equipment and other construction-related equipment (e.g., for waste management, water purification). Combined with IT solutions, industrial construction should lead to a major reduction in costs. Some estimate that the cost for renovations could fall to as little as 30 per cent of current levels. To date, this development remains in its infancy, although certain parts of BIM and industrial processes have already become widely accepted and are gradually being implemented. One reason for the slow rate of progress is, for example, that it is difficult to use industrial construction for bathrooms built during the *million-program*-era because they are too small.

In principle, industrialized construction processes are suitable for use in both new construction and renovations. It is reasonable to assume that these processes will be more quickly introduced in new construction than in renovation projects. Assessing just when and to what extent industrial construction processes will be able to be used effectively within renovation projects falls outside the scope of this report.

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<sup>50</sup>*IQ Samhällsbyggnad et al. 2013.*

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## 4 The Transition Stages in the System

Chapter 4 discusses the current position on a transition curve of development towards the sustainable renovation of *Miljonprogrammet* districts in Sweden. It also describes the current situation and, in general terms, the most important mechanisms that can contribute to either promoting or stifling transition.

### 4.1 Renovation in Sweden today

This study's interviews with experts and researchers active in the field reveal that they are very aware that the renovation of *Miljonprogrammet* districts is currently in a critical phase. The increasingly acute need for technical renovation in large numbers of Swedish apartment buildings, as in the rest of Europe, offers a window of opportunity for more extensive renovation in the form of energy-efficiency measures and efforts to improve the social environment and other aspects of the living environment. Despite these obvious needs, to date there continue to be very few good examples of sustainable renovation within *Miljonprogrammet* districts.

#### 4.1.1 Investment in housing at extremely low level in Sweden today

Housing shortages, particularly in Sweden's major cities, are a growing problem and are increasingly a topic of debate. Even so, investments in new housing are extremely low in Sweden at present. This means new construction is not driving innovative development within the building sector as a whole. While it is true that statistics show that the pace of new construction of multi-family residences has increased in recent years, it is equally clear that housing construction in major cities is not keeping pace with demand. If we consider tenant-owned apartments in major cities only, demand is markedly greater than the existing supply, as can be seen in indicators like the latest survey of real estate agents in four major Swedish cities (*Mäklarbarometern*)<sup>51</sup>. According to SBAB Bank, the housing shortage in major cities is the result of many factors, particularly large-scale migration to cities, low levels of housing construction and low housing loan interest rates, which, according to the Swedish National Board of Housing, Building and Planning's report "*Låst läge på bostadsmarknaden*", are thought to contribute to a more rapid increase in housing prices than the rate of increase for household income. Together with capital gains, this causes many residents to stay in their current housing because they cannot afford to move. In turn, this means that matching in the housing market is poorer than desired.<sup>52</sup>

Figure 5 shows house completions trends for single or two-family houses and multi-family residences for the period 1953-2013 for the whole of Sweden. Figure 6 shows the trends for Sweden's three major metropolitan areas and for the country as a whole for the period 1975-2013.

Figure 5: Housing completions (apartments) in new buildings, 1953-2013. Comparison, housing construction in major cities and in Sweden as a whole.<sup>53</sup>

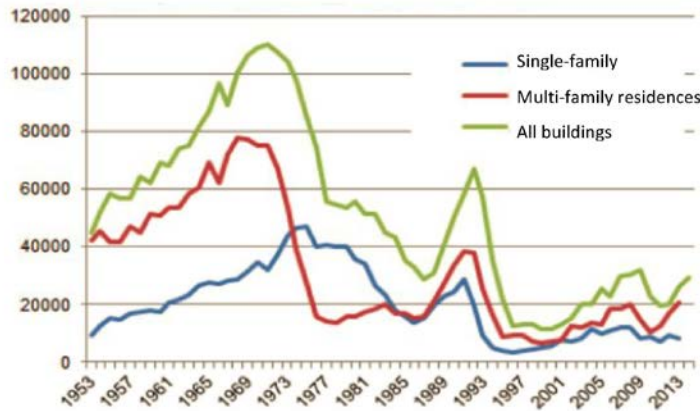
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<sup>51</sup> SBAB, *Mäklarbarometern Q1*, 2014, [https://www.sbab.se/download/18.39d09175144f282ee4c355/1397050345962/M%C3%A4klarbarometern+Q1+2014\\_140410.pdf](https://www.sbab.se/download/18.39d09175144f282ee4c355/1397050345962/M%C3%A4klarbarometern+Q1+2014_140410.pdf) (in Swedish)

<sup>52</sup> Swedish National Board of Housing, Building and Planning, 2014, p. 3.

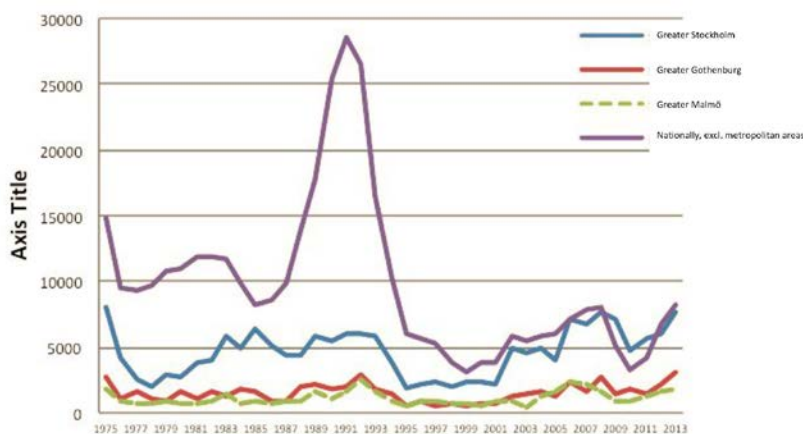
<sup>53</sup> The peak may also be the result of changes to building legislation. The National Board of Housing, Building and Planning's new Building Regulations came into effect in 1994. From 1989 to 1994, the Regulations for New Buildings applied.

Completed apartments in new buildings, 1953-2013



Source: Statistiska centralbyrån (Statistics Sweden)

Figure 6: Housing completions (apartments) in new buildings, 1953-2013. Comparison, housing construction in major cities and in Sweden as a whole.



Source: Statistiska centralbyrån (Statistics Sweden)

#### 4.1.2 Pace of renovation too slow

To date, the need to renovate *Miljonprogrammet* districts has been overshadowed in the public debate by the need to build new housing. Sustainable renovation and the opportunity to densify existing residential areas are rarely discussed as part of the solution to the housing shortage. As previously stated, the pace of renovation of *Miljonprogrammet* housing is currently far too slow. In Sweden today, 650,000 of the residences built under *Miljonprogrammet* are in acute need of renovation, which means that they must be renovated within the next ten years. Their sewerage pipes and electrical wiring are expected to last for a maximum of 30-50 years, and parts of the collection of residences in question may soon be beyond repair<sup>54</sup>. For Sweden to be able to meet its long-term renovation needs, major

<sup>54</sup> The problem of leaky pipe systems and dangerously worn electric wiring that are not repaired can quickly lead to an untenable situation in which residences become uninhabitable.

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social challenges and the objective of a 50-per cent reduction in energy use by 2050, extensive and sweeping renovations of Million Programme housing are required and the pace of renovation needs to be raised significantly immediately.

Presently, there are no systematic statistics on the scope and level of ambition of the renovations being carried out. The Swedish Energy Agency, the National Board of Housing, Building and Planning and the Swedish Environmental Protection Agency are currently running an energy-smart renovation campaign called *Renovera energismart*<sup>55</sup>, with the explicit aim of providing knowledge, showcasing opportunities and good examples, and contributing to a motivating dialogue about the energy efficiency streamlining of Sweden's multi-family residences, particularly Million Programme housing. Presently, the project's website presents just five good examples on sustainable renovation in Sweden. The example most often mentioned is the Brogården residential area in Alingsås, which is the first Million Programme district to be renovated to achieve passive house status. In total, the renovation encompasses 300 homes. Evaluations show that the renovation has led to an 80-per cent reduction in energy consumption for heating and an improvement in the indoor climate. In 2010, the property owner involved, Alingsåshem AB, won the major energy prize Stora Energipriset for its renovation of Brogården. The cost of the Brogården renovation was high, however, and the bill ultimately totalled SEK 1.3 million per apartment, which is more than double the cost of renovation projects undertaken with low energy-saving ambitions. The four remaining residential areas often mentioned as good examples are Orrholmen (Karlstad), Konstnärsgillet (Stockholm), Rosengården (Vallentuna) and Skärsätra (Stockholm).

#### 4.1.3 Current renovations not ambitious enough

This acute need for renovation offers a window of opportunity to undertake more extensive renovations. In addition to renovation that meets basic technical requirements, what are needed are energy-efficiency measures, improvements to indoor and outdoor environments, and the introduction of mobility and IT solutions so that residents both can and want to remain living there. Extensive improvements to residential areas are only possible (from both financial and technical standpoints) as part of more comprehensive renovation projects. According to interviews with representatives from the Swedish Association of Public Housing Companies (SABO) as well as representatives from the network of owners of multi-family residential buildings (BeBo) (see also section 6.3), renovations are currently being undertaken on a daily basis, but these address only the most acute technical needs. In some cases, they are combined with the introduction of energy-efficiency measures that provide the fastest ROI. As such, the renovation window is gradually closing. Housing estates that are only patched up will need to undergo further renovation within 15-30 years, or, alternatively, be demolished. If a more holistic approach were taken instead, these buildings could gain an expected lifespan of 50-70 years, with an energy performance that, hopefully, would last for as many years.

## 4.2 Malmö

Of the approximately 650,000 residences built under *Miljonprogrammet* that are currently in acute need of renovation, about 30,000 are in the city of Malmö. To date, there are very few good examples of renovation from Malmö. The Innovation Platform aims to change

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<sup>55</sup> <http://www.renoveraenergismart.se/om-kampanjen/> Accessed: May 2014.

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that. However, all those interviewed as part of this report, including representatives from both the national level and from Malmö, agree that the efforts being made to achieve a transition to sustainable renovation remain in a very early stage. According to the vast majority of those interviewed, in Malmö the lack of co-ordinating and broad-ranging political initiatives at the national level is seen as problematic.

#### 4.2.1 Ambition not lacking

Despite the major challenges involved, Malmö has a clear ambition to use the renovation issue as an engine to drive a more extensive change process that will lead to a sustainable city. In its efforts to become a sustainable city, over the past decade Malmö has consciously trialled new, innovative solutions through a number of projects both large and small. The impetus for this has come from different levels: city employees, citizens, companies (both private and public), special interest organisations and universities and university colleges in the vicinity. The experience gained from these highlights the need for increased co-operation and systematized innovation work. It has become apparent that no single actor is able to effect the change required and that existing work methods and models must be reconsidered if we are to overcome today's broad social challenges. Malmö's innovation platform now aims to utilize the insight and expertise acquired over more than a decade in an effort to create a dynamic innovation system through new forms of co-operation.

The physical renovation of Million Programme housing in Malmö has been identified as a key issue in driving development towards a sustainable city. The approach is broad and, in addition to technical needs, also includes the need for energy-efficiency measures and, not least of all, the need to meet social and economic challenges, which is viewed as a key issue in Malmö. The development potential of Million Programme districts is considered to lie in their residents, rather than in the buildings themselves. Therefore, the needs of residents must be the focus of any revitalisation, with clear initiatives that address both indoor and outdoor environments, increase residents' well-being and create new, green jobs. Calculations show that initiatives that help residents can quickly generate economic savings.

#### 4.2.2 Current projects within the Innovation Platform's framework

Actors from different societal sectors, including politics, administration, the business world, residents, organisations and academia, actively collaborate in Malmö's Innovation Platform to produce workable solutions. The tangible need to renovate Million Programme districts is the engine for jointly driving the development and use of new technology and the development of innovative business and financing models.

The express aim of the Innovation Platform is to stimulate development within six different work packages in a co-ordinated manner. These are: 1) *the technical development of buildings*, 2) *the physical development of residential areas*, 3) *social and economic development for residents*, 4) *Joint Action* 5) *new financing and business models* and 6) *urban global innovations arena*.

Below are some examples of on-going collaborative projects within the Malmö Innovation Platform's framework. These examples do not provide a complete picture of the activities undertaken within the platform, but instead illustrate the breadth of the measures being trialled to achieve sustainable urban development<sup>56</sup>:

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<sup>56</sup>Some of the most important activities within the platform's six work packages are not being undertaken as separate projects. This applies, for example, in development of new financing models.

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**1. District heating optimisation, E.ON is testing energy-efficiency measures for residences at Lindängen:** Within the framework of Innovation Platform Malmö, energy company E.ON, together with Schneider (a developer of energy technology equipment), has developed a district heating product that significantly improves energy efficiency. Trianon, a real estate company within the area programmes, has an ambitious goal to achieve 57-per cent better energy efficiency, in which E.ON's efforts play a large and important role. The project's actors have jointly reviewed co-operation between district heating production, distribution networks and the energy systems in the residences and the optimisation that this effort makes possible. By upgrading, adjusting and balancing the heating system located inside the residences, which are supplied with heat from district heating plants, a significantly more efficient energy supply is achieved. The project is also investigating the possibility of introducing individual metering and billing for hot water and the installation of solar cells.

**2. Social stipulations during the renovation of Lindängen:** Real estate company Trianon is trialling the standard inclusion of social stipulations that promote the use of local labour in all procurement processes. Thus, local jobs will be secured during the renovation work. Among others, Trianon is working with construction company Skanska in the renovation of windows. Laundry room renovations have also been procured using a similar model.

**3. Differentiated land prices from the Property Management Department:** This has been trialled through real estate company Trianon's promise of local job creation within its own organisation or with its sub-suppliers when purchasing land from the City of Malmö. Forty new jobs are being offered as part of the land purchase. New construction totalled 180 apartments.

**4. Collaborative consumption and the development of under-exploited buildings:** Within the Rosengård district there are currently more than 80 buildings not in use. A collaborative effort is now being made to determine how entrepreneurship, collaborative consumption or community development can be encouraged here. This work is part of the social initiative to improve Million Programme districts in Malmö. Run jointly by Malmö municipal real estate company MKB and the City of Malmö, the project includes an online innovation competition being run via the website [www.citymart.org](http://www.citymart.org).

**5. Energy behaviour in households:** Real estate company MKB and the Institute of Climate Impact Measurement (ICIM) are together investigating how to inspire commitment to conserving energy and a more conscious approach to sustainable living by developing digital applications (gamification). The result will benefit both residents and the property owner financially.

**6. Development of residential gardens in Lindängen and testing new methods for encouraging involvement:** Conducted as a co-operative project between real-estate company Willhem, the Swedish University of Agricultural Sciences and the City of Malmö. The project also investigates different forms of joint administration.

**7. Energy portal for providing digital energy advice to property owners (tenant-owned apartments):** A number of digital solutions are expected. Possible co-operation proposals related to open data and big data are being discussed with E.ON and/or Schneider.

**8. A 'Trip Advisor' for apartment-owners' associations wishing to upgrade their energy efficiency.** In an open source-like environment, apartment-owners' associations will share their experiences concerning renovation, give tips on good companies and warn about those that are less good.

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### 4.3 Role of technology

The transition towards sustainable renovation carried out on a sufficient scale will require the development and utilisation of new or improved technologies in a wide range of fields. Generally speaking, basic technologies do not appear to be a major bottleneck. The need for technological development can be divided into three main types that partially overlap one another:

- Systems integration on various levels, which will often require modifications and adjustments of basic technologies.
- Cost-saving technical development, partly achievable through a combination of learning or scale effects as the volume of renovation grows and changes in the organisation of construction processes. The development of new innovative technologies will also produce more cost-effective solutions.
- Evaluation of the real-life and long-term efficacy of alternative technical solutions, allowing more rational choices of renovation solutions and risk reduction.

Some of the relevant technologies may be classified as belonging to any of the following broad categories:

- The buildings themselves (including the materials, components and equipment they contain).
- The process of constructing buildings (including the manufacturing and logistics processes of the supplying industries).
- Information, communications and control systems (including sensors and actuators).
- Technologies for the local generation and transformation of electricity and heat (including, for example, heat pump and ventilation technologies and the integration of solar cells into building components).
- Systems for providing electricity and heat generated elsewhere (including, for example, next-generation district heating technologies).

This list is by no means exhaustive and may place too much emphasis on the individual buildings. If the focus is shifted from the purely technical renovation of buildings to the re-design and revitalisation of a residential area, non-technical knowledge and 'soft technologies' become increasingly important.

Information and communications technologies (ICT) are pervasive in their impact. They provide the basis for the integration and optimisation in real-time of functions and processes to an extent that was not at all possible formerly. In addition to the integration of different technical systems, this also allows individuals to become more active and well-informed decision-makers. Furthermore, ICT is seen as a major enabler for developing more effective, resource-efficient and quality-assured processes for constructing and managing buildings, with what is known as Building Information Modelling (BIM) expected to play a key role.

Given that buildings are expected to have long lives, the properties of the materials used in buildings and, consequently, the development of new or improved materials are of great

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importance. A major difficulty, however, is that new materials need to be tested under realistic conditions over long periods before their performance can be ascertained and they can be utilized on a large scale. Methods that reduce the time needed for testing materials are thus of great value.

Even if there is significant potential for the development of new or improved technologies linked to the renovation of buildings, the persons interviewed in this study do not consider technological development, in itself, to be sufficient for speeding up the rate of renovation nor for improving quality in renovation projects. A lack of technology is not seen as a major bottleneck. At the same time, it should be noted that the high costs associated with ambitious renovation are viewed as problematic. One might expect that dedicated efforts to develop better methods and technologies for renovation could potentially reduce its costs. It does not appear that this potential has yet been explored systematically.

#### **4.4 Why is not more being done?**

So, why is more not being done, when both the need and the preconditions exist? Because, in short, the challenge is a complex one. The renovation of Million Programme housing is a typical wicked problem consisting of a set of interconnected challenges that often obstruct each other's resolution. The solution requires technical development and social and organisational changes in conjunction with behavioural changes at the individual level. Overcoming this type of challenge also requires clear leadership, co-operative solutions and a structured process. In the date for this report, we have identified obvious bottlenecks hampering transition. These can be summarized under the following headings:

- *Financing conditions*

The economic aspects of renovation constitute a complex system. A manifest obstacle to increasing the pace and quality of renovation is the perceived lack of profitability for the actors who can and who are expected to drive development forward. This is particularly true of more ambitious energy-efficiency measures and other improvements, but, to a certain extent, also of more basic technical renovation. Workable financing models, which internalize the community's costs and benefits, are also lacking. In a global comparison, construction costs in Sweden are relatively high.

- *Knowledge and technology*

Exchanging knowledge and experience is a prerequisite for a successful transition. Today, effective mechanisms for sharing experience from renovation projects are lacking.<sup>57</sup> There is a lack of knowledge about optimal technical solutions and energy-efficiency measures for different circumstances, about innovative financing solutions, about workable business models and about how to use procurement to drive development. Even more knowledge about the connection between traditional expertise and IT within the building sector is also needed. More good examples are needed that can both show the way forward and break new ground.

- *Rules and requirements*

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<sup>57</sup> However, this report describes a number of praiseworthy initiatives that have been implemented for this purpose.



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The few goals and policy measures currently existing in the field at the international, national and local levels are important, but are insufficient for spurring development.

- *Decision-making processes and governance*

Harnessing the benefits of new technology and creating the preconditions for new, innovative financing solutions require a long-term approach, including work methods and new business and partnership models, which are currently significantly lacking. This applies within municipalities, among the building sector's many actors and also at the ministry and government agency level.

In Malmö today there exists a keen understanding of the above challenges and deficiencies and the Innovation Platform is an ambitious attempt to address this complex of problems. The aim is to transform the challenge of *Miljonprogrammet* districts (which risk becoming slums) into an opportunity to create a model for successful urban renewal.

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## 5 Actor Perspective on Driving Forces Behind and Obstacles to the Transition to Sustainable Renovation

Chapter 5 discusses the motivating forces and bottlenecks that affect development of the actors involved. The aim of Chapter 5 is to discuss driving forces behind and obstacles to the development of the sustainable renovation of Million Programme housing from the perspective of actor groups. The summary is largely based on conducted interviews, complemented by collected data.

### 5.1 The relationship of actors to development at the landscape, regime and niche levels

The transition to sustainable renovation is dependent on the decisions and actions of a long list of actors. They play different roles and act on different terms. The list below attempts to group the most important actors:

- property owners and residents<sup>58</sup>
- developers and their suppliers as well as other manufacturers of equipment used in residential properties or by companies that supply them with services
- financial institutions that finance investments in residential properties
- companies that offer services to homes and residents related to energy, waste disposal, water and sewerage, telecommunications, information, property care, maintenance etc.
- universities, colleges and other education providers, research institutes, consultancy firms and other organisations primarily focused on developing knowledge and technology
- non-profit and special interest organisations
- municipalities and regional public organs
- government departments and state authorities whose activities affect conditions within the housing sector, for example through the establishment of national objectives and strategies, regulations and building standards and through taxation and monetary grants for research, innovation and investments
- the European Commission.

Each group contains actors whose circumstances differ greatly from one another. A renovation project, for example, entails very different challenges for a large real estate company than for a small apartment-owners' association.

Landscape, regime and niche levels are key concepts within system innovation's theoretical framework. Here, the regime level within a certain area stands for the conceptions and behaviours that dominate and guide development within the area at a certain point in time. The landscape level is the broader environment in which the actors included in the regime

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<sup>58</sup> In the case of tenant-owned apartments, the two categories coincide.

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within a certain area conduct their activities. Examples of conditions in the landscape that affect a certain regime include widely-held conceptions and values, basic institutional circumstances at different levels and broad-ranging knowledge and technology development that impacts many areas. The niche level refers to activities within an area that are carried out in a way that deviates from the prevailing regime within the area and that, by definition, still have a relatively limited scope.

The theoretical framework for system innovation focuses particular attention on the dynamics in the interaction between the three levels and, in particular, how the development of the landscape and niche levels can contribute to a transition from the prevailing regime to a qualitative new regime. A regime is sustained by the actors who dominate it. For a regime to be changed significantly enough for the change to be described as a transition to a new regime, the dominant actors within it must either change their behaviour to a sufficient extent or be replaced by new actors. Actors within a regime are dependent on one another. Therefore, the transition from an existing to a new regime requires that the different actors change their behaviour more or less simultaneously and in a co-ordinated way. Ordinarily, such changes initially occur in a limited part of a regime's sphere of activity, in other words, in a niche. As some of these niches grow larger, a transition to a new regime can gradually take place. The interdependencies between different actors mean that if and when the partial transition from an existing regime to a new regime has achieved sufficient proportions, the transition tends to speed up. This is described as reaching a tipping-point.

It is important to note that a certain actor can contribute to preserving and reproducing a regime through the majority of its activities, at the same time as it contributes to laying the foundation for the emergence of a new, alternative regime through its participation in the development of a niche.

The aim of Chapter 5 is to discuss driving forces behind and obstacles to the development of the sustainable renovation of Million Programme housing from the perspective of actor groups and, in doing so, to make use of the concepts landscape, regime and niche as found in system innovation's theoretical framework. Some aspects and actor groups will be examined in more detail than others. In keeping with the overall design of the report, particular attention will be paid to the City of Malmö's actions. Research and innovation policy aspects will be addressed only very generally, as these will be discussed separately in chapters 6 and 7.

Rules and requirements have been allocated a separate section. In general, housing and construction are the subject of regulations and other measures implemented by public sector actors at different levels to a greater degree than many other areas. The reason for this is likely linked, in part, to the fact that housing fills a basic human need, that buildings have long lifetimes and high investments costs and that access to land in locations that are attractive for building housing is highly limited.

For similar reasons, public regulations and other measures play a relatively large role in the energy sector, too. As previously discussed, the energy sector has strong ties to sustainable development. Within energy, taxes have constituted an important steering mechanism for effecting the transition that has thus far taken place in the Swedish energy system towards a reduced impact on the climate. The possible role of the tax instrument in the field of renovation will be discussed briefly. The issue of financing will also be allocated a separate section.

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## 5.2 Values and ambitions – influence from the landscape

Environmental issues have long been assigned major importance in the Swedish community. This is true of the population at large, in both politics and the business world. There is broad support for an ambitious environmental policy and for the idea that Sweden should play an active role in formulating the EU's environmental policy. Many companies in Sweden base the public image they promote on their environmental work.

Measures for reducing the load on the ecological environment have gradually come to be seen as part of a broader ambition to achieve ecologically, socially and economically sustainable development. In very recent times, the social dimension (as also discussed in Section 3.1) has gained increased focus in sustainability discussions in Sweden. Similar tendencies can be seen internationally, where the debate on growing economic divides has intensified. Countries undoubtedly differ between what they focus on when discussing social aspects of sustainability. Discussions about social sustainability in Sweden can encompass both domestic and international conditions. In the former case, increased segregation and alienation in Swedish society, with a particular emphasis on problems in its major cities, are key issues. When social issues as viewed from an international perspective are raised in Sweden, these include such aspects as working conditions in the factories of global companies in developing countries.

The general support for the ambitions of achieving sustainable development in all these three dimensions is perhaps the most important influence exerted by the landscape on the actors who form the regime for renovating multi-family residences. Just what sustainable development entails is not the same for everyone. What the concept can and should entail in concrete terms and how sustainable development is best achieved are the subjects of constant interpretation. Naturally, this process is very much political in nature, but experience shows that many issues cut across traditional political divisions.

Given the relatively strong position that the drive to achieve sustainability has in Sweden, in general, one would naturally expect that sustainable renovation, as defined in this report, was a more high-priority issue. As noted previously, however, this is not yet the case. Why has the generally strong commitment to sustainable development seen in Sweden, that is, that found at the landscape level, thus far carried over so little to the area of housing renovation? Are there any signs indicating greater prioritisation of sustainable development at the landscape level can result in greater impact on housing renovation? The following observations appear relevant in attempting to answer these questions:

- Interest in the social dimension of sustainable development is relatively new and can be expected to gain increased weight and contribute to the perception of sustainable renovation as a more important issue.
- Within the housing sector, the transition in the production of district heating to fossil-free fuels has resulted in a dramatically reduced impact on the climate. This has moved the issue of more efficient energy use in housing out of the spotlight. In general, issues of supply have received greater attention in energy policy than measures for reducing energy consumption. However, to achieve the long-term climate objectives, energy use in housing must be reduced. For the same reason, a large portion of the waste currently used as fuel for producing district heating may need to be recycled rather than incinerated.

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- Historically, residential areas have been the objects of highly active political interventions of various kinds. During the *Miljonprogrammet*-era, these interventions also included extensive state financing. A reduction in the importance of public sector activities in the housing sector has been a long-term trend in Sweden. The state has retreated from its role as housing construction financier. A large part of what were formerly municipal-owned real estate companies has been sold to private stakeholders. Municipalities that still own real estate companies have been ordered to treat them on equal terms with private real estate companies and, for example, to require the same return on invested capital from their own companies as is expected in private real estate companies. In recent years the housing shortage (as seen in major cities, first and foremost) has emerged as an increasingly important issue and one of pivotal importance in growth policy. This has once again brought housing to the forefront of political debates. To what extent and in what way this will cause an about-face in the long-term trend of reduced state involvement in housing issues remains to be seen.
  - To the extent that housing has received increased political attention, it has been strongly focused on new construction. Given the lack of available housing, this is hardly a surprise. In public debate about the development of sustainable cities, urban densification is often presented as desirable. This is advocated particularly because it is thought to improve the potential of collective transport. The densification of communities as part of efforts to improve entire districts opens up opportunities for new construction. This opportunity has thus far been paid only very minor attention in Swedish discussions about how the housing shortage should be solved.
  - Another possible reason why new construction has come to overshadow renovation in today's housing policy debate is that, on average, residents in older multi-family residences have less purchasing power than the potential buyers of newly-built apartments. In pure business terms, ordinarily, new construction is therefore likely more attractive to developers than renovation of properties.

In summary, we can see how a number of factors have contributed to the failure of the generally high ambitions of promoting sustainable development to serve as a strong driving force for bringing about sustainable renovation. Looking forward, the increased interest in the social dimension of sustainability stands out as the factor in the landscape with the greatest potential to exert sufficient pressure in the area of housing renovation to contribute to a regime-change toward sustainable renovation. At the same time, the housing shortage in major cities and the singular focus on new construction that it has inspired to date appear to be factors that can continue to stop renovation issues from receiving the attention they deserve. Whether or not this can be viewed as belonging to the landscape level or not is open to debate, however. This brings to the fore the question of whether sustainable renovation is an appropriate definition of a system approach. This question will be addressed in Chapter 7.

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## 5.3 Driving Forces and Obstacles per Actor Group

The summary in 5.3 is largely based on conducted interviews, complemented by collected data.

### 5.3.1 Property owners and residents

Transitioning the regime for renovation of multi-family residences to sustainable renovation would result in both a significant increase in the pace of renovation and that renovations would take a more ambitious approach to energy-efficiency and the creation of an attractive social and physical environment for residents.

The decision to renovate is made by property owners and their level of ambition for renovation projects is decisive. The general opinion today seems to be that property owners lack sufficient incentive to undertake sustainable renovation on a large scale. Projects with ambitious energy-efficiency goals have only been small-scale and have incurred such high costs that real estate companies have not considered it financially feasible to scale them up. As such, there is much to suggest that property owners wanting to support development towards sustainable renovation also require a change in the general terms under which they operate.<sup>59</sup> As noted previously and also again later in this report, work is on-going in Malmö and a number of other municipalities to develop new financing models for housing renovation in which costs and revenue are evaluated in a broader context. Today, there are signs that more broad-minded approaches to estimated revenues and costs for renovation projects, including greater consideration for social aspects and job creation, are generating interest in investing in residential properties and their ambitious improvement among new actors.

Naturally, residents are greatly affected by the way in which renovation projects are carried out. This does not necessarily mean that they are involved to any great extent in the decisions made about renovation, however. Naturally, the situation varies between different apartment-owners' associations and real estate companies. In the case of apartment-owners' associations, it is ultimately the residents who make the final decision about renovation through their membership in their association. Involvement beyond the association's board is often limited, however. Residents in rental apartments often have little influence over the planning of renovation projects, and it is not uncommon for them to be presented with a fait accompli when rental fees are raised after more extensive renovations.

Several factors show the necessity of residents playing a greater and more active role in renovation if the transition to sustainable renovation is to be realized. These apply to both the decision-making process leading up to and during the renovation work and also later in the realisation of the development opportunities offered by the improvement of a residential area. Even if the technological improvement of residential housing and its surroundings may be a precondition for a good social environment, only residents can create this type of environment. The ability to bear increased costs incurred due to renovation varies between

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<sup>59</sup> *In an analysis of incentives for property owners to invest in energy-efficiency measures, Högberg and Lind (2011) draw the following conclusion: 'If our assessment is correct and no major technological breakthroughs occur, additional state action will be required to achieve the long-term objectives. These may include:*  
- *Regulations that force property owners to take measures that are likely unprofitable. For example, quantitative objectives at the property level combined with financial penalties if these are not achieved.*  
- *Economic measures that make energy savings more profitable; either increased energy taxes or subsidies for specific measures, as have been employed in a number of other countries.*

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households. As such, as far as it is possible from a technical standpoint, there is a need to adapt the standard of housing after renovation to suit the repayment capacity and the particular needs and wishes of different households. One example is the needs required to allow elderly residents to remain in their homes even if they suffer impaired health and mobility. Improving energy efficiency is increasingly dependent on co-operation and behavioural changes on the part of residents and is not achieved solely through the technological performance of buildings and equipment. Development within information and communications technology is creating new opportunities to connect behaviour with its effects at the individual level.

Contracts are examples of institutional conditions that contribute to defining a regime. Interviews and research conducted in preparation for this report show that the current design of rental contracts does not create an incentive to implement energy-efficiency measures. This reflects the problem of what are known as split incentives.<sup>60</sup> A tenant's incentive to save energy is greatest when under rental contracts that require paying for their own heating costs, while this reduces the incentive of a property owner to invest in energy-efficiency technology that can lower the cost of the building's energy needs. Landlords are not interested in footing the bill for measures that save tenants money, given that implementing energy-efficiency measures is not acceptable grounds for increasing rental fees. Notwithstanding, there are some interesting examples in which property owners and residents have co-operated to find good solutions through dialogue, clear information and the opportunity to choose green rental contracts or all-inclusive rental contracts that provide incentives for residents to reduce their electricity use.

The Swedish National Board of Housing's report 2013:32, however, acknowledges that divided incentives are a relatively minor problem compared with other obstacles, such as financing issues and other knowledge-related obstacles. The report also provides evidence for the argument that divided incentives are – by international standards – a limited problem on the Swedish market.<sup>61</sup>

### 5.3.2 Municipalities and regions

Municipalities stand out as the actor group that is currently most active in pushing for a regime change in the direction of sustainable renovation. As in all actor groups, certain municipalities are more active in this push than others. Malmö, a particular focus of this report, is definitely one of the municipalities most active in the fight to achieve a transition to sustainable renovation.

The municipalities' interest in regime change is explained, in part, by the following:

- If housing is allowed to fall into disrepair, this can cause major financial, social and image-related problems for the municipalities;
- Viewed from the municipalities' standpoint, the extra costs associated with an increased level of ambition in renovation projects can, under the right circumstances, contribute to

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<sup>60</sup> Landwehr, André (2013) maintains that 'Many of the studies conducted on the topic of energy efficient retrofitting of rented properties name the "split-incentives" issue as the biggest barrier towards practical realization of renovations for energy efficiency,' citing Hoppe & Lulofs (2008), Faber & Hoppe (2012) and van der Veen (2012).

<sup>61</sup> Swedish National Board of Housing, Building and Planning, 2013:32

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reduced costs or increased revenue, making it relevant for them to consider providing financial support to renovation projects;

- In the global competition between major cities (principally), to be attractive places for people to live and work in and for companies to run their operations in, the environmental profiles of cities have taken on increased importance. Many cities set ambitious targets in their environmental work, which they then focus on achieving. To a certain extent, a similar competition exists between Swedish municipalities. At least in the long-term, energy-efficient housing is an important part of a city's or municipality's environmental profile;
- Municipalities see the implementation of local development projects with ambitious sustainability objectives as a way to stimulate business development in the municipality. Ordinarily, this requires a willingness on the part of global companies able to provide advanced technology and expertise to participate in the projects. The effect is that the municipalities compete to become attractive demonstration and test environments for solutions to social challenges.

For Swedish municipalities, sustainable renovation is one of a number of sub-challenges faced within their broader ambition to achieve long-term sustainable urban development in all its aspects. A city comprises an extremely complex system with strong system dependencies between different types of infrastructures, activities and behaviours. Municipalities are the actors with both the greatest need and opportunity to see and act on the basis of these system dependencies. A broad perspective on the improvement of a particular urban district may involve reviewing land use in the area, for example. At the same time as housing is renovated, a reduction in the amount of land used for parking combined with the densification of developed areas can create room for new housing, vegetable gardens, other green areas, bicycle paths and more. Changes in the climate have created the need for new surface water solutions in which green areas in cities play a central role.

In many respects, regions have similar interests. However, outside of healthcare (and to some extent transportation), the majority of the public financial resources for local and regional development are found at the municipal level. The regions can play a part by contributing to co-ordinated activity between different municipalities in a region.

Although municipalities are promoting the transition to sustainable renovation, they also require the co-operation of other actors if a regime change is going to be effected. Developing new financing models definitely requires co-operation with property owners and financial institutions. On its own, a single city comprises far too small a market to be able to develop cost-effective renovation solutions. For large-scale sustainable renovation, the solutions produced within local development and demonstration projects must be transferable to a larger market. Ordinarily, this means the international market. The step from demonstration project to large-scale project, especially, is critical. Expressed in system innovation-related terms, demonstration projects can be viewed as development at the niche level. We will return to the question of how niche development can make an impact at the regime level. Note that, the municipal level has expressed the desire to be able to orient local efforts to a larger context in which the general lines of development for sustainable development have been identified. It is believed that local development projects could achieve a greater impact if they were carried out as part of a broader development and learning context. This kind of broader context has been lacking thus far, but is being called for. A national level context is perhaps the most immediate option, but the need for



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international harmonisation for creating a large enough market for the solutions produced means that a development platform at the EU level could be an important function.

### 5.3.3 Global and local energy companies within the construction, energy and other sectors

Today, sustainable urban development and their necessary investments are an important and prioritized market for many global companies in many industries, including information and communications technology (ICT), transportation and transport systems, construction materials and construction, energy technology, and water and waste management. China and other countries undergoing rapid urbanisation and growth are especially interested in building entirely new urban districts. Urban development in more mature economies like that of Sweden is a more heterogeneous market that, to a significant extent, is comprised of renovation and the development of existing infrastructure and buildings. The level of development in countries like Sweden, particularly their advanced use of ICT, makes them important places for developing and testing new technology and system solutions.

The potential markets opened up by the renovation of multi-family residences differ substantially between different types of companies. From the perspective of construction companies, the housing renovation market is still very local in nature. Major construction companies with their head offices in Sweden are involved in renovation projects throughout the country, but only to a very limited extent abroad. Conversely, foreign construction companies are largely absent from the Swedish renovation market. It is unclear whether conditions in other countries are markedly different or not.

The market for housing renovation must be considered fragmented and characterized by very low levels of standardisation.<sup>62</sup> Experts judge the great variety that exists at the component and subsystem level as far greater than what is warranted for meeting the unique needs of individual renovation projects. More standardisation at the component and subsystem level would facilitate increased use of industrial construction methods and would generally increase opportunities for sharing knowledge between various renovation projects to improve efficiency and quality, together with taking advantage of economies of scale in the manufacture of materials, components and subsystems. Development in this direction is currently on-going to a certain extent, thanks to efforts by large property owners and large construction companies.<sup>63</sup> It cannot be determined here if and when this development will reach a level and a degree of impact that appreciably increases competition, innovativeness and the dynamics of the renovation market, thereby contributing to a regime change.

Although the construction processes for renovation develop relatively slowly, a faster-paced development of some of the materials, components and equipment used in renovation contexts is occurring. These are manufactured by companies active internationally, with either Sweden or another country as their home base. One example of this is the development of improved and entirely new insulation materials, almost all development of which is

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<sup>62</sup> *Radio Sweden, 16 May 2014.*

<sup>63</sup> *An indication of interest by major Swedish-based construction companies in developing more efficient methods for the ambitious renovation of multi-family residences is that Skanska and NCC (two of the largest Swedish-based companies) are each working with separate demonstration projects concerning energy-efficiency through renovation within the Energy-efficient Buildings (EeB) programme. The Energy Efficient Buildings Association (E2BA) and the European Commission are jointly conducting the programme. NCC is co-ordinating its project, which focuses on industrial construction.*

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occurring outside Sweden, while a large portion of its manufacturing for the Swedish market is taking place in Sweden. On the other hand, heat pumps are an example of an area in which manufacturers in Sweden play a more prominent role in technology and product development for the international market within certain segments. Naturally, the development of materials, components and equipment with better performance and lower prices affects the long-term prospects for renovation projects, although development within each product area likely has a minor effect on the regime as a whole with regard to renovation. The effects could likely be significantly greater in the opposite direction, however. If a new renovation solution at the system level makes a major breakthrough on the market, even if this breakthrough is limited geographically, this can strengthen the global market position of manufacturers of individual products included in the system solution concerned. This is why global companies are also interested in participating in innovative local development projects.

This report attempts to show that design has a key role in the transition towards a sustainable society. This applies to both the design method itself as a tool for change, the design consultants' role in creating trends and influence behavior, and in their daily contact with companies regarding product development. The Energy agency has since 2005 been conducting a successful research program Energy, IT and Design. The program has resulted in a number of projects and products that made international influence and has shown how user-driven design can create new products and services in the energy field. Now the program's positive experience should give a solid base and the cooperation between energy, information technology and design be further strengthened.<sup>64</sup>

The wood goods manufacturing industry is a major supplier to the construction industry in Sweden, but also a major export industry. Many indicators suggest that major, unexploited development potential exists for using wood in construction contexts, including in renovation projects. This applies to materials technology development and to business models and logistics systems that would allow a higher degree of customisation while maintaining economies of scale in the manufacturing phase. The wood goods manufacturing industry in Sweden is aware of these opportunities, but so far initiatives specifically targeting the field of renovation seem conspicuously lacking.

More efficient energy use is one of the main aims of sustainable renovation. This means that energy suppliers have a key role to play. The direct effect of more efficient energy use is a reduction in the demand for energy and, thereby, a smaller market for energy companies. The way energy companies handle this situation will influence how well opportunities to streamline energy use in connection with renovation can be exploited. Playing an active and constructive role in developing effective solutions for the energy supply of renovated buildings requires energy companies to relatively radically revise their business models and pricing systems. Changes in the strategies and business models of energy companies stand out as a critical factor in the transition to a regime for the sustainable renovation of multi-family residences. Experience from Malmö indicates that energy companies are prepared to accept this challenge and have already begun to move in the desired direction.

The development of smart cities is based on new ways to harness the rapid and constant progress being made in the field of information and communications technology (ICT). This can be viewed as a development at the landscape level that affects development within the field of renovation. Unlike energy supply, ICT development is more about developing new

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<sup>64</sup> *Ilstedt Hjelm, Swedish Royal Institute of Technology (KTH), 2011.*

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systems rather than with driving changes to existing systems. This particularly applies to the development of information services and technological and business platforms for such services. Much of current development aims to integrate information from different sources and, when there has been a lack of information, generating the desired information, for example through the use of increasingly inexpensive and better-performing sensors or through more advanced analyses of the constantly increasing flow of information. From an innovation standpoint there is a certain amount of competition between closed and highly specialized platforms on the one hand, and more open platforms that aim to serve a number of different areas on the other. This is especially true of energy. The path chosen here presumably plays an important role in innovation dynamics surrounding the development and use of new information services.

The advanced utilisation of ICT in Million Programme housing is not critically dependent on whether or not sweeping renovations are carried out. On the other hand, sustainable renovation is dependent on the full use of ICT. This is certainly the case in achieving the desired high level of energy efficiency. It is also likely true if the actual construction work will have a high level of customisation and a high level of quality and efficiency. Many uses for ICT for improving a residential area – in the broadest sense of the term – can be imagined. These could involve everything from increasing the involvement of residents in the planning of renovation projects to the development of ICT-based services that make it easier for the elderly to continue living at home.

Suppliers within the ICT industry include companies of greatly varying natures and sizes, from global giants that contribute to setting the agenda for development within ICT at the global level to small niche companies that develop innovative solutions to highly specific problems. Viewed from a regime standpoint, ICT companies differ in their connections to the current regime.

#### 5.3.4 Financing and financiers

A regime transition to sustainable renovation requires the development of new financing solutions that internalize the positive social and national economic effects of investments in the used profitability assessments and financing arrangements. Implementing renovation projects that meet ambitious requirements for energy efficiency, but that primarily aim to bring buildings' technical status up to standard, are not currently considered profitable from a business economics standpoint.<sup>65</sup> If, instead, the approach is broadened to view the physical renovation of properties as part of the broader improvement of a residential district, where the development of social aspects is an integrated part of the improvement, then the assessment becomes more positive.

Research reports also lend support to the idea that social sustainability issues are an important motivator for successfully implementing housing improvement projects. Van der Veen (2012), who conducted empirical research on a number of local large-scale renovation projects in the Netherlands, states that social sustainability issues and social needs are the most effective way to drive sustainable renovation forward that generate acceptable results for residents, municipalities and property owners. Adopting a broader perspective on social sustainability as the primary purpose of renovation also often results in the best energy efficiency. This is because new influential stakeholders become involved and because it opens up the possibility of access to more public funding. Energy-efficiency measures are

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<sup>65</sup> Profitability is affected by calculation models and projected energy price trends.

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then seen as part of the broader concept of social sustainability, instead of as just a way of achieving environmental aims and ecological sustainability. Van der Veen also asserts that by developing a strategy that clearly links renovations with aims related to the alleviation of poverty and improved employment and health, many social sustainability issues can be more easily remedied. In this way, the improvement of residential districts also becomes a project that can be financed using Social Impact Bonds, which aim to provide financial resources in support of quantifiable contributions to socially sustainable development<sup>66</sup>. This approach is something that the City of Malmö has paid serious attention to in its work with the Innovation Platform. Similar approaches to renovation appear to be emerging in other locations in Sweden too. The social perspective and the well-being of residents are also key considerations in the models that the large construction companies have produced for improvement and renovation processes.

Work in developing new financing models for investing in the improvement of residential districts which integrate technical and social aspects is still in an early phase. Municipalities play a key role in this, as they are greatly and directly impacted financially by the costs and unrealized tax revenue caused by poor social conditions and unemployment. Measures that help reduce these problems can be seen as an investment that generates a return in the form of reduced costs and increased tax revenue and that makes municipalities potential co-financiers of renovation and improvement projects. However, this financing must be combined with capital from financial institutions in the form of loans or from some other source. As such, it is critical to spark the interest of financial institutions in the development of new financing solutions.

In the proposed financing plan presented publicly by the City of Malmö, two EU structural funds are important financial backers: the European Regional Development Fund (ERDF) and the European Social Fund (ESF). ERDF, which has a broad investment agenda, prioritizes (among other things) investments that can contribute to reductions in carbon-dioxide emissions. One of ESF's focuses is investments that promote employment and social integration. These two funds each mirror in their priorities one of the two main objectives of sustainable development: energy efficiency and social improvement, respectively.

Interest of other financial institutions also needs to be encouraged. There are signs of increased interest among real estate companies and investors in acquiring and investing in the improvement of Million Programme properties. One reason for this interest is likely the housing shortage in Sweden's major cities and the potential markets it creates. A number of real estate companies have made efforts to actively involve residents in the improvement of residential districts through measures like offering work directly connected to improving the social and physical living environment.

The extent to which the improvement taking place will prove to be socially and environmentally sustainable is open to debate. That said, it is realistic that investments in the social improvement of a residential district could be profitable even from a purely commercial standpoint. If this occurs at the expense of low income residents who are forced to move due to sharply increased rental fees, for example, then little has been gained in a broader social perspective. As previously mentioned, incentives for private investors to invest in a high level of energy-efficiency improvement in connection with renovation are currently considered to be far too meagre to motivate such efforts. Even if, consequently, the increased interest among private investors cannot be expected to lead to sustainable

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<sup>66</sup> *Mulgan et al. 2011.*

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renovation and improvement as defined in this report, this interest may nonetheless create openings for new, combined private-public financing solutions that incorporate ambitious sustainability requirements.

In the business world as a whole, corporate social responsibility (CSR) issues have gradually gain a strong foothold. Initially, much of the focus lay on the environmental impact of companies, but today, the CSR perspective is much wider and includes a host of aspects concerning the way that companies treat their employees and affect consumers and the communities in which they operate. This development in CSR also affects financial institutions which now commonly include an assessment of how well companies and projects meet CSR requirements in their investment criteria. If a system innovation perspective is established, the increased importance of CSR becomes an important change in the landscape that surrounds sustainable renovation. For financial institutions these changes in the landscape may be particularly significant and, as development continues they may increase the interest of financial institutions to become actively involved in projects that aim to address social, environmental and other societal challenges.<sup>67</sup> This would involve questioning the finance sector's approach in the wake of the financial crisis that began in 2008 and the major recent focus on growing economic inequality.<sup>68</sup>

State involvement in the financing of housing construction, which was very extensive under *Miljonprogrammet*, has fallen dramatically and, today, is of only marginal importance. A number of those interviewed in connection with this report believe that the state could facilitate the financing of energy-efficiency measures during renovation by offering state loan guarantees.<sup>69</sup> This could be justified by the uncertainty surrounding assessments of the effectiveness of individual energy-efficiency measures and how energy prices will develop. The genuine uncertainty in these assessments most often results on basing investment estimates on conservative assumptions, which means that profitability is commonly underestimated. Today, the typical interest calculated for costing purposes for energy-efficiency measures is 5-7 per cent. Several interviewees mentioned the need for a study to examine the option of creating a credit risk insurance that gives property owners who want to invest in renovation and energy-efficiency measures financing on reasonable terms. By taking out collective insurance policies through state institutions or member organisations like the Swedish Association of Public Housing Companies (SABO) or the Swedish Property

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<sup>67</sup> As a concrete example, it can be noted that SEB, one of Sweden's major banks, together with the World Bank, has developed a new framework for what has been termed green bonds. Following this framework, in September 2013 the City of Gothenburg became the first organisation in the Nordic region to issue green bonds. These were valued at SEK 500 million. This and other planned bond issues will be used by the City of Gothenburg to finance various environmental projects within public transport, water supply, energy and waste management.

<sup>68</sup> The enormous attention that Thomas Piketty's book, *Capital in the Twenty-first Century*, has received both in Sweden and internationally is a clear sign that questions of economic inequality are considered highly relevant.

<sup>69</sup> A report by the former National Housing Credit Guarantee Board (BKN, 2008) proposed a guarantee programme for improvement loans for multi-family residences.

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Federation, credit risk could be shared, which would create room for more energy-efficiency measures.<sup>70,71</sup>

Radically streamlining energy-efficiency in housing and other buildings is a societal interest that is currently valued more than the personal financial interest of individual residents. Swedish government authorities have actively used various economic policy measures, like taxes and investment grants, to implement environmental and climate policy. Thus far, these policy measures have primarily focused on reducing carbon-dioxide emissions from energy production and transports. A logical step would be to develop economic policy measures that focus directly on stimulating energy-efficiency measures in buildings.<sup>72</sup>

### 5.3.5 Non-profit and special interest organisations

There is insufficient room here to discuss all the different types of organisations involved in the improvement and renovation of residential districts. However, two additional categories of organisation should be noted beyond those already mentioned.

The first of these is special interest organisations. Trade and professional organisations belong in this category. Organisations that organize apartment-owners' associations can also be included here. Special interest organisations can serve either to promote or obstruct the transition to a new regime through the role they play as representatives for their members. The development of policy within a special interest organisation involves an exchange of information, knowledge, views and standpoints between the organisation and its members.

That both social and environmental issues are key aspects of sustainable renovation mean that there are many common interests with non-profit organisations. These can be expected to play a motivating role in such a transition. 'Social innovations' is a relatively new concept that has recently begun to gain ground. Non-profit organisations, businesses and researchers have attempted to systematically develop social innovations. Some interesting examples of this type of innovation can be found in Malmö. Without doubt, this type of development initiative can play an important role in renovating residential districts with a broad approach.

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<sup>70</sup> In Malmö, those involved have studied Germany's example, where energy-saving loans have been available for more than ten years. One evaluation states that German energy-saving loans have contributed to the renovation of several million homes and to a considerable reduction in energy use. Moreover, these renovations are assessed to have created 200,000 new green jobs each year. Jobs growth (and the increased VAT revenue associated with it) resulting from energy-smart renovation is seen as a welcome bonus in times of high unemployment. Ljung, Byggnads, 2012.

<sup>71</sup> One method used in Sweden today to reduce risks for property owners in connection with energy investments is Energy Performance Contracting (EPC), performance contracts that include operational responsibility and a performance guarantee. This business model is used for investments in energy-saving measures. The contractor who implements energy-efficiency measures assumes the risk and is liable to pay a refund if the promised energy savings are not realised. One limitation of EPC, which is currently used almost exclusively for office buildings, is that it favours those energy-efficiency measures that constitute a sure and short-term investment and that give a rapid ROI. As such, it misses the opportunity to exploit major energy-saving measures.

<sup>72</sup> A report issued by the Swedish Society for Nature Conservation (2013) discusses how a combination of energy-based tax deductions for households that repair, renovate or extend their properties (ROT-avdrag) and state loan guarantees could make energy-conservation measures in climate shells and ventilation systems profitable.

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## 5.4 The state and EU rules and requirements

Government authorities affect construction and housing in numerous ways, both directly and indirectly, through laws that regulate urban planning and rental fees, rules and requirements for construction, taxes, the financing of education and research etc. In this section, the primary focus of the discussion will be on the role of the state in rules and requirements, especially those related to energy use within the housing sector. Rules and requirements at the EU level are playing a growing role in this area and will also be addressed.

In general, it can be said that the need to more actively promote energy efficiency in buildings has been raised at the EU level, but that the frameworks formed for member states have no strong control function when it comes to improving energy efficiency during renovations. Swedish requirements for energy-saving measures during renovations as defined in building regulations are generally considered far too lax. At present, rules and requirements hardly promote the transition to sustainable renovation.

### *Environmental requirements*

Today there are several EU-wide and Swedish energy and climate objectives in place, particularly for the target years of 2020 and 2050. Some of the most important objectives in this context are contained in the Energy Performance of Buildings Directive (2010/31/EU) and the Energy Efficiency Directive (2012/27/EU). Directive 2010/31/EU states that, by 2020, all newly constructed buildings and houses must be nearly-zero-energy buildings and that all EU countries must promote the renovation of existing buildings in accordance with the nearly-zero-energy standard.<sup>73</sup> Since the release of the EU's 2010 energy strategy, buildings have been identified as one of the two sectors with the largest energy-saving potential.<sup>74</sup> In the new directive released in 2012, energy requirements were tightened for both new construction and renovations. From 2020, following major renovation all buildings must meet the national requirements for energy performance. Moreover, the requirement that all member states draw up national strategies for improving energy performance in existing buildings was added.<sup>75</sup> According to the national environmental quality objective 'Good Built Environment', energy use is to be reduced in the long-term and is to be followed up through the indicator 'Energy Use in Dwellings and Non-residential Premises'.<sup>76</sup>

Most large cities have established their own environmental objectives. In Malmö, the overarching objective is for the city's own organisation to become climate-neutral by 2020 and to have the whole of Malmö powered by 100-per cent renewable energy by 2030. To achieve these objectives, intermediate objectives and indicators have been created within the following areas: reduced energy use, more renewable energy, reduced emissions and a transition within transports and transportation use. Several documents describe the focus of Malmö's environmental work. Three of the most important policy documents at present are the city's Comprehensive Plan (Översiktsplanen), the Environmental Programme for the City of Malmö (Miljöprogram för Malmö stad 2009-2020) and the final report by the Commission for a Socially Sustainable Malmö, entitled Malmö's Path Towards a Sustainable Future. Health, Welfare and Justice.<sup>77</sup>

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<sup>73</sup> Swedish Energy Agency, 2013-11-18.

<sup>74</sup> Swedish National Government, 2013.

<sup>75</sup> Swedish Energy Agency and Swedish National Board of Housing, Building and Planning, 2013.

<sup>76</sup> Swedish Energy Agency, ER 2013:05.

<sup>77</sup> Malmö stad, 2013:2

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### *Building regulations*

Sweden's requirements for energy conservation and building emissions and environmental impact have been established in the Swedish Planning and Building Act (PBL). Requirements for energy efficiency in new buildings are regulated by the Swedish National Board of Housing, Building and Planning's Building Regulations (BBR). Municipalities previously had the right to impose more stringent requirements than those stipulated in the Board's Building Regulations, and they utilized this opportunity to promote development and achieve local objectives. In BBR2014, the opportunity to impose stricter requirements than those established by the document itself has been removed because reports revealed that special requirements prolonged the construction process, slowing the pace of renovation.

BBR2014 has been the subject of criticism by a long list of referral bodies, however <sup>78</sup> meaning that it fails to promote the development of technology as it can and should do. A number of those interviewed consider that BBR's requirements could and should correspond to passive-house level. They believe that, under current building regulations, it is unlikely that the Swedish Parliament's energy-efficiency objectives can be achieved. Several interviewees also emphasize that the current BBR document's solitary focus on purchased energy drives up carbon dioxide use by society. Instead of purchased energy, used energy should be measured since this makes it possible to steer development towards better climate shells, more efficient installations and low-energy buildings, regardless of the energy source. Using purchased energy as a policy measure means that buildings can be built more cheaply and with poorer-quality insulation and performance and still meet the energy requirements. Overall, this results in poorer energy efficiency.

Several of those interviewed point out the importance of a full system perspective when designing the regulatory framework and administrative policy measures. To successfully reduce total energy use, buildings need to be built and renovated to accommodate technology shifts and new energy systems. According to these interviewees, BBR could play an important role to stimulate this development, but today fails to do so in its current form.

The building regulations that aim to achieve energy efficiency also contain clauses concerning architectural and aesthetic requirements. A number of interviewees stress that the restrictions imposed by these requirements risk obstructing development by making renovation and energy-efficiency measures in existing multi-family residences more difficult to carry out. A couple of them called for an enquiry into the conflict in objectives between necessary energy-efficiency improvements and renovation on the one hand, and the requirements to maintain good architecture on the other.

### *Energy declarations*

According to the current law on energy declaration, buildings are to be inspected upon sale, rental and construction and information about energy use and their indoor environment is to be declared<sup>79</sup>. The purpose of energy declarations is to promote efficient energy use and a good indoor environment in buildings. A number of interviewees point out that energy declarations could be used to much greater effect than is currently the case. A high-quality,

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<sup>78</sup> <http://www.vgregion.se/sv/Vastra-Gotalandsregionen/startsida/Miljo/aktuellt-startsida-miljo/Kritik-mot-forslag-om-minskade-mojligheter-for-kommuner-att-driva-energieffektivt-byggande-/>, 2013-11-13 (in Swedish).

<sup>79</sup> Swedish Energy Agency (Energimyndigheten), 2013-11-13.



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credible energy declaration could influence the pricing of houses for sale, thus emphasising the value of energy efficiency and contributing to increasing the pace of development.

### *Environmental certification*

During the past two decades many voluntary environmental certification systems for buildings have emerged, including BREEAM and LEED, currently the two most well-recognized and international certification systems. Building green and being able to verify it with a certification are seen today as a meaningful and visible signs of accepting social responsibility, which, in turn, is seen as contributing to increased attractiveness. The development of climate-related aspects of the two certification systems has primarily revolved around energy-efficiency issues and is almost exclusively connected to new production. However, building certification will likely be expanded in the future and aspects like building materials, indoor environment and economic and social sustainability issues will be taken into consideration when certifying buildings. Studies show that this could contribute to increased interest in certifications for the housing market among private buyers of residential properties, where, thus far, there has been no great demand for environmentally-certified buildings. Private consumers still focus on other, more traditional factors when choosing their homes, such as location, price and function.<sup>80</sup>

#### 5.4.1 Knowledge producers

In Sweden, the building sector has traditionally been viewed as relatively unsophisticated from a technical standpoint and, within the sector itself, renovation projects have been assigned a particularly low status. Investments by construction companies in R&D have been modest. As is discussed in more detail in Chapter 6, public investment in R&D within urban development has also been small, and, moreover, has also fallen in the first decade of the new millennium.

In very recent years, however, a change has occurred in private and public sector attitudes towards the need to invest in knowledge development and innovation within urban development, and a certain increase has occurred in the public funds allocated to R&D within the field as a whole. Investments with a specific focus on renovation-related issues have been few and small. One notable exception is a grant from the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) in 2014 of SEK 23 million for the establishment of a strong research-environment in the renovation area at Lund University with close connections to the likewise recently established National Renovation Centre hosted by the same university.

To a greater or lesser extent, all actors with a role in a renovation project contribute their knowledge, and, in the process, acquire new knowledge. If feedback and exchange processes work well, this knowledge will go on to benefit new projects. In addition to the actors already mentioned, there are also others primarily focused on knowledge production and dissemination, such as universities and colleges, other education institutions, research institutes and consultancy firms. Even some young companies (besides consultancy firms) that have been established to commercialize a specific new technology or method or unique expertise can usefully be included in this same group. Cumulatively, the knowledge producers mentioned represent an important infrastructure for helping implement renovation projects in a rational manner with reasonably predictable results. They are represented in the

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<sup>80</sup> Swedish Royal Institute of Technology (KTH), 2012.

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majority of the initiatives taken within the framework of research and innovation policy as discussed in chapters 6 and 7.

If we attempt to make a general evaluation of the role of dedicated knowledge producers in the transition to sustainable renovation, the following observations are relevant:

- The knowledge producers need to place greater focus on issues specific to renovation, including participating in the follow-up and evaluation of completed renovation projects and disseminating the knowledge obtained from these. The establishment of the National Renovation Centre is a valuable initiative dedicated to this purpose.
- It is judged that all levels, including the trade level, have large, unmet needs for skills development concerning renovation-related issues. Knowledge producers have an obvious role to play in contributing to meeting these needs in good time. It is not a given that this is happening today. One particular need is the severe lack of expertise within information and communications technology among the majority of actors and professional groups within the building sector.
- There is a great need to integrate knowledge from different fields and research disciplines. As social aspects begin to assume a more prominent role in the planning and implementation of renovation projects, knowledge about the interplay between technology, organisation, economics and experiences and behaviour among individuals and groups needs to be developed. In this regard, a heavy burden of responsibility lies on knowledge producers to expand their frames of reference and develop more integrated approaches, knowledge and expertise.

## **5.5 Malmö Innovation Platform for integrated urban renewal**

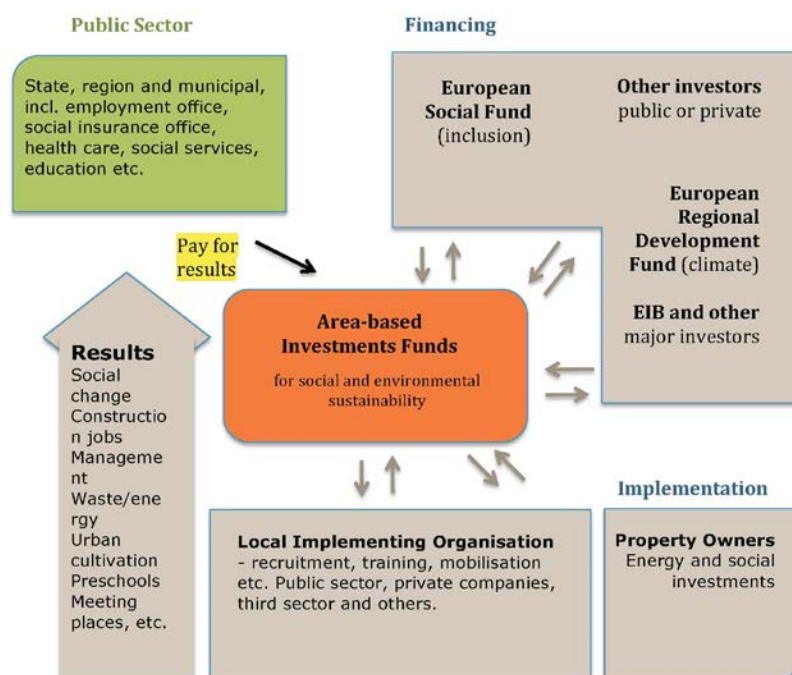
Malmö Innovation Platform is an ambitious attempt to establish a functional solution for the sustainable development of the city's Million Programme housing, in which financing has been identified as a key issue. The *Miljonprogrammet* districts need to be improved to meet the needs of residents. Investments in buildings, indoor climate and energy efficient living should be combined with investments in mobility (public transport, roads, bike-riding lessons etc.) and the outdoor environment, for example through vegetable gardens, recreation areas, the opportunity to run small businesses in connection to residences etc. The smart, Internet-connected home offers many new opportunities, such as the opportunity to regulate energy and resource use, so that residents can influence some of their living expenses. This, in turn, also promotes behavioural change. Another set of issues concerns the extent to which renovated buildings containing IT solutions can better meet the needs of the elderly. An ageing population is one of the major social challenges of our day and modernising residential districts in a way that makes it easier for the elderly to remain longer in their own apartments holds great potential. Critical elements of this include access to care in the home and other daily services.

As previously discussed, in the work to solve the problem of financing, studies are on-going into the feasibility of combining the use of the EU's Regional Development Fund and its Social Fund to finance the needed improvements. Malmö is co-operating with the European Investment Bank to produce models for residential area-specific investment funds for sustainable urban renewal that include a large element of measures supporting social development. Other financing models Malmö is currently studying are what are known as

Green Bonds<sup>81</sup> and Social Impact Bonds (SIB)<sup>82</sup>, which can be described as a kind of bond or issuances for financing social or environmental projects where the public sector and companies invest in sustainable projects and share the cost and/or risk.

One important component of the social investment policy that Malmö is attempting to develop is to prevail upon building contractors to employ and train local unemployed residents during a certain part of the construction work. There are already real estate companies in Malmö that include this kind of requirement in their construction project contracts. Recruiting in the residential district where the improvement work will be done helps more of the residents there to achieve stable finances and a better ability to manage any increases in rental fees. Calculations by the City of Malmö on the economic effects of an individual's transition from alienation and unemployment to being self-supporting point to major savings for the municipality and other public agencies. Figure 7 shows some of the main components of the financing model that Malmö is currently working with.

Figure 7: Bygga Bo Dialogens (Building/Living Dialogue's) proposal for financing models.



There are 47 million multi-family residences in the EU built during the *Miljonprogrammet*-era. As such, Malmö shares the challenge it now faces with many other cities in Sweden, Europe and other parts of the world. One long-term goal of the Malmö Innovation Platform is creating a model relevant to other cities and countries that can contribute to a 'transformative social development process and that drives the introduction of energy-

<sup>81</sup> Cf. footnote 60.

<sup>82</sup> Mulgan (2011) describes experiences concerning Social Bonds from the UK and US: 'In this way the project is using mechanisms of so called "impact investment" or "social impact bonds", often public-public, public-not-for-profit or public-private partnerships across organizational barriers commonly working towards a goal that all stakeholders have a mutual interest in. The idea has been successfully set into practice in 3 projects in the UK and the US, tackling social issues, such as homelessness and re-socialization of ex-prisoners.'

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efficiency measures and socio-economic development'. One important question is whether the solutions established locally can be scaled up to the national level and the global level, or at least to the European level. The preconditions for housing renovations differ from country to country, which means that solutions developed for Malmö will not necessarily suit cities outside of Sweden. In this context, it is an asset that several of the companies participating in Malmö's Innovation Platform are international companies active in many different countries.

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## 6 Policies & Measures for Innovation

The previous chapters have described the challenges linked to the need for renovating apartment buildings and relevant policy responses. Policies and measures usually considered belonging to innovation policy have occasionally been touched upon but not explored in any systematic way. This chapter shifts the focus towards research and innovation policies. The overall question is how and to what extent these policies have addressed issues of relevance to renovation of buildings and related topics. The focus is on national research and innovation policy in Sweden with some discussion of relevant initiatives on the European level.

### 6.1 Three vantage points for identifying relevant initiatives

It is useful to discuss the development of government research and innovation policies that are relevant to renovation of buildings and the rejuvenation of urban communities from three different, overlapping vantage points:

1. Policies and measures within the framework of energy policy
2. Policies and measures aimed at making cities more sustainable ecologically, socially, economically and culturally
3. Policies and measures aimed at promoting growth-inducing industrial innovation

The Swedish Energy Agency has primary responsibility for government support of energy-related R&D and knowledge diffusion. Reducing the reliance of the Swedish energy system on fossil fuels has long been an important political objective pursued through a wide repertoire of measures, including carbon taxes, funding of R&D and diffusion of knowledge in relevant areas. As far as the use and supply of energy for housing is concerned, the main focus has been on the supply side and more specifically on substituting fossil fuels with biomass and municipal waste in district heating systems based on co-generation of heat and electricity. Some of the initiatives do, however, aim at reducing energy use by making buildings more energy efficient.

In Sweden, like in many other countries, cities have increasingly come to be viewed as a key arena for the development of a more sustainable society in the broadest sense. Increasing energy efficiency in buildings is one important aspect of moving towards more sustainable cities, but certainly not the only one. The Swedish Research Council Formas has the main responsibility for government funding of research related to the “built environment”, including buildings and broader issues of “spatial planning”. Formas only funds researcher-initiated research, though in some cases research projects are jointly funded and carried out with industry. The Development Fund of the Swedish Construction Industry (SBUF) is a partner in such joint funding.

Buildings, cities and their infrastructures and supply systems represent important markets for many industries. These industries are potential targets for innovation policies and measures, which could vary from general measures open for all industries to measures limited to specific industries or technologies. Except for energy-specific programmes, VINNOVA has primary responsibility as the main innovation agency.

In addition to the Energy Agency, Formas and VINNOVA, the European Commission is also an important source of funding of research and innovation activities related to

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renovation of buildings. Several other funding organisations contribute in individual projects and some of them will be mentioned below.

## **6.2 Research fields, technologies and innovation areas**

Before discussing the development of research and innovation initiatives according to the three vantage points listed above, it may be useful to try to identify which fields are directly or indirectly relevant for the renovation of buildings.

The materials, components and equipment that go into the buildings themselves may be divided into the following categories:

- building materials (including insulation materials) and building components
- water & sewage pipes, air ducts, electrical and communication cabling, and so on.
- equipment for heating, air conditioning, ventilation, heat pumps, energy storage equipment, equipment for charging batteries and so on.
- kitchen equipment and fittings, bathroom fittings, laundry machines, lighting and so on.
- information, communication and control systems (including consumer electronics, computers, software, home networks, sensors, displays and others)

Overall the first two groups tend to have a long life and their replacement usually requires major renovation projects. To varying extents, equipment under the three latter categories may be exchanged more independently and more frequently, although major renovation projects will in many cases offer economically attractive opportunities for upgrading.

The process for planning, financing, designing and physically carrying out renovation projects is in itself an important area for research and innovation, which will influence the appropriateness, quality and cost of renovation. Key aspects which need development and innovation are:

- engaging stakeholders in the planning and design process;
- ascertaining the precise condition of the buildings to be renovated;
- developing financing models and arrangements;
- developing platforms for systematization of the renovation processes in order to realize learning and scale economies, including utilizing prefabricated components and subsystems;
- applying a life-cycle perspective in the design of the renovated buildings, which considers future management, maintenance, renovation, dismantling and recycling of the buildings.

developing and applying Building Information Modelling (BIM) as a means for calculating the use of energy and materials through the life cycle of buildings (important as a support for the last two tasks above) When apartment buildings are renovated as a part of a more comprehensive project to rejuvenate urban communities, additional issues beyond the individual existing buildings will need consideration. Densification of residences through construction of new buildings or extensions of existing buildings, development of local gardening, improvement of the stormwater retention capacity of local grounds, changes in

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the systems for waste handling to support increased recycling rates, and redesigning parking and transport systems to reduce dependence on cars are just some examples of measures which might be included in renovation of a city section.

More effective energy use is a central aspect of sustainable renovation. It is commonly expected that, in the future, the demand for and supply of heat and electricity for residential use will mutually adjust to each other much more than in the past. Buildings and their occupants will become active participants in the energy system. Developments that will make this necessary and possible are:

- Movement towards new combinations of local and more distant generation and transformation of heat and electricity (e.g. through local installations of solar cells, heat pumps and heat exchangers);
- Advanced use of information, communication, control and sensor technologies allowing for continuous adjustments between different types of equipment and for an active role for occupants in influencing (including remotely) their own energy consumption based on up-to-date and individualized information.

The much discussed smart grids embody important aspects of these developments. An important question is the extent to which the technology and service platforms that deal with energy-related information will be separate from platforms aimed at providing a broader range of information services to residents. If technology and service platforms can be widely shared, it is likely to both reduce costs and improve the innovation dynamics of providing information-based services. The development of a more integrated and interactive energy system serving and involving residential buildings will naturally influence the development requirements and innovation opportunities for different subsystems, equipment and components which make up the energy system. In Sweden, where district heating currently supplies most of the heating and hot water for residential buildings, there may be a need for some redesign of the district heating systems and their business models to allow them to stimulate rather than hinder energy savings and the use of locally generated energy.

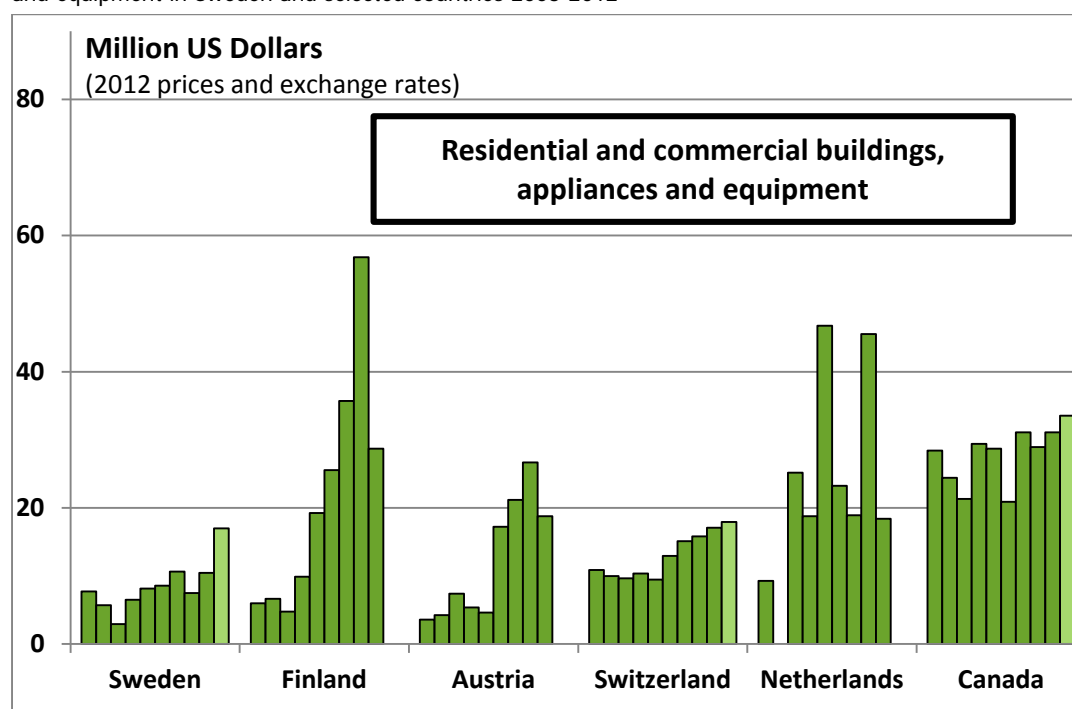
### 6.3 Energy

An important overall objective for Swedish energy policy has been to reduce the climate impact of the domestic energy system. In principle this might be done either by replacing fossil fuels with renewable energy sources or by reducing energy consumption or, in practice, through some combination of the two. Over the last few decades, the development of the energy system serving multi-family residential buildings in Sweden has revolved around increasing the use of district heating and replacing fossil fuels with biomass and waste as the fuel input in district heating plants. This has significantly reduced the climate footprint of residential buildings and of the Swedish energy system as a whole. In comparison, much less progress has been made in the area of making residential buildings and the lives of the occupants more energy efficient.<sup>83</sup>

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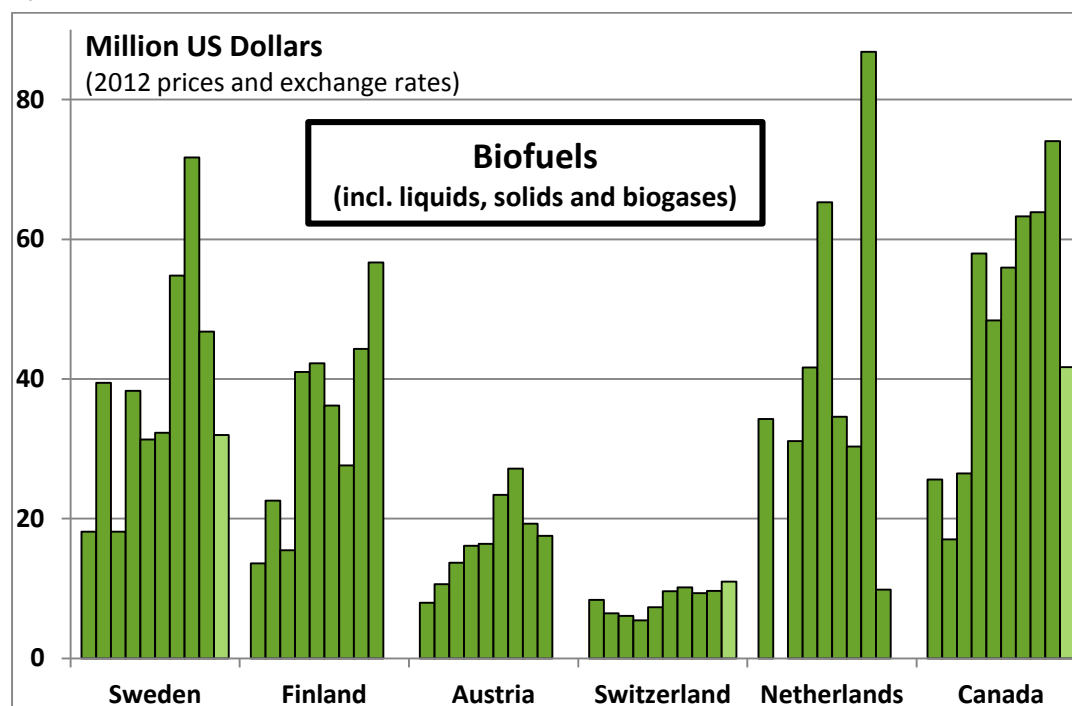
<sup>83</sup> For multi-family residential buildings, the average temperature-adjusted energy use for heating and hot water decreased from 183 to 158 KWh per square meter between 1995 and 2011, but other energy use increased from 60 to 81 KWh per square meter during the same period. The latter is primarily purchased electricity and includes all electricity used by households.

Figure 8 Government funding of energy-related R&D for residential and commercial buildings, appliances and equipment in Sweden and selected countries 2003-2012



Source: IEA Energy Technology RD&D Statistics

Figure 9 Government funding of energy-related R&D for biofuels in Sweden and selected countries 2003-2012



Source: IEA Energy Technology RD&D Statistics



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According to an estimate in a survey of Swedish energy-related building research, on average SEK 120 million per year in public funding were invested on this type of research during the period 1998-2011.<sup>84</sup> Nearly two thirds of the funding came from the Swedish Energy Agency. According to the same report, funding from the Energy Agency in the same area declined from a peak in 2006 of around SEK 115 million to around SEK 50 million in 2011. The International Energy Agency (IEA) collects data on government funding of energy-related R&D from its member countries. The R&D category most closely corresponding to building research is “residential and commercial buildings, appliances and equipment”. In this category, which is apparently more narrowly defined, total government funding during the period 2003-2011 averaged just under SEK 50 million per year. From 2006 there is a slight upward trend until 2011 and then a sharp increase in 2012 to around SEK 115 million.

It is not clear which of the two sources provides the most representative picture of the development of energy-related research and this report has not investigated this question, but together they at least show the order of magnitude of the resources involved.

The IEA makes comparisons of Sweden with other countries possible. Figure 8 shows that at least Finland, Austria and Switzerland have spent significantly more than Sweden on energy-related R&D for “residential and commercial buildings, appliances and equipment” in relation to their populations, although through its recent increase Sweden is catching up. It is also interesting to compare the area of biofuels. Here, only Finland has spent more than Sweden on a per capita basis of the five countries selected for the comparison (Figure 9).

Currently the largest support for energy-related building research is through the new programme “Research and innovation for energy efficient construction and dwelling” funded by the Energy Agency. The agency has allocated SEK 140 million for the period 2013-2017 and expects a similar-sized contribution from companies or other participating organizations or organizations that are in other ways stakeholders in projects. The matching ratio will differ depending on the nature of the individual project.

The annual support from the Energy Agency to the programme is three times that of the similar previous programme, “The centre for energy- and resource-efficiency in construction and facilities management (CERBOF)”, which ran 2007-2012. This suggests a major increase in the level of ambition. The official description of the new programme makes clear that “improved energy efficiency in the built environment” is now a prioritized area in the long-term support for energy-related research and innovation by the Energy Agency.<sup>85</sup>

The new programme takes a broad approach and aims at supporting projects covering “all energy use in the built environment through its whole life cycle”. Based on an evaluation of the CERBOF programme, the previously mentioned survey of energy-related building research and a planning exercise involving external experts the following six priority areas have been designated<sup>86</sup>:

- System perspective in construction, dwelling and activities
- Existing buildings, especially the *Miljonprogrammet*
- New construction of low energy houses and near-zero-energy buildings

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<sup>84</sup> Technopolis Group, 2012.

<sup>85</sup> Swedish Energy Agency, June 2013.

<sup>86</sup> Profu, 2011; Technopolis Group, 2012; Swedish Energy Agency, 2012.

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- The interplay between technology, architecture and community development
  - The construction process – from planning to facilities management
  - Building materials and building systems

In the first call for applications under the programme, ten projects were granted SEK 24 million from the Energy Agency and an additional SEK 16 million from other stakeholders. All ten projects are led by universities or research institutes.<sup>87</sup> Two of them focus explicitly on renovation of multi-family residential buildings. One of these looks at what is required of the occupants' lifestyles and routines in order to realize energy efficiency in renovated buildings that have had smart grid technology implemented. The other project looks at technical issues involved in determining the impact of facade systems on the energy efficiency prior to the construction process and moisture behaviour after renovation. A third project develops a methodology for analysing the potential for increasing the number of apartments in a city section by combining new construction with adding apartments to existing buildings when renovating. It also considers possible changes in the system for energy supply and use and using GIS and life cycle analysis. A fourth project aims at identifying methods for cost-efficient renovation of single-family houses to achieve both energy efficiency corresponding to passive-house standards and a good indoor environment. These examples suggest that renovation issues are receiving increasing and significant attention in the new programme.

The Energy Agency also provides financing for several other programmes more or less relevant for renovation. One example is a network of owners of multi-family residential buildings (BeBo), which has been actively documenting and sharing experiences of the energy performance of renovated buildings since 1989. The objective is to increase the knowledge and competence of the property owners as customers in renovation projects and to contribute to the early introduction of energy-efficient systems and products into the market. The basic financing of the BeBo network from the Energy Agency is currently on the order of SEK 4 million per year. Time-limited special campaigns to stimulate energy-efficient renovation are also carried out, for example, through targeted information or through providing grants for feasibility studies aiming for higher energy efficiency in renovation projects.

“BUILD UP Skills” is a strategic European-wide initiative to promote continuing education and training of craftsmen and other on-site workers in the field of energy efficiency and renewable energy in buildings.<sup>88</sup> Under the initiative and based on an analysis of the current and projected need and availability for education and training programmes, a team of representatives from stakeholders has developed an action plan for Sweden to secure a sufficient number of craftsmen and on-site construction workers by 2020.<sup>89</sup> In the analysis forming the basis for the action plan it is estimated that approximately 100 000 skilled workers within the construction industry need to receive vocational development to reach the 2020 goal. Additionally, 15 000 technicians and engineers working in building site management positions will need to undergo further training.<sup>90</sup>

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<sup>87</sup> *An objective of the programme is to strengthen co-operation between academia, industry and the public sector, so it can be assumed that companies, industrial associations or public sector organizations are involved in many of the projects.*

<sup>88</sup> *European Commission, June 2014.*

<sup>89</sup> *Tullstedt, 2013.*

<sup>90</sup> *Blomsterberg, WSP, 2012.*

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## 6.4 Sustainable and attractive cities

### 6.4.1 The Swedish research council Formas

In 2001, there was a major restructuring of government R&D funding for organizations in Sweden. The Research Council Formas was one of the new bodies created. It took over responsibility for building, construction and urban and regional planning (together labelled “built environment & urban planning” in the following text) related to R&D from the previous Swedish Council for Building Research. This was one of three main areas assigned to Formas, the other two being environmental research and agriculture and forestry research.

The funding of built environment-related research was around SEK 165 million per year 2002-2004 but then declined to around SEK 120 million 2008-2010 while the overall budget of Formas more than doubled. At least partly, this largely reflected that the built environment was not prioritized in overall government research policy. Since 2012 Formas’ funding of built environment & urban planning research has started to increase and in 2013 was roughly 30 per cent higher than the level 2010-2011.<sup>91</sup> A significant part of that increase has been in renovation-related research, which in 2013-2014 amounts to more than SEK 30 million per year as compared to probably not much more than SEK 5 million five years earlier. The increase in funding by Formas for built environment related research is in line with, and may partly have been triggered by, a similar recent development in overall government research policy mentioned below. It is worth noting, however, that Formas’ funding increased prior to the increased ear-marked allocation from the government.

A programme specifically focusing on “Sustainable reconstruction, renovation and renewal of housing and other buildings from the period 1950-1975” was started in 2012. Under this programme, seven three-year projects have been funded with a total budget of SEK 66 million, half of which from Formas and the other half from industry and other partners in the projects. Another important measure is a five-year grant to a strong research-environment in the renovation area, at Lund University, which has a strong connection to the establishing of a Renovation Centre. As mentioned earlier, the Energy Agency has long supported the sharing of experiences from energy efficiency projects among stakeholders in the building sector, but the establishment of the Renovation Centre signifies a raised ambition in this regard, including a stronger and more continuous involvement of academic researchers. Formas has also been funding a major Swedish participation in European (ERA Build and Eracobuild) and Nordic projects (Nordic Build). Together with the Energy Agency and VINNOVA, Formas also is participating as a funding agency in the Joint Programming Initiative Urban Europe.

According to the most recent government research and innovation bill, which provides the overall budget framework for government expenditure on civilian research and development for the period 2013-2016, funding for research in the area of sustainable built environment and urban planning will be increased by SEK 100 million in 2016 as compared to the level in 2012 through a gradual increase in the budget allocation to Formas.<sup>92</sup> In motivating the increased funding, the bill makes a special reference to the need for renovation of the *Miljonprogrammet*. There is thus good reason to believe that research support from Formas

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<sup>91</sup> The estimate of an increase of 30 percent is based on adding up data for individual programs as reported in Formas’ annual reports.

<sup>92</sup> The increase represents 2.5 per cent of the total increase in the funding level included in the research and innovation bill.

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for renovation-related research will increase. The bill also states that “according to the opinion of the government research within the area of sustainable built environment and urban planning is inadequate and needs to be strengthened” and that the funding should be used for initiatives which are “clearly action-oriented in order to contribute to technology development, innovation and export of environmental technology”.<sup>93</sup>

In the context of discussing funding of research on sustainable urban development, it is worth mentioning that the Swedish Foundation for Strategic Environmental Research (Mistra) has granted SEK 90 million during the period 2010-2015 for the establishment of an international centre for research on sustainable urban development under the name of Mistra Urban Futures and hosted by Chalmers University of Technology.<sup>94</sup> With separate funding, research at the centre has included studies of energy efficiency in buildings.

#### 6.4.2 VINNOVA

As part of the major reorganization of government agencies in the field of research, innovation and industrial policy in 2001, VINNOVA was formed through a merger of parts of three organizations.<sup>95</sup> During the first years after its establishment, issues of urban development had very little presence in VINNOVA’s programmes. The major exception was within the field of transport, where VINNOVA had inherited a major role in supporting transport policy research, some of which concerned urban transport systems. Contacts with municipalities and construction and other companies related to the built environment were in general very limited.<sup>96</sup> From around 2009 this situation began to change through several different initiatives, the major ones being:

- Broad programmes for environmental technology; projects in this area often tended to deal with problems in cities.
- The start of a new dialogue between VINNOVA and the built environment industry, which at the initiative of some of the large construction firms had begun to recognize that it needed to co-operate within the industry and with academia in order to build a common platform of strategic competences and technologies (the resulting new partnership program *Bygginnovationen* will be discussed further in the next section).
- In VINNOVA’s ICT programmes, smart homes, smart grids and intelligent transport systems increasingly appeared as application areas
- As part of a fundamental review of its strategy, in 2011 VINNOVA launched Challenge-Driven Innovation as a major new initiative, with “Sustainable & Attractive Cities” as one of four broad challenges to be addressed.
- In its new strategy, VINNOVA also put new emphasis on support for demonstration and testing; several of the test-bed projects concerned solutions for problems in cities.

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<sup>93</sup> Swedish Government , Oct 2012, pp 77-78

<sup>94</sup> <http://www.mistraurbanfutures.org/sv>

<sup>95</sup> The Technology division of the Swedish Board for Technical and Industrial Development (NUTEK), The Swedish Transport and Communications Research Board (KFB) and around half of the Swedish Council for Work Life Research (RALF).

<sup>96</sup> An exception was those activities in the wood manufacturing industry which had links to construction. This is discussed further in section 6.5.

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- More generally, in its new strategy VINNOVA has also included promotion of the “innovation capacity in the public sector” as one of its 11 strategic areas, in which activities managed by municipalities and county councils are prime targets.

### *Challenge-Driven Innovation*

Among the above listed initiatives, the Challenge-Driven Innovation programme has been the most important so far for increasing VINNOVA’s involvement with urban development. In 2013, projects in the area of “sustainable and attractive cities”, one of the four broad challenges addressed in the programme, received about SEK 80 million in funding, with municipalities and municipality-owned companies as key actors in most of the funded projects. Important features of the original programme concept include:

- Provides support for innovation projects aimed at developing solutions to specific societal challenges.
- Recognizes that societal challenges are systemic in nature and that technological elements of solutions are embedded in a wider social, political, legal and commercial context that has to be addressed in developing effective solutions.
- Applies a stage-gate investment model for funding. Initial small-scale funding is intended for developing ideas and building the necessary constellation of actors. Promising projects receive larger funding in two more stages.
- Requires that users/customers are actively involved in developing and testing solutions.
- Uses the relevance of solutions for the global market as an important criteria for selecting projects to be funded.

Out of a total of 59 projects that have proceeded to the second stage of the Challenge-Driven Innovation programme so far, 23 projects fall within the theme “sustainable and attractive cities”. Projects at this stage typically run over two years with a budget of SEK 20 million, half of which comes from VINNOVA. In four of the 23 projects the focus is on energy efficiency in buildings or dwellings with the use of advanced ICT forming the key core part of the solutions in three of the projects. A fifth project aims at establishing an open and generic ICT platform for information services in a new residential area. A sixth project addresses technical problems associated with green roof systems and similar facilities. Issues related to renovation of residential buildings are not explicitly addressed in any of the projects. Certain results from some of the mentioned six projects, however, may be of use in renovation projects. The same may be true for some of the other projects if the perspective is widened to rejuvenation of whole city sections. There are, for example, four projects dealing with ecosystem services and other projects concern the integration of digital and physical elements in playgrounds, the design of silent urban spaces, innovative parking solutions and new methods for handling storm water. Two projects for developing more participatory planning processes may also have relevance in the planning of renovation projects.

Recognizing the interconnectedness of challenges facing cities, in 2013 VINNOVA supplemented its support for focused innovation projects with special grants for so called innovation platforms for sustainable and attractive cities aimed at allowing municipalities to design and implement integrated strategies for development of selected city sections. Two-year matching grants of SEK 10 million each from VINNOVA were extended to four cities, including one grant to the city of Malmö. As earlier described, in its innovation platform Malmö focuses on sustainable renovation and rejuvenation of a *Miljonprogrammet*

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residential area in south-east Malmö. One of the other grants – to the city of Borås – also concerns renewal of a *Miljonprogrammet* residential area.<sup>97</sup>

As discussed at length in this report, sustainable renovation of residential buildings represents a systemic challenge. In this respect it aligns with the concept of the Challenge-Driven Innovation programme. At the same time it seems clear that the format of the innovation projects in the programme do not fit the requirements for addressing the scale and the complexity of the renovation challenge. The Innovation Platform grants therefore appear to serve a useful function. The current funding, however, is limited to only two years and even if significant results were to be achieved during this time, it seems clear that efforts need to be sustained over a much longer period.

### *Strategic Innovation Areas*

In 2012, VINNOVA started another major new programme, Strategic Innovation Areas. The programme was given ample attention in the recent government research and innovation bill. Substantial new funding was allocated and the Swedish Energy Agency and the Research council Formas joined forces with VINNOVA. Different from the Challenge-Driven Innovation programme, this programme aims at more broadly and strategically strengthening Sweden's innovation capacity in areas in which Sweden already is, or has the potential for becoming, one of the leading countries in the world. While the primary objective is not to address specific societal challenges, societal challenges are nevertheless likely to play an important role for defining the desired building of innovation capacity in the Strategic Innovation Areas.

Within the new programme financial support is provided for two types of efforts:

- “**Strategic research and innovation agendas** to stimulate a strategic dialogue between actors so as to, through a joint research and innovation agenda, highlight areas for efforts and the needs and possibilities available.”
- “**SIO programmes** – that aims to support the implementation of the research and innovation agendas that are most important for Sweden. As well as those that have the greatest potential to create conditions for international competitiveness and to find sustainable solutions to global challenges for societies.”<sup>98</sup>

Grants for developing Strategic research and innovation agendas are fairly small and granted rather generously. So far, 116 agenda projects, together spanning a very wide spectrum of areas, have been funded. One of the projects, “Strategy for Innovative and Sustainable Renovation of Apartment Buildings” has directly addressed renovation of the *Miljonprogrammet* residential buildings. The agenda project did not result in any application for establishing an SIO programme, but, as mentioned above, the main recommendation in the report from the project – the establishment of a forum for all stakeholders engaged in renovation projects in the form of a Renovation Centre has been implemented and significantly strengthened through a five-year grant from Formas to a strong research-environment in the renovation area, at Lund University, which has a strong connection to the establishing of a Renovation Centre.<sup>99</sup> A couple of on-going agenda projects address the

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<sup>97</sup> The other two grants were given to the City of Gothenburg and the City of Lund, respectively.

<sup>98</sup> VINNOVA's official website.

<sup>99</sup> <http://www.vinnova.se/PageFiles/0/Strategier%20f%20b6r%20innovativ%20och%20h%20a5llbar%20renovering%20av%20flerbostadshus.pdf>

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development of sustainable cities from a broad perspective and a handful of other projects address more specific issues related to waste, water, city logistics and traffic safety. Several projects deal with issues related to the process of constructing buildings and infrastructure and will be discussed in the next section.

## 6.5 Industrial innovation

### *The innovation capacity of the construction sector*

Promoting industrial innovation and growth has traditionally been the major rationale for innovation policy. The focus has then been on industrial companies and their potential to develop new technologies, products and businesses. Success will typically be measured in terms of the international competitiveness of the developed technologies and products and the extent to which this translates into growth. In a small and open economy like Sweden's, growth will typically depend on exports.

In relation to these common objectives for policies aimed at industrial innovation, industries engaged in renovation of residential buildings are not obvious targets for support. To realize systems innovation for developing sustainable cities, a narrow focus on export industries will not be sufficient. Key actors, such as the construction industry, consulting engineering, property owners, energy companies, municipalities and non-profit organizations involved in social innovation will also have to be actively engaged in the innovation process. This is naturally happening in VINNOVA's new programme for Challenge-Driven Innovation, including in the Innovation Platform projects in Malmö and three other cities. These and similar actors may also need to be more involved in other innovation policy initiatives in their role as system integrators and as representing the demand side. There may also be a need for initiatives that raise the innovation capacity of the relevant industries, not least the construction industry.

The construction industry has on the whole been seen as a rather conservative and not particularly technology-intensive industry. While a few of the big construction companies have undergone a transformation to global companies in recent decades, they are not major exporters as most of the value created in export markets is produced through local operations. The internationalization of major Swedish construction companies appears, however, to have raised their awareness of the need to improve the domestic infrastructure in terms of education, research and supplier industries. Responding to initiatives from industry, there have been two developments during the last five years worth noting:

- The establishment of a new partnership programme “*Bygginnovationen*” (Innovation for the Construction Sector) for support of innovation projects in the construction sector, with a budget of SEK 90 million for the period 2011-2015, half from VINNOVA and half from industry. This programme aims at strengthening the innovation capacity of small and medium sized firms in the sector and the links between industry and universities and other research organizations.
- The establishment in 2011 of the “Swedish Universities of the Built Environment (SBU)” as a permanent co-operative organization for co-ordinating education and research in the field of built environment among four universities with civil engineers programmes – Chalmers University of Technology, KTH Royal Institute of Technology, Luleå University of Technology and Lund University Faculty of Engineering. The preparatory phase 2009-2010 was financed jointly by VINNOVA, Formas, the

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Development Fund of the Swedish Construction Industry (SBUF) and the participating universities.

Together with the previously described increased funding for built environment research through Formas and the Swedish Energy Agency, these initiatives have undoubtedly significantly strengthened the overall innovation system of the construction sector. However, it seems that very few, if any, of the projects under the *Bygginnovationen* programme address issues specifically related to renovation.

Productivity development in the construction sector has long been very poor, resulting in the relative cost level of construction tending to increase. There is a great need to improve productivity and quality in the construction sector, in the broad sense, including reducing the environmental footprint of the construction process itself. This is important for making sustainable renovation more economically feasible and is discussed in a separate section below.

While the market for construction of buildings is largely domestic, the situation is to some extent different for companies supplying materials, components, equipment, software and services for buildings and construction. They include different-sized companies in a wide variety of industries, meaning they do not have a distinct identity as a group. Currently there does not seem to be any comprehensive picture of the potential for innovation, growth and exports for companies in Sweden in the relevant industries. A special case for Sweden is the wood manufacturing industry, which will be discussed below.

Building on a strong tradition in mechanical engineering, Sweden has also nurtured a considerable number of companies producing different types of equipment important for efficient energy use in buildings. This includes heat pumps, heat exchangers and ventilation equipment. Recognizing this, the Swedish Energy Agency has supported “applied R&D in refrigeration and heat pump technology” through several generations of programmes since the mid-1990s. In the most recent programme, “EFFSYS+”, the Energy Agency provides SEK 36 million matching funding during the period 2010-2014 covering 40 per cent of project costs.

VINNOVA and the Energy Agency have operated many programmes in addition to the ones already discussed, some of which have certainly contained individual innovation projects with some relevance for renovation of multifamily residential buildings. It has been beyond the scope of this report to try to identify all such projects.

### *Wood manufacturing*

Sweden is among the world’s leading exporters of wood products. Almost all the products from wood manufacturing in Sweden end up in buildings or furniture. For this reason, at times the industry has been targeted for special support for research and innovation. A major objective of such support has been to increase the value added to exported products. There is a general consensus that this requires a stronger customer focus. There are visions of a transformation of the whole value chain from the current production-driven system towards one in which the chain of manufacturing steps all the way back to logging operations in the forests would be geared towards meeting specific customer orders.<sup>100</sup> Advances in information and communication systems and process control in manufacturing and forest

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<sup>100</sup> An example of articulation of this vision can be found in the Research and Innovation Agenda “Den elektroniska motorvägen – från bygge till hygge” WoodCenter North and Luleå University of Technology, 2013.



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operations make such scenarios realistic, but major obstacles remain, for example, in terms of business models and co-ordination among actors to realize the vision. The capacity of the wood manufacturing industry to deliver highly customized building components will influence the way and extent to which it can contribute to and benefit from growth in the market for renovation of buildings.

A foresight study published in 2010 provides a clear indication that the renovation market is increasingly seen as strategically important for the wood manufacturing industry.<sup>101</sup> The study was done towards the end of an R&D programme for wood manufacturing in response to a growing perception among participants in the programme that the environment for the industry had changed significantly since the start of the programme and, as a consequence, the vision for the industry's future needed updating.<sup>102</sup> The main novelty compared to the vision outlined in 2004 was that "industrialized renovation" was identified as a market with great potential for the wood manufacturing industry.<sup>103</sup> After the foresight study was published and the wood manufacturing programme ended, there has been no new programme targeting the wood manufacturing industry. As a result, there has been no discernable major effort to realize the vision of industrialized renovation using wood manufactured products or other materials.

Looking at VINNOVA's portfolio of projects related to wood products over the last decade, the focus has been on developing the wood products themselves, especially their characteristics as materials. While material characteristics are probably very important, the bottleneck for realizing the vision of industrialized renovation most likely lies elsewhere. It involves the business models of and the information flows between the different actors in the value chain connecting the design and construction of buildings on the one hand and the various industrial manufacturing steps on the other. The transformation of the wood manufacturing industry from production-driven to customer-driven might in itself be considered a "system transition". The need for a stronger customer focus is not limited to the value chains involving wood materials but applies to the construction sector also more broadly.

Some of the issues related to a more customer-centred development of wood-based construction are the focus of a new regional innovation cluster initiative, "Smart Housing Småland", which started in 2013 with initial support of SEK 22 million for the period 2013-2016 from VINNOVA under its VINNVÄXT programme.<sup>104</sup> It remains to be seen the extent to which wood use in renovation of multi-family residential buildings will be dealt with within the cluster initiative.

### *Industrialized construction*

Generally, concerted efforts to decrease costs in the actual construction processes are urgently needed. Although there are couple of initiatives internationally, surprisingly little attention has been given to this aspect in Sweden. Consensus has been building among the actors in the construction sector for a sector-wide and sustained push to develop platform-based construction processes, which allow more effective learning processes and exploitation of economies of scale. In this, the challenges would be particularly great for

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<sup>101</sup> SP Trätek, 2010.

<sup>102</sup> Prior to the start, a more extensive study of the Innovation System of Wood Manufacturing had been performed, VINNOVA 2004.

<sup>103</sup> This was added to two previously recognized key areas "industrialized construction using wood" and "resource efficient design of interiors", partly overlapping with these.

<sup>104</sup> <http://smarthousing.nu/in-english/>

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renovation projects where customization is essential. The new possibilities created through information technologies and the internationalization of some of the largest construction companies promote innovation, while the local nature of construction markets and the fragmentation of the construction industry are obstacles. Implementation of new construction processes for sustainable renovation of residential multi-family housing would seem to be a suitable area for innovation procurement with potentially large multiplier effects on supplier industries to the construction industry, including the wood manufacturing industry.

As part of VINNOVA's new programme, Strategic Innovation Areas, many actors in the building and construction sector have joined forces to develop a common strategic research and innovation agenda in the field of "structured information management and industrial processes for the construction and property sector".<sup>105</sup> The agenda is very broad and includes all types of built environment, both buildings and infrastructure. The agenda represents a merger of two previous agendas, one dealing with Building Information Modelling (BIM) and the other with industrialization of construction processes. The extent to which such a broad approach to the "system transitions" in the field of built environment will deal effectively with any specific requirements related to renovation cannot be judged here.<sup>106</sup> Based on the agenda, a proposal to establish an SIO programme was submitted but not funded.

A major initiative at the European level "to promote research on new methods and technologies to reduce the energy footprint and CO<sub>2</sub> emissions related to new and retrofitted buildings" is the Energy-efficient Buildings (EeB) Public Private Partnership.<sup>107</sup> Two large projects concern demonstration of energy efficiency through retrofitting existing residential buildings. One of these projects, E2ReBuild, is co-ordinated by NCC AB, one of Sweden's three large construction companies. It focuses explicitly on industrialized retrofitting and has as its vision "to transform the retrofitting construction sector into an innovative, high-tech, energy efficient industrialized sector." Swedish actors, including Sweden's largest construction company, Skanska AB, which also participates in the other project, BEEM-UP.<sup>108</sup>

## **6.6 Is research and innovation policy contributing sufficiently to the development of sustainable renovation?**

The overview of research and innovation policy initiatives presented above clearly shows that energy efficiency of buildings, the development of sustainable cities and innovation in the construction sector have received significantly increased attention during the last 3-5 years. There are more research projects focusing on renovation funded by the Energy Agency and Formas today than earlier and the recently established Renovation Centre is likely to offer a much needed research-based platform for documenting and sharing

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<sup>105</sup> IQ Samhällsbyggnad et al, 2013.

<sup>106</sup> Much could be said about how ideas and efforts in the field of industrialization of construction have evolved in Sweden. This development is in itself a system transition deserving a separate study. In terms of research and innovation policy, the largest initiative is the VINNOVA-supported programme Lean Wood Engineering, which was carried out 2006-2013 at a total cost of SEK 150 million, of which SEK 36 million from VINNOVA.

<sup>107</sup> EeB PPP is a joint initiative of the European Commission and the E2BA, the latter being an initiative that grew out of the European Construction Technology Platform (ECTP).

<sup>108</sup> EeB PPP Project Review, July 2012

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experiences of implemented renovation projects. By comparison, government funding of industry-led development projects that explicitly address renovation-related problems still seems very limited. The Innovation platform in Malmö funded by VINNOVA takes a comprehensive view of renovation of one *Miljonprogrammet* residential area, but the resources and time committed so far are quite limited in relation to complexity of the task at hand.

To correctly judge the adequacy of current research and innovation efforts in relation to the window of opportunity presented by the acute need for physical renovation of *Miljonprogrammet* residential areas would require a larger and more expert study than is the ambition of this report. Some questions may still be formulated:

- To what extent are technical and organizational solutions developed for the construction of new residential buildings appropriate for renovation projects and to what extent is there a need for development of solutions specifically aimed at renovation?
- How can technical, social and economic aspects best be integrated in concrete development efforts?
- Is there a need for industry-driven development projects focusing on renovation, for example, in the area of platform-based renovation?
- Is there a need for a systematic and co-ordinated development effort at the national level to:
  - attract the attention of industry and increase its willingness to invest in the development of solutions for renovation;
  - develop a common roadmap as a guide and context for individual development efforts and learning at the local level;
  - provide sufficient scope and scale for experimentation;
  - organize innovation procurement?
- What is the potential for industrial innovation and growth in Sweden driven by an accelerated transition to sustainable renovation?

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## **7 Future perspective of sustainable renovation of buildings and VINNOVA's role in policies for system innovation**

Most of Swedish apartment buildings built during the 1960s and 1970s have yet to be renovated. The large investments and work ahead are both major challenges and opportunities. The big question is the extent to which these renovations will contribute to making both the concerned urban communities and Sweden as a whole more sustainable ecologically, socially, economically, and culturally. This will not occur automatically. In fact, broad consensus exists among relevant actors that current renovations are overall not sufficiently ambitious. There is thus a real risk that the window of opportunity presented by the need to carry out basic technical renovation will not be utilized to make Sweden a more sustainable society.

Previous chapters described this situation in some detail from the point of view of urban development with special focus on the city of Malmö. In Chapter 6 we described how and to what extent research and innovation policies and measures have dealt with issues relevant for renovation of apartment buildings. In this concluding chapter we will consider how research and innovation policies might most effectively contribute to making future investments in building renovation successful in terms of the quality of life for the residents, the energy efficiency of the renovated buildings, and as a stimulus of innovation and growth in industry in Sweden. The purpose is to try to identify the demands that this specific system transition puts on research and innovation policy and its relationship to policies in other areas. As a conclusion to the chapter, we will discuss what lessons from these renovations might be generalizable to other system transitions.

Sooner or later the pace of renovating buildings in Sweden will have to increase significantly. The ambitions set for the upgrading of energy efficiency, indoor environment, accessibility, ICT infrastructure, waste handling, green spaces, and other characteristics of apartments, buildings, and their environment are likely to differ between individual property owners and specific renovation projects. Building standards and other regulations will impose minimum requirements but allow significant room for real choices to be made by property owners. The choices made will be influenced by a large number of factors, many of which probably will have little connection with research and innovation policy. As discussed in this report, financing models that internalize societal benefits are likely to play a particularly critical role.

With progress in technology over time, new functionalities can be achieved while also requiring less human and natural resources. Some of the technical advances pertaining to buildings reflect changes in basic technologies that are used in many sectors, while other advances are the result of innovations more specific to the building sector. Whatever the combination may be, the functionality-cost characteristics of available technical solutions will tend to improve over time in most fields, including that of renovation of buildings.

If the renovation of buildings is to make a real contribution towards more sustainable cities and societies, changes to the buildings themselves must be combined with changes in other systems related to the buildings and their occupancy. If we consider the renovation of apartment buildings in relation to the conceptual framework of system innovation as articulated by Geels, the most significant changes in the socio-technical regime become

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visible only when we consider the buildings in their wider context of interconnected systems. Some of these systemic interdependencies have strong technological content:

- Relation with suppliers of district heating
- Local energy production
- New opportunities offered by integrating homes and buildings into smart networks
- Developing new more industrialized building processes which increase quality and allow customization at lower cost

In using the term “sustainable” as used to characterize renovation of apartment buildings, we do not suggest that there is an absolute and constant norm for what should be considered sustainable.

## **7.1 Moving towards take-off of sustainable renovation of buildings**

### **7.1.1 Political priorities**

While Sweden’s ambitions for environmental and climate policies have generally been to lead policy development internationally, government policies for promoting energy efficiency in buildings have been surprisingly cautious. There are probably several different reasons for this. The success achieved in significantly reducing the climate footprint of the building sector by substituting biomass and waste for fossil fuels when generating district heating may have been the most direct reason. A possible satisfactory explanation could be the sheer complexity of devising effective and politically viable policies for the housing sector, which is very heterogeneous in terms of the occupants, the buildings, and the local social and economic context. Compared to introducing incentives for replacing imported oil with domestic fuels, forceful policies for reducing energy use in buildings would be expected to be politically much more divisive. When measures to save energy come into conflict with the occupants’ ability to pay for those measures – as is the case with energy-efficient renovation of many of the *Miljonprogrammet* residential areas – basic differences in political outlook are likely to come into play and will have to be overcome.

During the last 10-15 years, the importance of cities as central arenas for the development of a more sustainable Swedish society has increasingly become recognized. Initially the focus was overwhelmingly on ecological sustainability while the social dimension of sustainability has only recently begun to receive significant attention. Renovation of multi-family residential buildings offers a major opportunity for simultaneously improving the social and physical environment in cities and reducing one of the largest sources of energy consumption. Nationally, there is not yet sufficient agreement that seizing this opportunity should be given high priority and, if so, what measures need to be taken. This will have to change to develop effective policies and measures.

In February 2014, the government tasked a commission to five agencies, with the Swedish National Board of Housing, Building and Planning as the co-ordinating body, to establish and maintain a “platform for questions about sustainable urban development”. The activities of this platform could play an important role in increasing the visibility and priority of issues related to sustainable renovation of *Miljonprogrammet* urban areas.

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### 7.1.2 Who should pay?

It is technically possible to greatly increase the energy efficiency of residential buildings in connection with renovation, but this also increases costs significantly. Some part of that increase will be recuperated through reduced energy costs, but at current and projected energy prices this saving is not enough to economically justify the increase in investment costs. This suggests that special incentives to property owners and/or residents will be needed to encourage desirable investments in improving energy efficiency.

Another issue is that in some of the *Miljonprogrammet* communities, a large part of the residents have very limited economic resources and would be unable to pay an increase in the rent resulting from a major renovation project. In recognizing this, the City of Malmö is trying to develop financing models that internalize the social costs and benefits associated with alternative ways of revitalization of city sections in the investment calculus of renovation projects.

It seems clear that suitable financing arrangements must be in place for sustainable renovation to occur and that this is currently not the case. Many of the issues are political – involving both the local and the national level – but there are also highly technical aspects of devising effective financing models. Regulations surrounding the housing market are politically sensitive, which likely inhibit the development of innovative political solutions.

It is interesting to compare with the very active promotion of low emission vehicles and biofuels through various tax incentives. So far there have been no comparable efforts to provide incentives for sustainable renovation even if this would seem to be as important from a societal point of view. The fact that Sweden has large export-oriented vehicle industries may partly explain the difference.

### 7.1.3 Long-term framework of building rules

So far, policy measures to improve energy efficiency of buildings have primarily been designed to meet the demands of relevant EU directives as they have changed over time. Mandatory energy standards for existing buildings were not introduced in Sweden until January 2013, and apply only when buildings are altered. In principle, the same energy standards now apply to altered buildings as to new buildings, but as there are numerous caveats, such as “if economically reasonable”, the practical significance of the these standards are still very unclear.

In order to meet EU requirements, the government has formulated what is still a rudimentary “national strategy for increasing energy efficiency through renovation of buildings”, but has signalled that the strategy will be further developed and that energy standards may be raised.

There is currently considerable uncertainty regarding the long-term development of energy standards for buildings that undergo renovation. The elimination of the previous objective to reduce energy use in buildings by 50 per cent by 2050 has added to this uncertainty.

### 7.1.4 Industrialized building processes which increase quality and allow customization at lower cost

When the *Miljonprogrammet* residential areas were built during the 1950s and 1960s, much effort was devoted to streamlining and exploiting economies of scale in the construction processes. The large and predictable volumes of construction stimulated this. An important question is whether there is any scope for significantly reducing the costs for renovation of the same buildings in relation to what is today the norm.

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For construction in general, a consensus has been building among the relevant actors for a sector-wide and sustained push to develop platform-based construction processes, which would allow more effective learning processes and exploitation of economies of scale. As previously noted, this has also resulted in a concrete proposal for an SIO program. However, this proposal did not receive funding.

Compared to new construction, renovation will require more customization. Considering the new possibilities created through information technologies, which are the key technologies underlying the concept of platform-based construction, customization should not be an insurmountable problem. Implementation of new construction processes for sustainable renovation of residential multi-family housing would seem to be a suitable area for innovation procurement with potentially large multiplier effects on supplier industries to the construction industry, including the wood manufacturing industry. Development projects will have to be on a sufficient size and in sufficient number to allow learning between projects. Leading roles by major Swedish construction companies in international projects aimed at developing more cost-efficient renovation methods suggest that there is interest in Swedish industry.

#### 7.1.5 Education and training for sustainable renovation

Even if the construction process of renovation could be made more industrialized and efficient, it would still be quite labour-intensive and, if performed on a large scale, have big effects on domestic, and largely local, employment. In any political or socio-economic calculus, this fact must be counted as a great merit. A big question is, however, whether there would be enough exports and craftsmen with the right qualifications available if renovation work was really accelerated. There seems to be a general consensus that the pool of qualified persons needs to be greatly expanded. Since 2011, the Energy Agency runs the Swedish part of the European “Build Up Skills” initiative. In order to support a take-off in sustainable renovation, this initiative might need to be scaled up. The situation is further complicated by a perceived general shortage of qualified craftsmen in the construction industry and an expectation that new construction of residential buildings will increase.

#### 7.1.6 The knowledge infrastructure

After a period of relative neglect during the first decade of the millennium, in recent years research related to the built environment and urban planning has received increasing attention and support from both the Research Council Formas and the Swedish Energy Agency. Furthermore, the increase is expected to continue as a consequence of allocation of targeted funding in the most recent government research and innovation bill.

In line with this general increase, funding for renovation-related research has also increased significantly. A newly established National Renovation Centre and a special call for proposals focusing on renovation have together significantly strengthened the research base. In due time, it will be important to assess whether the individual research environments are internationally competitive and connected.

While the need for interdisciplinary research that integrates technical, social, and economic aspects is recognized, research in Sweden on the built environment is still almost entirely performed in the engineering schools of universities or in research institutes. A broader involvement of social scientists, including economists, would be desirable.

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### 7.1.7 Many system transitions and how to draw system boundaries

A difficulty in applying the Systems Innovation framework in the urban context is that cities undergo several system transitions in parallel and that, as the case of renovation of housing clearly shows, these systems and their transitions are strongly interlinked. Importantly, they also compete for political attention. As lack of housing is currently seen as limiting growth in Sweden's large cities, and therefore for Sweden, for example, it will be difficult for issues related to renovation and rejuvenation of existing residential areas to successfully compete for attention with construction of new housing unless an approach that includes both issues is deliberately adopted. Ideally, one would like to always consider the whole urban system, but system boundaries will have to be drawn to develop concrete actions. How these are drawn is crucial. For a while it appeared that reducing the environmental footprint and, especially, the carbon footprint of cities could be the overarching objective that would define the key transition. It now seems clear that due consideration must also be given to other aspects, such as social segregation and demographic changes. While this is increasingly acknowledged, the development of national policies for promoting energy efficiency in buildings still appears to be based on systems boundaries being drawn too narrowly, and it is hard to find any real attempts to include social costs and benefits in the deliberations. Against this background, what happens with the "platform for questions about sustainable urban development" now in the process of being established and how its agenda is set will be crucial. Looking at the organizations charged with establishing the platform and the organizations with which they are supposed to consult, social aspects of urban development are represented to a very limited degree.

### 7.1.8 Need for more comprehensive initiatives

The City of Malmö is making a serious effort to develop a scalable model for financing renovation projects that meet high standards of sustainability in all three of its dimensions. Internalizing local social costs and benefits in the investment calculus and combining financing from multiple sources, including grants from EU structural funds serving social as well as climate policy objectives, are core parts of the concept. The objective is clearly to lay the basis for a broad-based transition towards sustainable renovation in Malmö. The effort builds on numerous separate past and on-going projects, but is different from most of these in that it takes an integrated and systemic view of urban renewal with a clear focus on renovation of the *Miljonprogrammet* residences.

While the need for a systemic approach has grown out of Malmö's experiences from previous development projects, it appears that the grant from VINNOVA to establish an Innovation Platform has been essential for Malmö to make a major push to try to implement this approach. The current funding, however, is limited to only two years and even if significant results were to be achieved during this time, it seems clear that the effort needs to be sustained over a much longer period. Two questions that need answering are how long is it productive to pursue development of models for sustainable renovation in a single city<sup>109</sup> and when and how should similar efforts in other cities be encouraged. More generally, there is the question of whether a nationally co-ordinated effort might be called for to address the challenges of developing sustainable renovation and, if so, what should be done and by whom.

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<sup>109</sup> Is mentioned earlier the Innovation Platform for Borås (and more specifically the city neighbourhood Norrby) also has a *Miljonprogrammet* residential area as its focus.



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There is already some exchange among the different Innovation Platforms through joint workshops. Workshop participants, which have included the City of Stockholm, appear to experience them as very fruitful.

## 7.2 VINNOVA and System Innovation

A major reason for VINNOVA joining the OECD project on System Innovation was to develop a better understanding of the extent to which VINNOVA's current strategy and programmes meet the needs of broad systemic innovation processes as conceptualized in the System Innovation framework.

Many academic studies of System Innovation have focused on system transitions in urban contexts. As discussed in this report, many of the projects under VINNOVA's Challenge-Driven Innovation programme are working toward the development of sustainable and attractive cities. The funded projects have been selected on their own merits in an open competition with other projects in a stage-gate process. Around 80 projects have been funded through the first stage under the theme sustainable and attractive cities. Only a couple of these dealt directly with renovation of the *Miljonprogrammet* residential areas and none of these made it through to the next stage. In contrast to the regular projects of the Challenge-Driven Innovation programme, renovation of the *Miljonprogrammet* residential areas figured prominently among the specially funded innovation platforms for sustainable and attractive cities. Two out of four funded platforms have this focus, including the one in Malmö studied for this report. This difference suggests that the challenge of renovating the *Miljonprogrammet* residential areas is simply too broad and large to fit into the framework of focused projects of the Challenge-Driven Innovation programme. The fact that none of the funded projects is aimed at solving specific problems related to renovation may also indicate that there is little potential for individual technical solutions to have a big impact on the feasibility of sustainable renovation.

Looking more broadly at the portfolio of Challenge-Driven Innovation projects, there is a clustering of some projects around certain themes raising the issue of whether a more organized exchange between the projects under each theme would be desirable and, if so, how this could best be realized. To some extent this is already happening spontaneously. It might, however, be worth investigating whether there is a need for extra funding to facilitate exchange and co-operation between related projects.

When VINNOVA started its programme for Challenge-Driven Innovation in 2011, the systemic nature of many of the important societal challenges was recognized and formed the basis for design of the programme. In many ways, renovation of the *Miljonprogrammet* would seem to fit the objective of the programme very well. That this challenge has played a marginal role among the applications and funded projects (other than the Innovation Platform) may suggest that the programme, at least in the context of urban development, is not well suited to address broader systems transitions. Looking at the project portfolio at large, it is possible to view many of the projects as niche projects that could contribute in systems transition towards more sustainable and attractive cities. To contribute in a more direct way to systems transitions, a different and broader approach is probably needed.

For VINNOVA, one conclusion is that the Innovation Platform part of the Challenge-Driven Innovation (CDI) programme appears to serve a very important function as a complement to the highly focused innovation projects that form the bulk of the programme. It could even be argued that more of the resources in the CDI programme aimed at sustainable, attractive

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cities should be devoted to initiatives for “systemic action design and experimentation”. More attention also needs to be given to the interlinkages between different urban subsystems and to the interplay between social, economic, and engineering aspects. This suggests that VINNOVA, the Swedish Energy Agency, and the Research Council Formas could benefit from working more closely together.

While the Challenge-Driven Innovation programme is geared towards supporting highly focused innovation projects, the Strategic Innovation Areas programme, which is operated jointly by VINNOVA, the Swedish Energy Agency, and the Research Council Formas, aims at more broadly strengthening the innovation capacity of actors in Sweden in a particular field. The purpose of the programme is described as “creating preconditions for international competitiveness and sustainable solutions to global societal challenges”. Of the ten Strategic Innovation programmes (SIO programs) selected for funding so far, all but one are primarily oriented towards strengthening and renewing manufacturing industry in Sweden.<sup>110</sup> The exception is the Chronic Diseases programme, where meeting a societal challenge and developing industry have more equal weight.

As in the case of the Challenge-Driven Innovation programme, the SIO programmes are selected through open calls for proposals. A proposal has to be based on a strategic research and innovation agenda developed by key stakeholders in the area covered by the proposal. There is no *à priori* limitation of the areas or themes that can define an SIO programme. In principle, it would be possible to, for example, select an area linked to sustainable urban development or even more specifically to renovation of *Miljonprogrammet* residential areas as a theme for an SIO programme. However, so far there has been no proposal for an SIO programme with a strong link to urban development. The closest are proposals dealing with construction, but these are primarily concerned with the industrial aspects. A factor contributing to the dearth of urban development related SIO programme proposals may be that the industry involved is quite diverse and its international competitiveness and potential for growth not easily determined. That the construction industry is usually regarded as a domestic industry may also make it seem less possible to apply merits of international competitiveness to the building of innovation capacity centred around sustainable urban development.

The actor composition of Challenge-Driven Innovation projects differs between the four broad themes of the programme. For two of the themes – health and sustainable and attractive cities – almost all projects have significant participation by public sector organizations<sup>111</sup>, companies, and research organizations, while the other themes – competitive manufacturing and information society 3.0 – with few exceptions have no presence of public sector organizations. In the SIO programmes selected so far, with the Chronic Diseases programme as the main exception, public sector organizations other than universities and research institutes play a marginal role. This inevitably raises the question of whether there is not a need to also involve public sector organizations in the more strategic development of Sweden’s innovation capacity. The very active engagement by municipalities and county councils (and their hospitals) in the Challenge-Driven Innovation programme strongly suggests that forms need to be found to also engage them in more strategic capacity building. It is beyond the scope of this report to present any detailed recommendation of how this can be done most effectively. The experience from the

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<sup>110</sup> Increasing energy and material resource efficiency is an important objective of most of the programmes.

<sup>111</sup> Mainly municipalities, hospitals, and county councils (the latter in their role as owners of public hospitals).

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renovation area suggests that there may be a need to combine the logic of Challenge-Driven Innovation programme and Strategic Innovation Areas programme.

### 7.3 The role of indicators

The present case study has not allowed any in-depth investigation of available statistics and suitable indicators for monitoring the progress of the system transition under consideration. The discussion of indicators in the following is therefore limited to a few general comments.

A general impression is that available national statistics concerning apartment buildings do not presently allow monitoring of changes in the status of individual buildings or apartments and how they relate to the extent to which various types of renovation have or have not been performed. A new system for energy declaration of buildings was introduced in 2007. In 2012, a requirement was introduced that experts drawing up the declarations must be specially certified for the task. This was aimed at improving the quality of the energy declarations.

There does not seem to be any systematic statistics on the performance of renovation. On an aggregate level, the national accounts statistics distinguish between four categories of investments in residential buildings, one of which is investments in existing apartment buildings.

Statistics on energy use in apartment buildings focuses on purchased energy for heating or hot water. Such data can be linked to the year of construction and the floor area of the apartments. This allows for monitoring of aggregate changes in the average use of purchased energy for heating and hot water per square meter but not for linking these changes to specific causes. There are two additional limitations in the available statistics for monitoring total energy use in apartment buildings:

- Electricity purchased by the individual households is not registered.
- Production of energy locally within the residential property (and thus not purchased) is not registered, nor are the effects of local use of heat pumps (except in terms of purchased electricity for the heat pumps).

The City of Stockholm in 2014 added an indicator for energy efficient renovation to its existing portfolio of 81 indicators used for monitoring the progress of its environmental programme.<sup>112</sup> The indicator measures the area of buildings owned by the city (or by companies which it controls) that have significantly improved their energy efficiency as a result of major renovation projects. The indicator calculates this area as a percentage of the total area of buildings owned by the city. In order to be included, buildings must achieve at least the energy efficiency mandated for newly constructed buildings according to the Swedish building standards.<sup>113</sup> So far data is only available for 2012, in which year 0.8 per cent of the area of the city's buildings were renovated to the standard of high energy efficiency.

As has repeatedly been argued in this report, energy efficiency, while very important, is only one of several quality dimensions of an apartment or, more broadly, of a residential

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<sup>112</sup> <http://miljobarometern.stockholm.se/sub.asp?mp=MP15&mo=3&dm=4>

<sup>113</sup> In the case of "very large renovation projects", energy consumption shall be reduced by 50 percent or to the level of newly constructed buildings according to the Swedish building norm if this is lower.

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area. A system of indicators for monitoring renovation progress must therefore not be limited to energy parameters.

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## 8 Conclusions

Sustainable renovation of multi-family residential areas built during the 1960s and 1970s in Sweden has been studied as a system transition using the System Innovation conceptual framework. The main objective has been to identify the role that research and innovation policies and measures have played so far in this transition and to reflect on how their contribution could be enhanced as the transition continues to unfold. The following are some of the conclusions from the case study.

Renovation of the *Miljonprogrammet* residential areas represents a major window of opportunity for the development of more sustainable cities in Sweden in social, ecological, and economic terms. Cultural sustainability may be added to the list as the *Miljonprogrammet* residential areas represent a unique element in the development of Swedish society and in terms of their architecture and physical construction are regarded as well worth preserving.

As the physical deterioration of the *Miljonprogrammet* buildings proceeds, some degree of renovation will be required to address the most pressing needs. To the extent that renovation will stop at this, the window of opportunity for a transition towards sustainable renovation will gradually close. There are still very few examples of truly sustainable renovation projects in Sweden, and it is by no means certain that a full-scale transition towards sustainable renovation will occur. At present, there are no clear indications that a take-off in transition is imminent. Suitable incentives, financing models and arrangements are major bottlenecks.

Finding a financing solution requires an understanding of where the public benefits from renovation occur, both in the short- and the long-term. Additionally, there also needs to be a financing model based on the players who benefit from the renovations paying for them from the very beginning. The renovation of *Miljonprogrammet* housing highlights the need to understand where benefits arise and to find approaches for co-financing. Many other issues characterized by a clear systems perspective share this need.

With this in mind and from a systems perspective, it is also crucial to understand the long-term value of investments in social innovation and in measures to improve the attractiveness of housing. It is necessary to find ways to both follow up investments and to measure their direct and indirect effects, which show how social investments and investments in improving the attractiveness of housing contribute to growth and competitiveness in the long-term.

While drastically reducing energy consumption is a major aspect of accomplishing sustainable renovation, a singular focus on energy efficiency has increasingly come to be seen as both inappropriate and unworkable. In recent years, efforts in Sweden to promote sustainable urban development, which long focused almost entirely on ecological sustainability, have begun to put increasing weight on issues of social sustainability. This also means that the perspective is broadened from technical renovation of individual buildings to revitalization of residential communities.

The development towards more sustainable cities and society entails a number of different system transitions with strong interlinkages. Renovation of residential areas has to compete for political attention with other system transitions and so far has not been given a high priority at the national level. Replacing fossil fuels with biomass and household waste in district heating systems has allowed the carbon footprint of buildings to be reduced without significantly improving their energy efficiency. As this potential is nearly exhausted, energy

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efficiency in buildings is likely to be perceived as more important than before. On the other hand, the pressing shortage of housing in major cities is making new construction a higher priority than renovation of existing buildings.

While the owners of residential buildings have the ultimate responsibility for decisions to invest in renovation, municipalities with their multiple roles and capacities in relation to the development of a city are also major stakeholders in such projects. To the extent that municipalities are able to integrate their various capacities, they can strongly influence the actions of and co-operation among key actors with a potential to contribute to sustainable renovation. This includes owners of buildings, residents, construction companies, urban planning and building consultants, energy companies, and industrial companies. The City of Malmö has taken the lead in organizing a consortium of such actors through an Innovation Platform, partly financed by VINNOVA, to pursue renovation and rejuvenation of a section of the south-eastern part of the city in a comprehensive way. The effort builds on a number of earlier, more narrow projects. A key aspect is to develop concrete investment models which integrate social costs and benefits in the investment calculus for renovation projects. While strategic co-operation with external actors is a central aspect, integration of strategies, policies, and measures across different sections of the city administration presents its own challenges.

Urban development and the construction sector were generally given low and declining attention in Swedish research and innovation policy during the first decade of the new millennium. As cities have come to be seen as major arenas for realizing sustainable societies, the support for research and development related to the built environment has increased in recent years and is expected to continue to increase further. As a result, the research community dealing with built environment is being strengthened through funding from the Research Council Formas and the Swedish Energy Agency. This includes both engineering fields and social sciences. While many research projects benefit from contacts with industry, there is very little in terms of government support for industry-led development projects. Municipalities have traditionally not been engaged in research and innovation activities. As cities are increasingly regarded as important innovation arenas, this is beginning to change. The very active participation of municipalities in VINNOVA's Challenge-Driven Innovation programme is a good example of this.

As the overall support for built environment related research and innovation has increased in recent years, so has research on issues of renovation, although it remains fairly modest. Particularly noteworthy is the establishment of a new National Renovation Centre in 2014 at Lund University.

There are no obvious individual policy measures or actions which would ensure a take-off in the transition towards sustainable renovation. An integrated approach with key actors represented of the kind attempted through the Innovation Platform in the City of Malmö appears to be a necessary prerequisite. Individual niche projects are unlikely to effectively contribute to the start of a system transition unless they are conceived and performed within a larger long-term framework that places the individual projects in an organized learning loop and gradually moves the cost-performance of integrated solutions to a level where large-scale implementation can be achieved on a routine basis. While individual projects will be performed in local contexts and sharing of experiences and specific technologies internationally will be important, the organizing framework will most likely have to be established on the national level. Whether this would best be accomplished through a bottom-up joining of forces among some cities or through a top-down national initiative is

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by no means a foregone conclusion. Whichever way is chosen, a core of group of committed major cities must be engaged.

Reducing costs in the construction process as well as developing innovative financing models will both be crucial. Social aspects and energy efficiency will need to both be considered in a balanced way. To organize innovation procurement in accordance with these requirements is a challenging but important task. Securing a sufficient supply of craftsmen with up-to-date knowledge of best-practice renovation methods will also be crucial if the transition is not to lose its momentum early on.

There are many ways in which the national government could facilitate the transition towards sustainable renovation. First of all, its priority needs to be established much more clearly and strongly than has so far been the case. Co-ordination among different ministries and agencies would of course be desirable, but for such co-ordination to be productive it needs to be based on a shared vision of the main features of the transition towards sustainable renovation. Such a roadmap would need to allow for uncertainties, for example, in terms of energy prices and the potential for developing more cost-effective construction methods and other technologies. A predictable long-term schedule for minimum energy standards of renovated buildings would also be helpful. Finally, more direct economic incentives for sustainable renovation, in one or another form, may be needed to align private and societal priorities.

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## Interviews

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### Personal interviews

Andersson, Sandra, Swedish Energy Agency, Programme Manager, the Department for Energy. interview 2014-02-14

Alghed, Jessica, Mistra Urban Futures, Deputy Director, interview 2013-11-05; 2014-02-10

Björling, Stefan, SABO, Swedish Association of Public Housing Companies, interview 2014-02-11

Björnsson, Moa, Sustainable Development, City of Malmö, Sweden, project manager Innovation Platform Malmö, interviews 2014-02-13; 2014-05-07

Briswall, Maja Stockholm, Resilience Centre, interview 2014-03-18

Edelstam, Mikael, Miljöstrategi AB, Skåne County, Sweden, interviews 2014-02-13 2014-05-07

Engström, Dan, NCC Construction Sverige AB, interview 2014-03-05

Eriksson, Lena, Sustainability strategist, Malmö Stad, interviews 2014-02-13, 2014-05-07

Eriksson, Arne, Eriksson Consultancy, interview 2014-03-12

Eriksson, Staffan, Royal Swedish Academy of Engineering Sciences, IVA, interview 2014-01-29

Perez Vico, Eugenia SP Technical Research Institute of Sweden, Researcher and policy analyst, interview 2014-03-03

Finessi, Patrizia , SABO, Swedish Association of Public Housing Companies, interview 2014-02-11

Graham, Trevor, Head of Sustainable Development, City of Malmö, interviews 2014-02-13

Handelskammaren, Manager of Attractive City at the Trade Policy section, West Sweden Chamber of Commerce, Groupinterview 2013-11-14

Johansson, Dennis, Lund University, Faculty of Engineering, Head of the newly formed Renovation Centre, interview 2013-11-05

Jurdell, Petter, SABO, Swedish Association of Public Housing Companies, interview 2014-02-11

Landahl, Gustaf, Head of the Environmental Protection Agency for the City of Stockholm, interviews 2013-11-18; 2014-02-11

Lilled, Lars, Director S2020 City of Gothenburg), interview 2014-01-29

Nordling, Jan, Royal Swedish Academy of Engineering Sciences, IVA, interview 2013-10-30

Olsson, Per, Stockholm Resilience Centre, interview 2014-03-18

Olsson, Sören, Professor of social work at University of Gothenburg, interview 2013-10-30

Persson, Anette, Swedish Energy Agency, Co-ordinator Sustainable Urban Development, the Department for Energy, interview 2014-02-14

Persson, Bengt, Landscape Architect at Landskapsarkitekterna Lund AB, Interview, 2014-02-03

Percovich Gutierrez, Victoria, Project Manager, City of Malmö, interviews 2014-02-13, 2014-05-07

Samuelsson, Olle, R&I strategist at IQ Samhällsbyggnad, interview 2014-03-04

Siesjö, Björn, City Planning Office, City of Gothenburg), interview 2013-11-04

Silfver, Lotta, Project Manager, Development of the Environmental programme for the City of Gothenburg, interview 2013-10-23



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Stenquist, Bjarne, Project Manager at Environmental Department, City of Malmö, interviews 2014-02-13; 2014-05-07  
Stoltz, Anna-Karin, City of Stockholm Innovation Platform, Director for Norra Djurgårdsstaden, interview 2014-02-13  
Westman, Per, Royal Swedish Academy of Engineering Sciences, IVA, interview 2014-01-29  
Zätterström, Sandra, responsible for Attractive City at the Trade Policy section, West Sweden Chamber of Commerce, interview 2014-01-29  
Örn, Peter, Management Consulting Professional (previously led the Delegation for Sustainable Cities), interview 2014-01-29

### **Phone interviews**

Hågbrandt, Lars, Movium think tank and manager of city planning for the municipality of Katrineholm), interview 2013-11-07  
Lindblad, Sverker, Department of Commerce, interview 2013-11-07  
Martinson, Lina, Department of Social Affairs, interview 2013-11-11  
Pelin, Katarina, Environmental Department for the City of Malmö, as well as member of the Delegation for Sustainable Cities), interview 2013-11-12  
Ronnle, Erik, WSP Environmental, interview 2014-03-05  
Svensby, Björn, Swedish Energy Agency), interview 2013-11-26  
Åkerman, Jonas, Royal Institute of Technology), interview 2013-11-14  
Örtenvik, Mattias, Head of Sustainable City, E.ON Nordic, interview 2014-03-10

## **Other contacts**

### **Short conversations**

Ford, Jake, Landscape architect, Malmö, White, conversation 2014-05-07  
Sjöblom, Susanne Skanska Sverige AB, conversation 2014-05-07  
Ola Ohlsson, Ola, Bitr. Regional manager Bygg Syd Peab, conversation 2014-05-07  
Andersson, Olof CEO Fastighets AB Trianon, conversation 2014-05-07  
Arnesson, Tanja, Green business developer, Skanska, conversation 2014-03-20  
Vidén, Sonja professor of architecture, Stockholm, conversation 2014-01-20  
Arthur, Alarik GDI Consulting AB, conversation 2014-02-10  
Sandoff, Anders Gothenburg University's School of Business, Economics and Law, conversation 2014-02-13  
Berggren, Thomas, Swedish Energy Agency, conversation 2013-11-18  
Pragert, Paula, The University of Malmö, conversation 2013-11-13  
Anette Persson, Swedish Energy Agency, 2014-10-08  
Conny Rolén, Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas), 2014-10-13

### **Workshop researchers at KTH, 2014-05-13**

Brown, Nils William Olof: doctoral student in energy efficiency in the built environment.  
Gunnarsson Östling, Ulrika: researcher in sustainable development, future studies, environmental justice, feminism  
Högborg, Lovisa: doctoral student in energy efficiency in Miljonprogram and sustainable renovation of Miljonprogram  
Liljeström, Carolina: research engineer in energy efficiency

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Malmqvist, Tove: researcher focused on environmental management of renovations  
Olsson, Stefan: industry doctoral student in sustainable renovation.  
Stenberg, Erik: architect/researcher with focus on building systems and adaptation of  
apartments to today's needs  
Svane, Örjan: professor of sustainable urban development with focus on sustainable  
renovation  
Wangel, Josefin: researcher in future studies and sustainable urban development

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## Sources

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- BKN, National Housing Credit Guarantee Board (Statens bostadskreditnämnd). 2008. Upprustning av miljonprogrammets flerbostadshus - Statlig medverkan i finansieringen. BKN:s dnr: 17-140/07
- Blomsterberg, Å. WSP, 2012. BUILD UP Skills – Sweden – Analysis of the national status quo, WSP, August 2012
- Burke, S & Lindhe, J. 2010. Renovering och minskning av energianvändningen i befintliga ”miljon programshus”, Rapport/SBUF. Malmö: Ett samarbetsprojekt mellan Peab, Sydtotal och Lunds Tekniska Högskola
- Börjesson, LTH, PPT-presentation <http://www.sbhub.se/file/hallbara-biodrivmedel-borjesson.pdf>
- EeB PPP Project Review, July 2012, FP7 Founded projects under the 2010 and 2011 calls
- European Commission, 2014. BUILD UP Skills – EU overview report, Staff working document, European Commission, October 2013, revised in June 2014
- Geels, F.W. 2002. ‘Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study’, *Research Policy*, 31(8/9), 1257-1274
- Geels, F.W. 2004. From sectoral systems of innovation to socio-technical systems Insights about dynamics and change from sociology and institutional theory. *Research Policy* Volume 33, Issues 6–7, s. 897–920
- Geels, F.W. 2005. ‘Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective’, *Technological Forecasting and Social Change*, 72(6), 681-696
- Hellström, A & Sandkvist, O. 2010. Energibesparing inom miljonprogrammet – är miljömålen 2020 och 2050 rimliga? Avhandling Lunds Tekniska Högskola
- Hendriks, C.M. & Grin, J., 2007. ‘Enacting Reflexive Governance: The politics of Dutch transitions to sustainability’, *Journal of Environmental Policy and Planning*. 9 (4): 333-350.
- Holmqvist, E., 2009. Politik och planering för ett blandat boende och minskad boendesegregation – Ett mål utan medel? Avhandling Uppsala universitet
- Hoppe, T., 2012. "Adoption of innovative energy systems in social housing: Lessons from eight large-scale renovation projects in The Netherlands", *ENERGY POLICY*, vol. 51, pp. 791-801
- Högberg, L. and Lind, H., 2011. Incitament för energieffektivisering i 60- och 70-talets bostadsbestånd, Department of Real Estate and Construction Management, KTH, Stockholm 2011.
- IEA Energy Technology RD&D Statistics
- Ilstedt Hjelm, S., 2011. Design, energi och hållbar utveckling, Kungliga Tekniska Högskolan, Stockholm, maj 2011.
- Industrifakta AB, 2008. Förnyelse av flerbostadshus 1961-1975 (Electronic 2014-06-12): [http://www.eio.se/SiteCollectionDocuments/fornyelseavflerbostadshus1961\\_1975.pdf](http://www.eio.se/SiteCollectionDocuments/fornyelseavflerbostadshus1961_1975.pdf)
- IVA (Royal Swedish Academy of Engineering Sciences), 2012. Ingenjörsvetenskapsakademiens rapport Energieffektivisering av Sveriges flerbostadshus.

---

Hinder och möjligheter att nå en halverad energianvändning till 2050, (Electronic 2014-06-13): <http://www.iva.se/Documents/Publikationer/Projekt/201206-IVA-Energieffektivisering-rapport1-F.pdf>>

Swedish Royal Institute of Technology (KTH), 2012. Energieffektivisering av Sveriges bebyggelse. Hinder och möjligheter att nå en halverad energianvändning till 2050. Ett arbete inom IVAs projekt Ett energieffektivt samhälle (Energy efficiency measures for Swedish buildings. Obstacles and possibilities in reducing energy use by half until 2050. A report within the IVA project an energy efficient society) (In Swedish, abstract in English)

IQ Samhällsbyggnad/Cementa, NCC/Luleå University of Technology, Swedish Universities of the Built Environment/Luleå University of Technology, 2013. Smart Built Environment - Processes and information management in construction and facility management.

Landwehr, A. 2013. How can local governments push for ambitious energy-efficient. -An exploratory case study on the Bygga om Dialogen. Project in Malmö. Master Thesis: Malmö University

Ljung, S. Byggnads, 2012. Energieffektivisering av bostäder, En rapport från Byggnads om klimatpolitiska utmaningar och hur vi kan ta tillvara tyska erfarenheter av energisparlån, June 2012

Malmö stad, 2013:2, Kommission för ett socialt hållbart Malmö. 2013. "Malmö's väg mot en hållbar framtid. Hälsa, välfärd och rättvisa", (Commission for a Socially Sustainable Malmö, Malmö's Path Towards a Sustainable Future. Health, Welfare and Justice). Malmö Stad, viewed 5 August 2013, (Electronic 2014-03-13): [http://www.malmo.se/download/18.31ab534713cd4aa921357ef/malm%C3%B6kommissionen\\_slutrapport\\_digital\\_130312.pdf](http://www.malmo.se/download/18.31ab534713cd4aa921357ef/malm%C3%B6kommissionen_slutrapport_digital_130312.pdf)

Malmö stad, 2013-11-13, (Electronic 2013-11-13): <http://www.malmo.se/download/18.76105f1c125780a6228800037564/Västra+Hamnen+-+Bo01-området+-+Stad+för+människan+och+miljön.pdf>

Malmö stad, 2014. Innovationsplattform Malmö Sydost (Electronic 2014-01-19): <http://www.malmo.se/Medborgare/Miljo--hallbarhet/Miljoarbetet-i-Malmo-stad/Hallbarstadsutveckling/Innovationsplattform-Malmo-Sydost.html>

Mulgan, G., Reeder, N., Aylott, M., & Bo'sher, L. 2011. "Social Impact Investment: the challenge and opportunity of Social Impact Bonds.", Young Foundation, 22 July 2013

Möllerström, V. 2011. Malmö's omvandling – Från arbetarstad till kunskapsstad, Lunds universitet. Avhandling, Lunds universitet

OECD, 2013. Green Growth in Cities, OECD Green Growth Studies, OECD Publishing: <http://dx.doi.org/10.1787/9789264195325-en>

Profu, 2011. Evaluation of the CERBOF programme, Profu, 15 March 2011

Radio Sweden, P1. May 2014. Industriellt byggande blir billigare", Vetenskapsradion (radio programme), Radio Sweden, 16 May 2014.

SBAB, Mäklarbarometern Q1. 2014. (Electronic 2014-08-03): [https://www.sbab.se/download/18.39d09175144f282ee4c355/1397050345962/M%C3%A4klarbarometern+Q1+2014\\_140410.pdf](https://www.sbab.se/download/18.39d09175144f282ee4c355/1397050345962/M%C3%A4klarbarometern+Q1+2014_140410.pdf)

Schot, J. & Geels, 2008. Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. Technology Analysis & Strategic Management Vol. 20, No. 5, September 2008. 537-554

---

Schulman, M. 2000. Stadspolitik och urbanforskning i Norden. Stockholm: Nordregio Working paper 2000:4. Se 19, 26

SOU M 2011:01 Slutredovisning av Delegationen för hållbara städers verksamhet, Stockholm, Delegationen för hållbara städer (Final report: Activities of the Delegation for Sustainable Cities, Delegation for Sustainable Cities, 2011:01)

SP Trätek, 2010. Framsyn Trämanufaktur – trämanufaktur i ett uthålligt samhälle” (“Foresight Wood Manufacturing – wood manufacturing in a sustainable society”), SP Trätek, 2010.

Statistics Sweden (Statistiska Centralbyrån, SCB), 2012. Bostadsbyggandet lågt under lång tid. Byggnade- och bebyggelsestatistik, (Electronic 2014-06-12): <http://www.scb.se/sv/Hitta-statistik/Artiklar/Bostadsbyggandet-lagt-under-lang-tid/>

Statistics Sweden (Statistiska Centralbyrån, SCB) Byggnade- och bebyggelsestatistik (Electronic 2014-03-10) [www.scb.se/BO0101](http://www.scb.se/BO0101)

Swedish Energy Agency (Energimyndigheten), 2010. Finansieringsinstrument för energieffektivisering. ER 2010:37

Swedish Energy Agency (Energimyndigheten), 2011. Renovera Energismart, (Electronic 2014-09-02): <http://www.renoveraenergismart.se/wp-content/uploads/2011/09/Renovera-energismart-sept-2011.pdf>

Swedish Energy Agency (Energimyndigheten). 2012. UP report Buildings in the Energy System, Swedish Energy Agency, ER 2012:10

Swedish Energy Agency (Energimyndigheten). 2013. Programme description for the collaboration programme Research and innovation for energy efficient construction and dwelling 2013-2017”, Swedish Energy Agency, 14 June 2013

Swedish Energy Agency (Energimyndigheten). ER 2013:03. Energistatistik för flerbostadshus 2012. ES 2013:03 Statens energimyndighet ES 2013:03. ENERGY POLICY, vol. 52, pp. 628-638.

Swedish Energy Agency (Energimyndigheten), 2013-11-13 (Electronic): <http://energimyndigheten.se/Foretag/Energieffektivt-byggande/Lokaler-och-flerbostadshus/Bygga-och-renovera/Energideklaration-av-byggnader/>

Swedish Energy Agency (Energimyndigheten), 2013-11-18 (Electronic) <http://www.energimyndigheten.se/sv/Foretag/Energieffektivt-byggande/>.

Swedish Energy Agency (Energimyndigheten). ER 2013:05. Energiindikatorer. Uppföljning av Sveriges energipolitiska mål. ER 2013:05.

Swedish Energy Agency and Swedish National Board of Housing, Building and Planning (Energimyndigheten och Boverket). 2013. Förslag till nationell strategi för energieffektiviserande renovering av byggnader. Rapportnummer: ET2013:24

Swedish Environmental Protection Agency (Naturvårdsverket), 2009. Effekter av investeringsprogrammen LIP och Klimp. Rapport 5991. (Electronic 2014-06-13): <http://www.naturvardsverket.se/Documents/publikationer/978-91-620-6357-3.pdf>

Swedish Environmental Protection Agency (Naturvårdsverket), 2010. Effekter av investeringsprogrammen LIP och Klimp. Redovisning till regeringen april 2010. Rapport 6357.

Swedish Environmental Protection Agency (Naturvårdsverket). 2013. Klimatinvesteringsprogrammen. Klimp 2003–2012. Rapport 6517. (Electronic 2014-06-

---

13): < <http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6517-1.pdf?pid=3826>>

Swedish Environmental Protection Agency (Naturvårdsverket), 2014. Sveriges klimatpolitik, (Electronic 2014-06-12): <<http://www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Uppdelat-efter-omrade/Klimat/Klimatpolitik/>>

Swedish Ministry of the Environment (Miljödepartementet), 2008. Uppdragsbeskrivning Delegationen för hållbara städer, Miljödepartementet 2008-09-05

Swedish Ministry of the Environment (Miljödepartementet), 2011, Dir. 2011:29 Kommittédirektiv. Delegationen för hållbara städer.

Swedish National Board of Housing, Building and Planning (Boverket), 2008. Nyttan med Allmännyttan: Utvecklingen av de allmännyttiga bostadsföretagens roll och ansvar. Stockholm. Boverket internal

Swedish National Board of Housing, Building and Planning (Boverket), 2013. Samhällsplanering, (Electronic): <<http://www.boverket.se/Vagledningar/PBL-kunskapsbanken/Teman/Nationella-mal/Bebyggelse/Bebyggelsutveckling-och-planering/>>

Swedish National Board of Housing's report 2013:32. Analys av de delade incitamenten för energieffektivisering:  
<http://www.boverket.se/globalassets/publikationer/dokument/2013/analys-av-delade-incitament-for-energieffektivisering.pdf>

Swedish National Board of Housing, Building and Planning (Boverket). 2014, p. 3, Låst läge på bostadsmarknaden. Market report, May 2014

Swedish Royal Institute of Technology (KTH), 2012, (Electronic): <http://www.diva-portal.org/smash/get/diva2:555371/FULLTEXT01.pdf>

Swedish Society for Nature Conservation (Naturskyddsföreningen), 2013. Byman, K och Jernelius. S. 2013. Miljöprogram för miljonprogrammet - styrmedel för energieffektiv renovering av flerbostadshus. Stockholm.

Technopolis Group, 2012. Energy-related Building Research in Sweden: A Survey, Technopolis Group, March 2012

Swedish National Government, 2012. The Swedish Innovation Strategy, (Electronic 2014-06-12): <[www.government.se/content/1/c6/20/25/58/ace0cef0.pdf](http://www.government.se/content/1/c6/20/25/58/ace0cef0.pdf)>.

Swedish National Government, Oct 2012, pp 77-78, Government bill 2012/13:30, Research and innovation, Swedish Government October 2012

Swedish National Government. 2013. Förslag till genomförande av energieffektiviseringsdirektivet i Sverige, N2013/2873/E, (Electronic):  
<http://www.regeringen.se/content/1/c6/21/38/38/5728a468.pdf>, 2013-12-17

Technopolis Group. 2012. Energy-related Building Research in Sweden: A Survey, Technopolis Group, March 2012

The Swedish district heating association (Svensk Fjärrvärme), 2009. Fjärrvärme – A real success story, (District heating – a real success story), (Electronic viewed: 2014-06-13):  
[http://www.svenskfjarrvarme.se/Global/Rapporter%20och%20dokument%20INTE%20Fj%C3%A4rrsyn/Ovriga\\_rapporter/Fjarrvarmens\\_historia/Fj%C3%A4rrv%C3%A4rme\\_stor\\_y.pdf](http://www.svenskfjarrvarme.se/Global/Rapporter%20och%20dokument%20INTE%20Fj%C3%A4rrsyn/Ovriga_rapporter/Fjarrvarmens_historia/Fj%C3%A4rrv%C3%A4rme_stor_y.pdf)

The Swedish district heating association (Svensk Fjärrvärme), 2009. Värmeanvändning i flerbostadshus och lokaler, (Heat use in apartment buildings and business premises) Rapport 2009:4

---

The Swedish district heating association (Svensk Fjärrvärme), 2014. Fjärrvärmepriser (Electronic 2014-06-10): <http://www.svenskfjarrvarme.se/statistik--pris/fjarrvarmepriser/>

The Swedish research council Formas, 2012 (eds), Miljonprogrammet – utveckla eller avveckla? Stockholm, T2:2012 pp. 209-220

Tullstedt, L & Douhan, Å. 2013. BUILD UP Skills –Sweden; Roadmap: Building Skills for Energy-efficient Buildings, The Swedish Construction Federation, 14 April 2013

Van der Veen, R. S. 2012. "Local government influence on energy conservation in the existing Dutch social housing stock", MSc Thesis, Utrecht University.

Vetenskapsrådet, 2009. The Lund Declaration, (Electronic 2014-06-12): [http://www.vr.se/download/18.7dac901212646d84fd38000336/1340207548018/Lund\\_Declaration.pdf](http://www.vr.se/download/18.7dac901212646d84fd38000336/1340207548018/Lund_Declaration.pdf).

VINNOVA, 2004, VINNOVA Analys VA 2004:02. Trämanufaktur, det systembrytande innovationssystemet” (Wood manufacturing, the innovation system which breaks system boundaries”)

VINNOVA, 2012. Utveckling av innovationsplattformar för Hållbara attraktiva städer, (Electronic 2014-06-13): < [http://www.vinnova.se/EffektaXML/ImporteradeUtllysningar/2012-03695/Uppdaterad%20utlysningstext%20Utveckling%20av%20innovationsplattformar%20f%c3%b6r%20HAS%20121219\(440708\).pdf](http://www.vinnova.se/EffektaXML/ImporteradeUtllysningar/2012-03695/Uppdaterad%20utlysningstext%20Utveckling%20av%20innovationsplattformar%20f%c3%b6r%20HAS%20121219(440708).pdf)>

VVS Företagen (Swedish Association of Plumbing and HVAC Contractors), 2012. Lönsam energieffektivisering, saga eller verklighet, VVS Företagen, 2012

Warfvinge, C., Dahlgren, B., & Kling, R., 2012. "Passa på att spara energi när husen ändå ska renoveras", Forskningsrådet Formas (eds), Miljonprogrammet – utveckla eller avveckla? Stockholm, pp. 273-286.

WoodCenter North and Luleå University of Technology. 2013. Research and Innovation Agenda “Den elektroniska motorvägen – från bygge till hygge” (“The electronic highway –from construction site to the logging site”)

#### **Other Websites used as sources**

<http://miljobarometern.stockholm.se/sub.asp?mp=MP15&mo=3&dm=4>

<http://www.mistraurbanfutures.org/sv>

<http://www.renoveraenergismart.se/om-kampanjen/> Accessed: 9 May 2014.se/.

<http://www.sbhub.se/file/hallbara-biodrivmedel-borjesson.pdf>

<http://smarthousing.nu/in-english/>

<http://www.swedishsmartgrid.se/>.

<http://www.vgregion.se/sv/Vastra-Gotalandsregionen/startside/Miljo/aktuellt-startside-miljo/Kritik-mot-forslag-om-minskade-mojligheter-for-kommuner-att-driva-energieffektivt-byggande-/>, 2013-11-13







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