CLUE
Climate Neutral Urban Districts in Europe

Practices, Tools and Policies.

European Cities Moving Towards Climate Neutrality

Final Report

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CLUE
Climate Neutral Urban Districts in Europe

INTERREG IVC
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Preface

The reduction of cities' negative climate impact is a central task towards a sustainable world of nine or ten billion people in 2050. Stockholm aims at being a 100% fossil fuel free city by 2050 and similar goals can be found across Europe. New urban districts, like the Stockholm Royal Seaport, are being planned to be in the technological forefront and to be showcases for sustainable urban development with an emphasis on climate mitigation and climate neutral development. These forerunner districts help to show the way towards urban development that does not negatively affect the global climate anymore.

This report, after two years of work by the twelve CLUE (Climate Neutral Urban Districts in Europe) project partners, delivers many well recognised examples of climate mitigation from cities and regions in the forefront of this work across Europe. Compared to many other mitigation oriented reports, the CLUE project shows that working with climate neutrality requires cooperation across department borders in a city, also involving external stakeholders to capitalise on experts' knowledge. This is a very complex task as technological solutions must respect social needs; environmental improvement must meet economic feasibility. Striving for climate neutrality is a task that needs long term system synergies, commitment, large but necessary investments and a strong political will!

Thus, an increased capacity of holistic thinking and finding the right business models are essential for developing the climate neutral city. Dedicated work on climate neutral urban districts, for example as Stockholm works with eco-profile areas, is one of the possible and recommendable ways to support cities policy making in this field as it creates new know-how and viable solutions.

With this report, the CLUE project aims to deliver support to local and regional policy makers in their work on climate neutrality. The project's experience is that it is possible to realise the cities' necessary transition towards climate neutrality. Everyone is invited to do their best to make this European wide change possible.

Anette Scheibe Lorentzi
Director of the City Planning Administration in Stockholm

Key messages

The climate neutral city of the 21st century is about innovative solutions and the institutional structure which is necessary to generate technological and social transformation. The climate neutral city has to ensure legitimacy, political leadership, long-term commitment to climate change and a stable socio-economic foundation.

Climate neutrality is an ambitious goal

Climate neutrality is a newly emerged and still evolving concept. Cities have begun to strive for climate neutrality and are developing ambitious strategies that aim to reduce greenhouse gas (GHG) emissions as much as possible, while developing mechanisms to offset the remaining unavoidable emissions. Thereby cities aim to reach net zero GHG emissions.

The climate neutrality of cities is inherently connected with sustainable urban development. Striving for climate neutrality provides cities with the opportunity to also address other environmental, economic and societal challenges with integrated strategies and measures.

Choosing the right climate mitigation policies is dependent on local conditions and differs from city to city. Cities know their local situation best and are most suitable for developing tailor-made solutions that fit their local specifications. There is no one-size-fits-all solution. Moreover, local actions allow for the creation of synergies and take advantage of local opportunities as many measures that promote climate neutrality also enhance other goals of sustainable development. Cities need to take a lead as long as international and national frameworks do not set climate neutrality as the overall goal.

Striving for climate neutral urban development becomes transparent when adequate GHG accounting and management systems are in place. The definition of emission boundaries regarding a city´s geographical, temporal, activity and lifestyle distribution allows for the evaluation of progress and results. Cities have to consider their own mandate(s) and responsibilities – i.e. they should start with appropriate and realistic measures and scopes.

CLUEs – test beds for new necessary holistic solutions

Climate neutral urban districts (CLUEs) are spaces for demonstrating sustainable urban development. They create room for experimenting and learning about innovative solutions in addition to sustainable structures and functions. As such, they illustrate more resilient urban environments within Europe's cities in the future.

CLUEs function as test beds and give important guidance regarding the transition process of entire cities on their paths towards climate neutrality. Results and lessons learnt from locally implemented CLUEs can, and must, go beyond their district and reach the level of the city in order to improve the regular planning agenda.

Forerunners in climate mitigation have realized that their leading role in urban development has many co-benefits. Such city districts have become highly visible and have served to communicate progress and excellence across Europe. Thus, they have served as inspiration to other cities.

Roadmaps as a tool to define a broad set of essential policies towards CLUEs

The CLUE project opts for a strategic approach towards climate neutrality where cities and regions should approach climate mitigation measures according to a roadmap. The roadmap to the climate neutral city is a local answer to the global challenge of mitigating climate change. It adopts European strategies and targets and applies them at the local level and thus contributes to realising European targets of climate mitigation.
The roadmap as an integrative approach for climate mitigation accommodates many different measures and instruments, constant learning, follow-up and continuous improvement. A roadmap offers flexible guidance as cities approach their long-term goal of climate neutrality.

How this guide works

This guide provides practical orientation and guidance on how to promote the development and implementation of highly ambitious concepts of climate mitigation within the urban environment, namely climate neutral urban districts (CLUEs). It brings together some of the major results of the INTERREG IVC project "CLUE – Climate Neutral Urban Districts in Europe". In a three-year partnership, nine partner cities and regions and three universities, from nine European Member States, discussed climate neutral urban districts as test beds for a more sustainable future of our cities.

This document only contains one part of the results of the CLUE project. While this document gathers the findings from the work of the partner cities and regions involved, a second report summarises the outcomes of the participating academic partners. Based on their different perspectives, both reports cover different aspects of the very new and still evolving topic of climate neutral urban development, delivering a broad but not yet comprehensive picture.

The findings presented in this guide draw upon the analysis of various good practices identified by the project partners within the CLUE partner cities and regions. All selected good practices are considered to contribute to the successful planning and implementation of climate neutral urban districts. They comprise innovative technological solutions as well as planning approaches, processes and instruments. The project partners' work with the identified good practices resulted in the formulation of two sets of policy recommendations: one for each of the five thematic fields addressed in the project and a second set of overall, more general recommendations. The guide and its policy recommendations are aimed at key shapers of policy and practice within local governments and administrations of European cities.

This document is structured as follows:

Chapter 1 provides a short introduction to the field of action and to the specific challenges cities and regions face when working towards climate change mitigation. Moreover, it introduces the goals and content of the CLUE project.

In Chapter 2 the relevant European policy framework is introduced as it provides the framework within which European cities operate.

Chapter 3 considers the role and opportunities for cities in mitigating climate change. It introduces the concept of climate neutrality and discusses the need to define system boundaries for emissions accounting. The concept of a roadmap to guide local action towards the goal of climate neutrality is discussed from a more theoretical perspective. Finally, some of the findings of the CLUE university partners regarding the role of evaluation, benchmarking and scenario methods are briefly summarised.

Chapter 4 then presents the major findings of the five thematic work groups of the project. It discusses each fields' contribution to climate neutrality, delivers main findings from the cross-analysis of the good practices of the respective work group and presents policy recommendations specific to the work group topic.

Chapter 5 presents the overall policy recommendations for promoting CLUEs on a more general level. They can be understood as the synthesis of the overall work within the project. The chapter closes with a brief outlook on the path ahead.

1 Introduction

1.1 Cities facing the challenge of climate change mitigation

There is a strong scientific consensus that greenhouse gas (GHG) accumulations due to human activities are causing global warming with potentially catastrophic consequences (IPCC 2013). Climate change is not "a problem" waiting for "a solution." It is a highly complex phenomenon with various environmental, cultural and political implications which are re-shaping our way of thinking and acting. It must be seen as one of the most serious set of political and societal challenges ever faced by human society. International agreements and European climate policies have formulated the goal of limiting the global temperature rise to 2°C by cutting GHG emissions by 80 per cent below 1990 levels until the year 2050. Whether or not this goal is at all achievable strongly depends on the climate mitigation efforts made in cities as they make up 80 per cent of the global GHG emissions. In other words, cities are both key contributors to climate change and essential players in combating it.

The rethinking and reshaping of policy making and action includes the adoption of strong precautionary principles to frame climate change policies by today's generation in order to minimise the risks of potentially disastrous climate change impacts for future generations. Avoiding severe climate change requires setting an ambitious agenda for climate mitigation and socially resilient actions. This requires that, in a future with the majority of our planet's population living in urban areas, decision-makers in cities have to understand and play their role as crucial forerunners, especially as long as international institutions and states fail to set ambitious binding targets.

Figure 1: The CLUE partners

1.2 Goals and content of the CLUE project

Climate Neutral Urban Districts in Europe, or CLUEs, are about transforming city development and reshaping urban policies in order to mitigate GHG emissions and to alter the urban fabric, thereby promoting a sustainable city environment for future generations. The idea of climate mitigation in cities, to reduce or altogether remove the city's negative impacts on the global climate, is evident in several cities in Europe and beyond. However, the question posed in the CLUE project is how to best approach the specific concept of the climate neutral urban district.

A climate neutral urban district is a city area where the use of innovative techniques and solutions have been implemented to remove the city's carbon footprint. Many European cities aim to become 100% free of fossil fuels, to avoid unsustainable GHG emissions or to become energy smart by 2050 or earlier. Similar approaches can be found across Europe. New or renewed urban districts like the Stockholm Royal Seaport and Wilhelmsburg in Hamburg (part of International Building Exhibition Hamburg) are being planned to achieve such goals. The CLUE project

gathers several cities and regions (see figure 1) with city district examples as Vienna's Aspern+ and the Vallbona district in Barcelona in an effort to try to identify good techniques and approaches to ambitious climate mitigation efforts in urban development.

The formal objective of the CLUE project is to increase the local and regional capacity in policy development for climate neutral urban districts. More precisely, CLUE looks at how cities and city regions can implement and assess new policy measures and methodologies promoting low carbon urban development. The consortium brings together local and regional authorities as well as universities from 9 European countries who work together in eight thematic work groups (see figure 2). The project results, among others, highlight good practices and policy recommendations for the integration of climate mitigation in the urban development process. Furthermore, the CLUE good practices are also part of the INTERREG IVC good practice database.

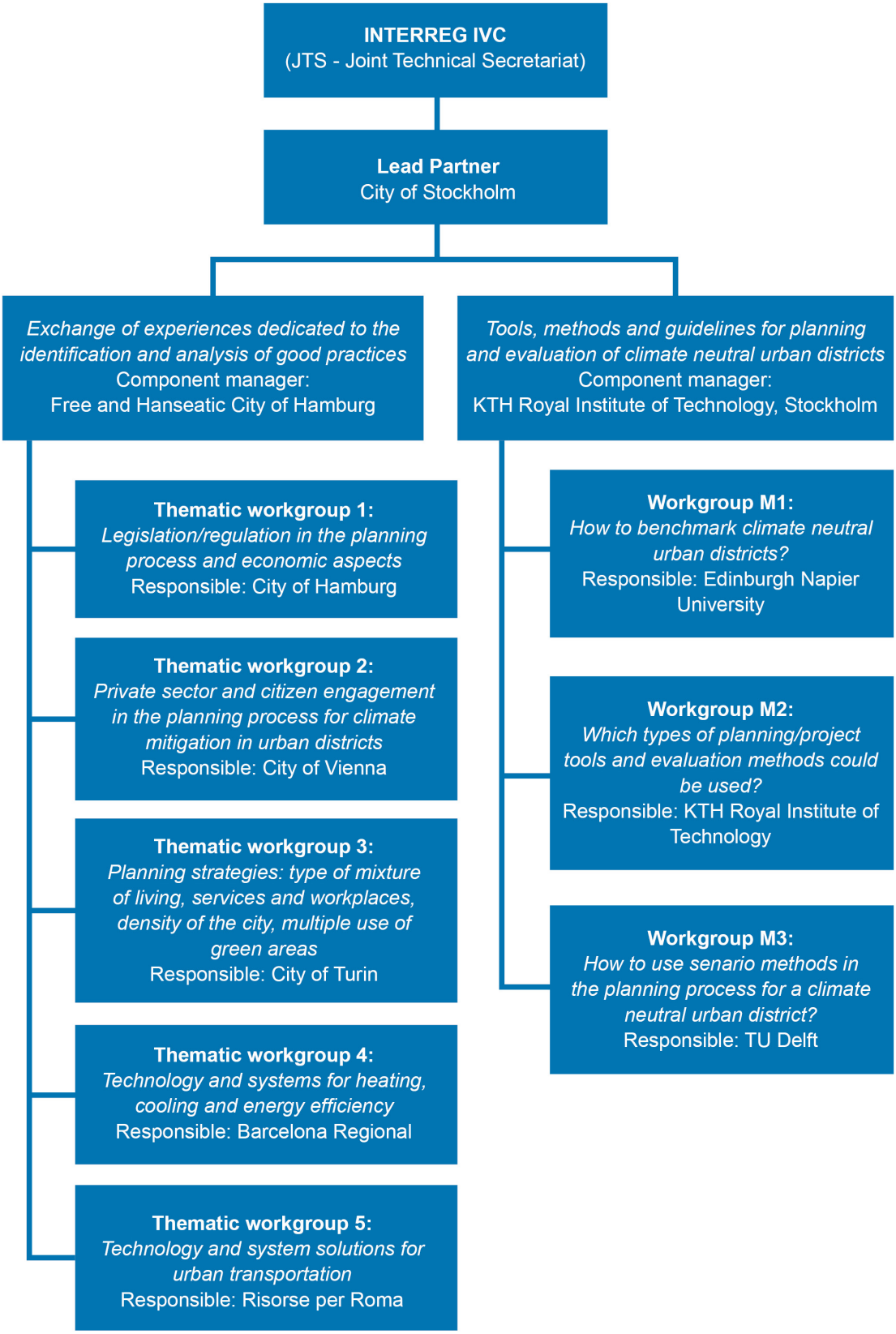


Figure 2: Thematic work groups of the CLUE project

”Climate change is not a problem waiting for a solution. It is a highly complex phenomenon with various environmental, cultural and political implications which are re-shaping our way of thinking and acting.”

Mike Hulme, Cambridge

2 European policy framework

In the European Union (EU) there are several policies in place which set the framework for the development of CLUEs, namely in the fields of renewable energy generation, energy efficiency and the reduction of GHG emissions. The EU's climate and energy legislation package includes legally binding targets on renewable energy production and CO_2 emissions reductions to be achieved by the year 2020. The package, defining the "20-20-20" targets, has three key objectives:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels,
- Raising the share of EU energy consumption produced from renewable resources to 20%,
- A 20% improvement in the EU's energy efficiency.

Within the field of reducing GHG emissions, the EU's Emission Trading System (ETS) is seen as a key tool for cutting industrial GHG emissions most cost-effectively. A recent revision of ETS of 2013 is also the start of the third trading period. Major changes include the introduction of a single EU-wide cap on emission allowances instead of the existing system of multiple national caps. The cap will be cut each year so that by 2020 emissions will be 21% below the 2005 level. The free allocation of allowances will be progressively replaced by auctioning, starting with the power sector. The sectors and gases covered by the system will be slightly widened.

The climate mitigation work of the EU is covered by the so-called Effort Sharing Decision. Member States have taken on binding annual targets for reducing their GHG emissions from the sectors not covered by the EU ETS, such as housing, agriculture, waste and transport (excluding aviation). Around 60% of the EU's total emissions come from sectors outside the EU ETS. And many of these sectors (such as housing and waste) are directly influenced or even regulated by local or regional authorities. The national targets cover the period 2013-2020 and are differentiated according to the Member States' relative wealth. They range from a 20% emissions reduction (compared to 2005) by the richest Member States to a 20% increase by the least wealthy. Member States must report on their emissions annually under the EU monitoring mechanism.

Renewable sources of energy shall replace fossil fuels. This not only reduces GHG emissions from energy generation and consumption but also the dependence on fossil fuel imports (in particular oil and gas). The goal for 2020 is to reach a 20% share of energy produced from renewable sources in the overall energy mix. EU policies focus on efforts regarding electricity, heating and cooling sectors and on biofuels. Local and regional authorities are required to ensure the technical systems needed for the distribution of renewable energy for electricity and heating and cooling are installed when districts are planned or (re-) developed. In transport, where the fuel consumption is basically completely dependent on oil, the goal is to reach a share of 10% biofuels by 2020. Important policy examples are the EU's Renewable Energy Roadmap, the Biomass Action Plan and the EU strategy for Biofuels.

The Energy Efficiency Directive, agreed on in October 2012, includes the objective to reduce energy consumption by 20% by 2020. It does not introduce binding targets at the national level but "binding measures" such as an obligation to renovate public buildings and other initiatives. One key measure, among others, is that EU countries are requested to outline a roadmap to make the entire building sector more energy efficient by 2050 (commercial, public and private households included).

A fourth element of the EU's climate and energy package is the directive creating a legal framework for the environmentally safe use of carbon capture and storage technologies (CCS). CCS involves capturing the carbon dioxide emitted by industrial processes and storing it in underground geological formations where it does not contribute to global warming. The directive covers all CO_2 storage in geological formations in the EU and defines requirements which apply to the entire lifetime of storage sites.

Long-term EU policies targeting 2030 and 2050

An integrated policy framework for the period up to 2030 is currently produced to ensure a coordinated approach among Member States and to establish regulatory certainty for enterprises in Europe. The new framework presented by the European Commission in January 2014 seeks to drive continued progress towards a low-carbon economy. It aims to build a competitive and secure energy system that ensures affordable energy for all consumers, increases the security of the EU's

energy supplies, reduces the dependence on energy imports and creates new opportunities for growth and jobs. The new framework will be decided on in October 2014.

The European Commission is also working with the Roadmap 2050. The target here is to move towards a competitive low-carbon economy in 2050. This means to look beyond short-term objectives and set up a cost-effective pathway for achieving much more extensive emission cuts by the middle of the century. Cost-efficiency is a key word in combination with making the European economy more climate-friendly and less energy-consuming. By 2050, the EU could cut most of its greenhouse gas emissions (see figure 3).

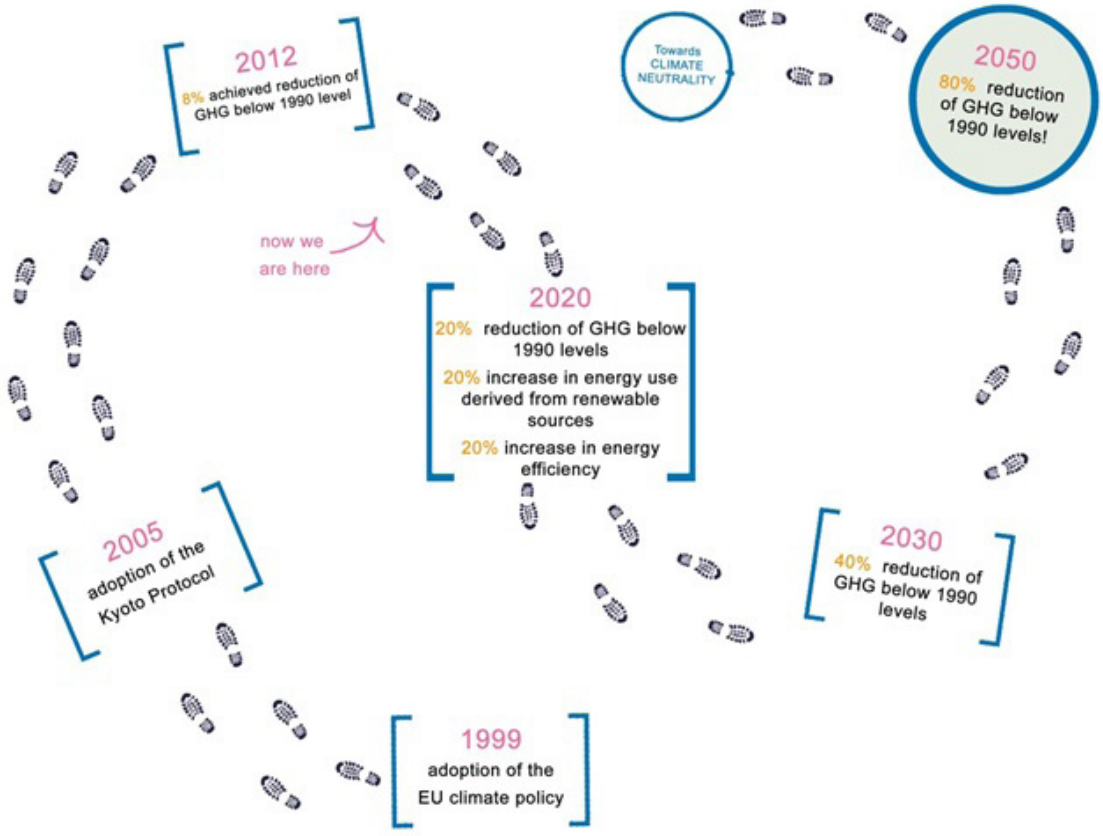


Figure 3: EU climate mitigation targets

Cities play a vital role in reaching European climate mitigation goals.

3 The CLUE roadmap: practices, tools and policies for climate neutrality

The CLUE project's core issue is to work towards Climate Neutral Urban Districts. The concept of climate neutral districts is a young field of discourse and a new planning approach facing many challenges. However, the CLUE project has shown that the work on climate neutral urban districts can make a valuable contribution to the necessary transition towards low carbon or even carbon neutral societies.

One of the guiding ideas of the CLUE project is that climate neutral urban districts function as test beds for new integrated solutions which lead to a considerably lower carbon footprint or potentially even to climate neutral development. The examined districts are both new development areas and redeveloped areas within existing structures. However, it is clear that the biggest challenge of transforming cities into climate neutral areas is the conversion of the existing urban fabric – yet this has not been the main focus of the CLUE project.

3.1 Local policies and initiatives for climate neutral cities

Worldwide, cities take a leading role in mitigating climate change. Cities are the major emitters of global GHG and thus are the major drivers of climate change. However, as growing and evolving spaces of human interaction cities also bear the potential for major cuts in emissions and the creation of technological, organisational and behavioural innovation and cultural change. While the international commitment of national governments fails to set binding goals which are sufficient to keep global warming below 2°C, cities have been developing local climate mitigation programmes and defining ambitious goals to reduce their carbon emissions. As they are responsible for many processes that affect GHG emissions, cities are experienced in addressing sustainable development and can take advantage of the opportunity to develop and try out innovative solutions in cooperation with citizens, businesses and organisations. In other words, cities play a crucial role in solving the problem of climate change. Furthermore, taking action in climate mitigation on the local level provides the chance to exploit the various co-benefits of these measures such as

improving the health of urban citizens through better air quality and more cycling and walking or creating local jobs and growth in "green" industries. Therefore, mitigating climate change is not only a responsibility but also an opportunity for cities and (city) regions.

Cities have the ability and democratic mandate to intervene in many processes that are sources of local GHG emissions. Notably, the fields of urban planning, urban transportation and energy consumption of buildings are highly important for the production and thus reduction of GHG emissions. Cities have the instruments which can greatly influence these fields of action. They are one of the key actors influencing the urban fabric and the every-day life of citizens. Furthermore, the localized production of energy by renewable sources and the distribution of renewable energy within the city play an important role in decarbonizing the energy production and consumption of our society. However, there is no one-size-fits-all solution or approach. Measures have to be locally specific and fit geological, meteorological, infrastructural, cultural and organisational conditions. These tailor-made solutions can be best developed and implemented by cities. Therefore, local policies play an important role in promoting the transition to climate neutrality.

Cities are in very different starting positions concerning climate change mitigation and the development of low carbon or climate neutral solutions. The EU has emerged as a leading governing body regulating and guiding the governance of climate change mitigation (see chapter 2). The transformation that has occurred in its policies and institutions has profoundly affected climate change politics at the international level, and within its Member States and European cities. However, Europe comprises many levels of government and governance. Political leadership and policy choices are highly diverse. This means that cities are confronted with very complex challenges associated with climate policy making – this has also been clearly shown in the CLUE project.

The ambitions in regard to mitigating climate change vary among European cities. In some cities mitigation is hardly discussed, other cities only look for business-as-usual solutions within their sphere of influence, while some cities are very ambitious and strive for the transition of systems and structures to a more sustainable state. The last mentioned cities are often organised in networks such as the Covenant of Mayors, ICLEI, C 40, Clinton Climate Initiative, World Mayor Council of climate change,

etc. These cities are determined to considerably reduce their climate impact. However, it is not evident if these cities can also become or really have the political determination to strive for climate neutrality in the near future. There are crucial framework conditions beyond the influence of the local level. This means that reaching climate neutrality in a broader context, not only on the level of single projects or (re-)developments, is only possible in the long run as today's circumstances and framework conditions do not promote and support climate neutrality.

Developing policy recommendations to promote the transition to climate neutrality

The CLUE project partners developed policy recommendations to promote the transition process to climate neutrality in European cities. A policy comprises a course or principle of action which is adopted or proposed by an organization or an individual to guide decisions and activities. It contains the selection of goals as a statement of intent and the definition of means to reach these goals. Policies are usually the result of a dynamic process of policy making which involves a series of decisions that cumulatively result in a specific outcome. The implementation of policies often results in establishing new procedures or protocols. In general, policies can be adopted by public and private actors i.e. governments of different levels, businesses, private organisations, etc. However, as mentioned above, local policies adopted by municipal governments are especially crucial for climate neutrality. Thus, these policies are focused by the CLUE work and the developed policy recommendations outlined in chapters 4 and 5.

Public policies are the result of democratically legitimized decisions of local governments. They are created in complex processes of policy formulation and decision making which involves various actors on political, administrational and societal levels. To simplify and illustrate these processes, the policy cycle was developed (see figure 4). It suggests a sequence of stages that structure the policy making process.

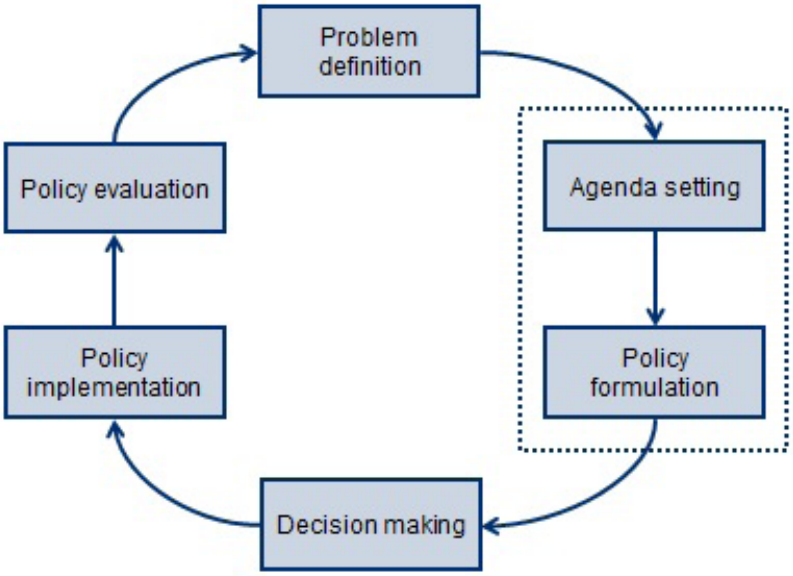


Figure 4: The policy cycle indicating the focus of the CLUE policy recommendations

As one result of the work within the CLUE project, the partner cities and regions developed policy recommendations for promoting the transition process to climate neutral urban districts and cities (see figure 5). These recommendations are targeted at policy makers at the local and regional level of cities and (city) regions. The CLUE project partners developed a process of good practice selection and analysis, outlined below

Two sets of recommendations were developed within the following process: Firstly, the project partner cities and regions selected good practices in the five thematic work groups:

- Legislation and regulation
- Private sector and citizen engagement
- Planning strategies
- Technologies for heating, cooling and energy efficiency
- Urban transportation

The good practices comprised processes, projects and policies already implemented or planned in the CLUE partner cities and regions. The CLUE partner cities and regions developed specific criteria to identify and select good practices in each thematic work group. All selected good practices (25 overall) are considered most relevant for the transition process to climate neutrality and are tried and proven in practice. These good practices were identified and then analysed in regard to their

planning and implementation processes and barriers, effects, outcomes, needed actors and resources. Based on this, the work groups derived policy recommendations for their specific field of action. These recommendations are outlined in chapter 4.

In the following step, a second set of recommendations were developed on a more general level. These overall policy recommendations address more general aspects of developing climate neutral urban districts and cities. They constitute a general approach to climate neutrality and lay the groundwork for promoting the transition process by local policies and local actors (as shown in figure 4). Thus, they focus on the first steps of the policy cycle of problem definition, agenda setting and policy formulation. The overall policy recommendations are outlined in chapter 5.1.

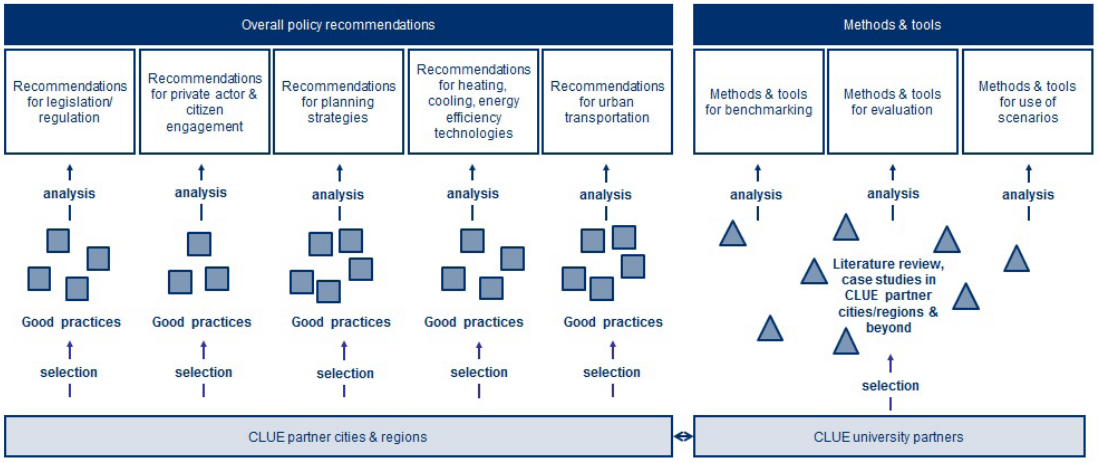


Figure 5: The development process of CLUE policy recommendations

3.2 The concept of climate neutrality

There is no shared understanding of the concept of climate neutrality. It is still quite new and emerging and not yet widely used by cities around the world. In general, climate neutrality implies avoiding global climate change through the elimination of carbon emissions from anthropogenic activities. Thus, in the context of urban development it focuses on the role of in mitigating global climate change. Within the CLUE project the following definition as specified by the United Nations has been applied:

"Mitigation and adaptation are two sides of an urban strategy for climate neutrality. Such a strategy suggests that:

- Cities aim to achieve net zero emissions of GHG by reducing such emissions as much as possible and developing mechanisms to offset the remaining unavoidable emissions;

- and cities aim to become climate-proof, or resilient to the negative impacts of the changing climate, by improving their adaptive capacities." (UN Economic Commission for Europe 2011 p. 14)

This is a rather vague but also very open concept which allows for a broad perspective on climate neutral cities. It allows a holistic view on (urban) development which involves climate mitigation and adaptation but also other environmental, economic and social challenges. Thus, it allows the connection of climate neutrality to the concept of sustainable development which is the broader framework under which the climate neutral city is situated. While the concept of climate neutrality also addresses climate adaptation as a means to accommodate the impacts of climate change, the CLUE project focuses on the climate change mitigation aspects of the concept.

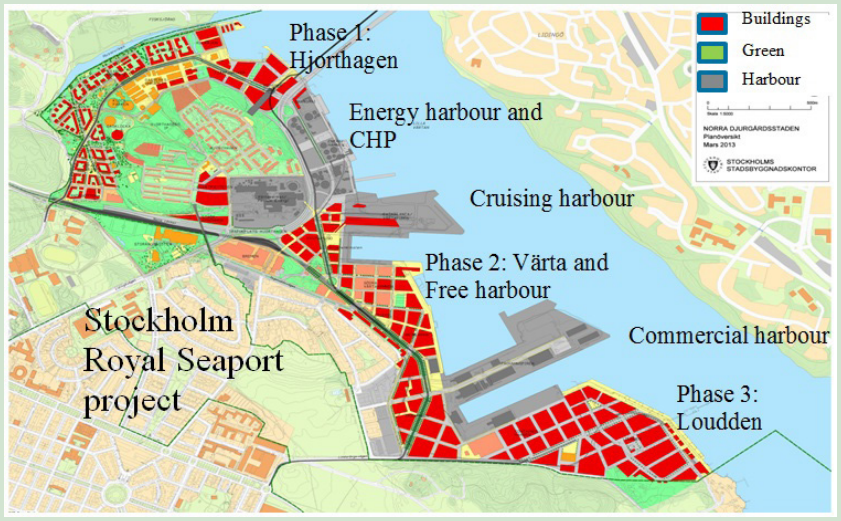
To function as a goal for the future development of cities the rather vague concept of climate neutrality needs to be operationalised, i.e. objectives that can be adapted for evaluation have to be specified. Therefore, system borders in regard to timeframes, activities, sectors and geographical areas of local emissions have to be defined. Furthermore, restrictions on offsetting (unavoidable) local emissions have to be set in order to make sure that overall emission reductions are not hampered by externalizing emission sources.

Urban districts in the form of CLUEs can be used as test beds and role models in this regard. On the one hand, new ideas and technologies can be introduced and tried out in a smaller, more controlled way. This allows for gaining practical experience and valuable insight for developing further measures and strategies. On the other hand, realised climate neutral urban districts can function as role models for the future transition of the whole city towards the climate neutral city. It demonstrates the otherwise abstract concept of climate neutrality and raises awareness among citizens, politicians, public administrations and enterprises.

City district Stockholm Royal Seaport – striving for climate neutrality

Currently, the Stockholm Royal Seaport (SRS, in Swedish Norra Djurgårdsstaden) is an exemplary state-of-the-art project which is part ofthe City of Stockholm's drive to promote sustainable urban development. The project spearheads, above all, climate neutrality on district level. Moreover, the project addresses a broad spectrum of aspects within urban sustainability. The project covers approximately 260 ha, making it one of the largest urban development projects in Europe. Stockholm has the ambition to create an urban district that can function as a role model for other growing cities, particularly with regard to climate mitigation and resilient urban structures.
The area of SRS will be transformed from an industrial area and harbour zone into a climate neutral urban district with 12,000 new dwellings and 30,000 work places, including social and commercial services and infrastructure upgrades. The project builds on the previous experience of the eco-district of Hammarby Sjöstad. The City has developed an ambitious eco-profile concept, advocating smart design and green technology which makes it easy to live and work in a sustainable way in the area.

The SRS area will be an integral part of central Stockholm e.g. characterized by a high level of connectivity and state-of-the-art mobility systems. The surrounding green spaces and waterfront location offers great potential for an attractive urban environment. The figure below illustrates the extent and structure of the area, comprising three main sub-areas and development phases. Hjorthagen in the north is almost completed, and the first housing blocks entered into use in autumn 2012. The second and third phases will be completed by 2020. All in all, the district will offer a mixed use environment of high density with the integration of cultural facilities, new housing and office developments as well as featuring a modernized harbour.



Source: City of Stockholm

SRS is a test ground for green tech solution and processes. A first calculation of the effects from the requirements placed on developers in regard to energy efficiency and local energy production indicates a 50% reduction of CO2-emissions. At the end of the project the goal is to be CO2-neutral or even positive, according to the Clinton Climate Initiative framework. The SRS, as one of 18 selected worldwide projects of the Climate Positive Development Program, seeks to improve the energy performance of buildings, enhance the availability and use of public transport and improve the efficiency of urban resource cycles. Combined with sustainable life styles the ambition is to arrive at a "climate positive district". For the SRS, this means that the emissions from the district should be as close to zero as possible and with the inclusion of offsets (credits allowed in the framework) the emissions would be negative.

However, the creation of this "world-class environmental district" requires continuous dedication to implement the ambitious goals and being open to new innovative thinking. From the Stockholm experience, this requires close collaboration between public, private and academic institutions, as well as a clear vision and goals.

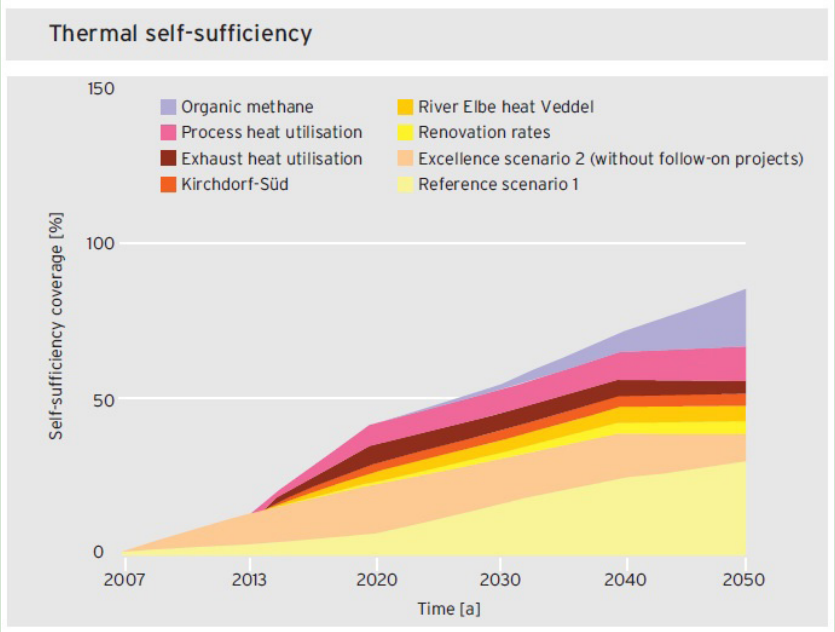
For more information visit: http://bygg.stockholm.se/Alla-projekt/norra-djurgardsstaden/In-English/Stockholm-Royal-Seaport/

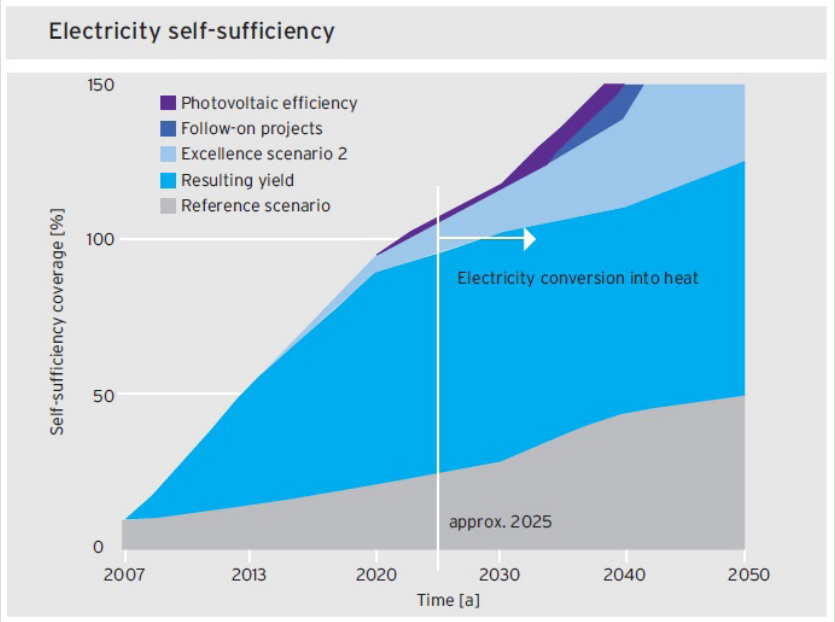
City district Wilhelmsburg, Hamburg – converting a district to climate neutrality

The climate protection concept “Renewable Wilhelmsburg” illustrates how an existing urban district can be converted to climate neutrality by 2050. Concept development and the implementation of the first measures were part of the International Building Exhibition (IBA) Hamburg from 2007 to 2013. The district of Wilhelmsburg is characterized by a diverse mix of uses from residential areas, to industrial and harbour areas, as well as major traffic arteries and large green spaces. Wilhelmsburg is Hamburg’s biggest district in terms of surface area, with a size of 35km² and 55,000 inhabitants.

The concept “Renewable Wilhelmsburg” establishes a strategic approach to make the district of Wilhelmsburg climate neutral by 2050, i.e. the reduction of CO2 emissions by 95% compared to 2007 levels. It is based on the idea of utilizing the district’s local energy resources to supply renewable energy at the same time as considerably increasing the efficiency of local energy consumption while strengthening local economies.

In order to reach climate neutrality, every opportunity for localized energy production by renewable sources should be exploited. Climate neutrality requires converting the total power supply of the district to renewable sources. Furthermore, the installation of regenerative heating networks allows substantial carbon reductions within a relatively short period of time. More extensive, local neighbourhood heating networks achieve a much more efficient co-generation of heat and power compared to the supply of single buildings. The reduction of energy demand and consumption, on the other hand, is reached by stringent new-building and refurbishment standards, the provision of information and advice for property owners as well as financial incentives to motivate actions of citizens. The local population is involved as full partners in all action programmes derived from the strategy.





Source: IBA Hamburg GmbH

The climate protection concept is based on an extensive survey in the form of scenario analyses. The scenarios compared future energy demand and the potential for savings, increased efficiency, and the use of renewable energy in the various types of urban environment present within the district and explored strategic measures for the optimisation of energy supplies. Different scenarios for the timeframes of 2013, 2020 and 2050 were developed in order to demonstrate the impacts of possible measures. Based on this, strategic instruments, measures and projects were derived and implementation steps were defined.

Local and international experts as well as members of the civic population were involved in the development of the strategy. First projects to realize the climate protection concept have already been realized. Examples are the Energy Bunker and its district heating network and the Energy Hill. The already realized or already scheduled projects will generate a renewable power reduction of 54% and renewable heat production of 14% of the overall demand by 2015. In fact, the results of the study demonstrate that it is possible to supply the district by local renewable energy sources by 2050 even if the population grows from 55,000 to 73,000. A 100% supply by renewable power is possible by 2025 and an 85% supply by renewable heat by 2050.

For more information visit: http://www.iba-hamburg.de/en/projects/climate-concept/projekt/renewable-wilhelmsburg-climate-protection-concept.html

3.3 Defining climate neutral areas

A principal problem when establishing climate neutral areas (cities as a whole or urban districts) is the necessity to find a balanced relationship between political ambition and realistic efforts. This is a question of where to draw the borders of urban climate mitigation, i.e. only including measures within the administrative territory of a city/urban district or going beyond these borders.

Kennedy and Sgouridis (2011) state that "a large number of communities, new developments and regions aim to lower their carbon footprint and aspire to become zero carbon or carbon neutral. Yet there are neither clear definitions for the scope of emissions that such a label would address on an urban scale, nor is there a process for qualifying the carbon reduction claims". One way of tackling this problem is to propose three levels of emission categories. The system of Kennedy and Sgouridis was also used in the CLUE project (see figure 6). The three levels, also called scopes, are:

- Internal emissions based on the geographical boundary of a city/urban district (Scope 1)
- External emissions directly caused by core municipal activities (Scope 2), and
- Internal or external emissions due to non-core activities (Scope 3).

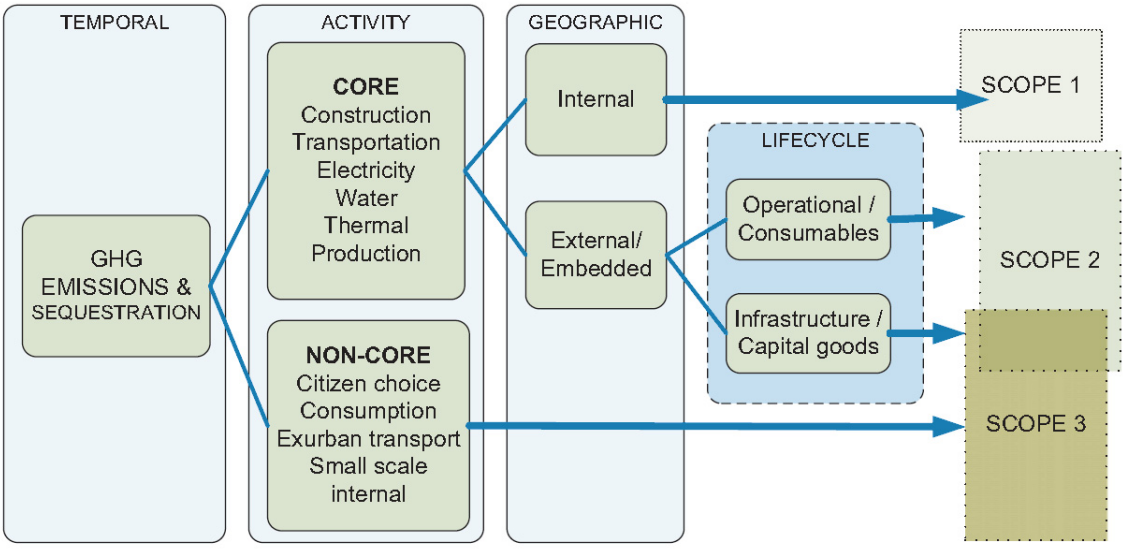


Figure 6: Urban GHG emissions scoping and boundaries (Kennedy & Sgouridis 2011)

Each of these scopes implies its own carbon management strategy (reduce, eliminate, balance and offset) in order to meet a climate neutral status. However, there are many trade-offs and difficulties in implementing these GHG accounting and management systems, which the CLUE project experiences prove. No city so far has achieved a rigorous system of accounting covering scope 2 and 3 emissions and related decision-making. It should be mentioned that no CLUE project city is using such a broad accounting system. Furthermore, all good practices analysed within the CLUE project affect scope 1 emissions. Thus, in theory, this system could work fairly well but it must be broadly tested before becoming part of a cities' decision and policy-making, benchmarking and implementation processes.

The boundary problem is probably one of the most important issues to overcome before a city or urban district can be defined as climate neutral. So far, the usual accounting schemes such as the Greenhouse Gases ISO 14064:2006, ICLEI's Community-Scale GHG Emissions Accounting and Reporting Protocol or the ClearPath tool, the Covenant of Mayors' emissions inventory guidelines or the International Standard for Reporting Greenhouse Gas Emissions for Cities and Regions (by UNEP, UN-HABITAT and the World Bank) only take into account emission sources and processes inside a city and leave GHG emission and CO2 footprints outside a city or an urban district (e.g. long distance travel, imported services, consumption goods, etc.) without significance. In order to strive for climate neutrality it would therefore be necessary to widen the scope and be honest in the accounting system.

The model of Kennedy and Sgouridis has been broadly discussed among the CLUE project partners. Their concept suggests four system boundaries for GHG emissions accounting that go beyond temporal and geographic borders of a city or urban district. These boundaries are:

- The area's geographical boundaries that distinguish "internal" from "external" emissions,
- Temporal boundaries within which emissions are tracked,
- An activity boundary outlining the carbon emitting activities for which a city should be held responsible for and that must be accounted for in the city's carbon balance for a given scope (e.g. CO2-footprints) and

- The Lifecycle boundary, i.e. the degree to which the production and disposal of capital goods required for any activity are included.

Emissions from each urban activity can be mapped accordingly into the suitable scope according to its location inside or outside of each of the four mentioned boundaries. Figure 7 shows a city's metabolism in terms of material, energy and CO2 flows. For deeper understanding it is suggested to read the original article of Kennedy and Sgouridis (2011).
Evidently, a great deal of GHG emissions occur outside a city's or district's boundaries. Thus these are outside a city's mandate and sphere of influence, i.e. cities cannot directly influence "external emissions" except by communication campaigns targeted at citizens and enterprises as well as through mitigation devoted procurement of services and goods that take into account the CO_2 emissions in a life cycle perspective.

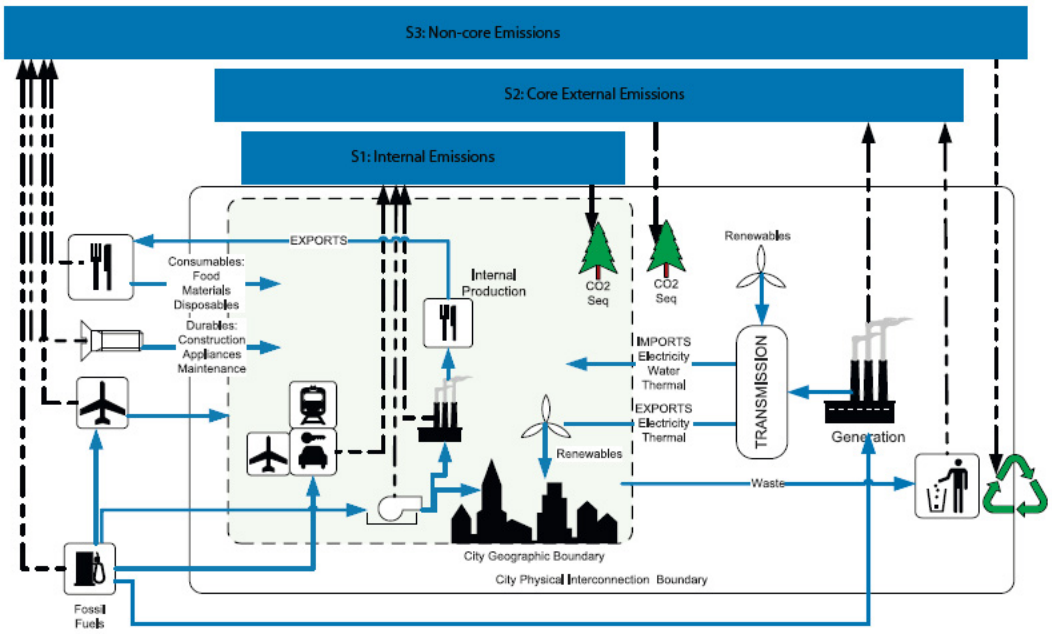


Figure 7: Urban metabolism related to three scopes of emissions (Kennedy & Sgouridis 2011)

Currently, it is practically impossible for a city or urban district to entirely avoid all carbon emissions within scope 1 or 2. This means that no sufficient balancing or offset can be realised inside system borders. However, for reaching a workable approach to climate neutrality, it is possible to suggest an offset trade comprising an emission gradient from little to comprehensive. Such a method is therefore crucial for the discussion of climate neutrality in practice.

In the definition used by the UK Sustainable Development Commission the limitation on offsets are discussed as follows: "one that causes no net accumulation of CO_2 emissions to the atmosphere. Therefore carbon neutrality allows emissions to be netted off in some other location, a process which is called 'offsetting'. However the Commission would caution against a carbon neutrality policy which is focused solely on carbon offsetting. As the aim should be to reduce overall emissions over time, simply offsetting emissions without a carbon management strategy in place is at best misconceived, and at worst counter-productive." This means that cities have to work on their own mitigation strategies first of all and take the off-set possibilities as a way to balance their own emissions – and this should not be only for statistical and conceptual reasons of reaching climate neutrality.

In the CLUE project, discussions and conclusions found that climate neutral urban development approaches can have positive effects for establishing sustainable urban forms. This is also mentioned in the UNECE report from 2011 which connects climate neutrality to a more holistic view of development: "While climate neutrality is a strategy to be 'climate-smart', it is also a means to address other environmental, economic and social challenges." This is a central aspect and tends to reinforce the fundamental message that climate neutrality in cities or urban districts must be connected to the issues of sustainable urban development. This implies securing participation from a wide range of different stakeholders, avoiding sub-optimisation and creating synergies as well as multifunctional solutions. Dedicated urban mitigation action is a must in order to reach climate neutrality from a long-term perspective. Roadmaps can be of great help when structuring such broad efforts.

3.4 Roadmap to climate neutral urban districts and cities

Pursuing climate neutrality requires fundamental changes of and in our cities. It is not only a matter of implementing technological solutions to reduce the carbon intensity of our energy consumption. Rather, changes in individual behaviour and consumption, the way we move and the buildings we live in are two examples of what is needed in order to create the transformations, which in sum will lead to climate neutrality. Furthermore, social, economic and wider ecological implications have to be considered. Therefore, a holistic, long-term oriented

approach is needed which supports learning, the creation of synergies and the adaptation to changing circumstances while allowing for local characteristics, framework conditions and starting situations of different cities. Thus, integrating flexibility into a goal-oriented process of consequent action development and implementation is the key for a successful transition to climate neutrality.

Different cities – different paths to climate neutrality

The approach of using the concept of a roadmap aims to lay out a guiding procedure for European cities to work towards climate neutrality. However, different types of cities must find their own ways to turn climate mitigation efforts into a success for citizens, institutions and businesses. When aiming at climate neutrality local policy makers have to deal with various highly complex challenges in terms of the urban fabric, planning laws and regulations, institutional capacities, opportunities for participation and co-generation, land ownership and financial potential. Thus, each city should draw up its own roadmap that has to accommodate its particular starting points, framework conditions, local characteristics and pathways. There is no single path, and cannot be, to reach the climate neutral city. In fact, the concept of climate neutrality is used to guide (urban development) processes towards the desired goal of the climate neutral city.

The necessary considerations and prerequisites are diverse – as are the paths to reach climate neutrality. The cases analysed in the CLUE project show that, on the one hand, being ambitious and a forerunner in climate mitigation needs a lot of time, money and engagement, and on the other hand, it also generates new knowledge, positive publicity and leads to substantial improvements in the urban fabric. However, it also demonstrates that the possibilities to pursue climate neutrality on the local level are limited by missing or hampering framework conditions as cities are always dependent on global resources, energy flows and emission compensating ecosystem services.

Guiding short-term action towards the long-term goal of climate neutrality

Roadmaps as a “method” to collect all necessary methodological steps, decisions and measures into a long-term oriented, strategic approach can be found on different levels e.g:

- Global: Clinton Climate Initiative with roadmaps of selected cities towards climate neutral areas/solutions linked to the C40 Cities Climate Leadership Group,
- Europe: EU roadmap towards a competitive low-carbon economy in 2050,
- National: Swedish roadmap towards a fossil free Sweden 2050,
- Local: roadmap for an energy efficient Vienna 2020).

The concept of a "roadmap" as a policy approach has therefore been chosen by the CLUE project partners in order to establish and follow a step-by-step framework and process towards climate neutral urban districts and cities.

A roadmap defines the framework to guide, structure and promote the transition process to climate neutrality on the local level of cities and (city) regions (see figure 8). It gathers basic methods and approaches to climate neutrality that can be derived from the experiences of the CLUE partners and their work in the project. However, there are many other good examples and intelligent solutions all over Europe that can be picked up on – the solutions are there, but they must be used and integrated in a well thought out framework.

The CLUE good practices are planned or proven in practice to be effective in reducing local carbon emissions. Thus, these policies, measures and projects contribute to climate neutral urban districts and cities. However, these are selective and only cover specific aspects of the transition process. To successfully promote the transition to climate neutrality complementary measures and the adaptation to local specifics and framework conditions are necessary.

The roadmap to the climate neutral city is a local answer to the global challenge of mitigating climate change. It adopts European strategies and targets (see chapter 2) and applies them at the local level and thus contributes to realising European targets of climate mitigation. Implementing climate mitigation policies and measures on the local level can thereby create various benefits and synergies within the city such as job generation and growth in "green" industries. Created by pro-active decision-makers, local GHG mitigation strategies which are supported by consequent and far-reaching financial

investments can have profound positive implications for the city's competitiveness and its urban development. A local roadmap to climate neutrality should function as a framework to systematically generate and exploit such synergies and opportunities.

Steps along a flexible roadmap towards climate neutrality
A roadmap has a start and an end point. The start is to make a broad analysis to identify local challenges and fields of action

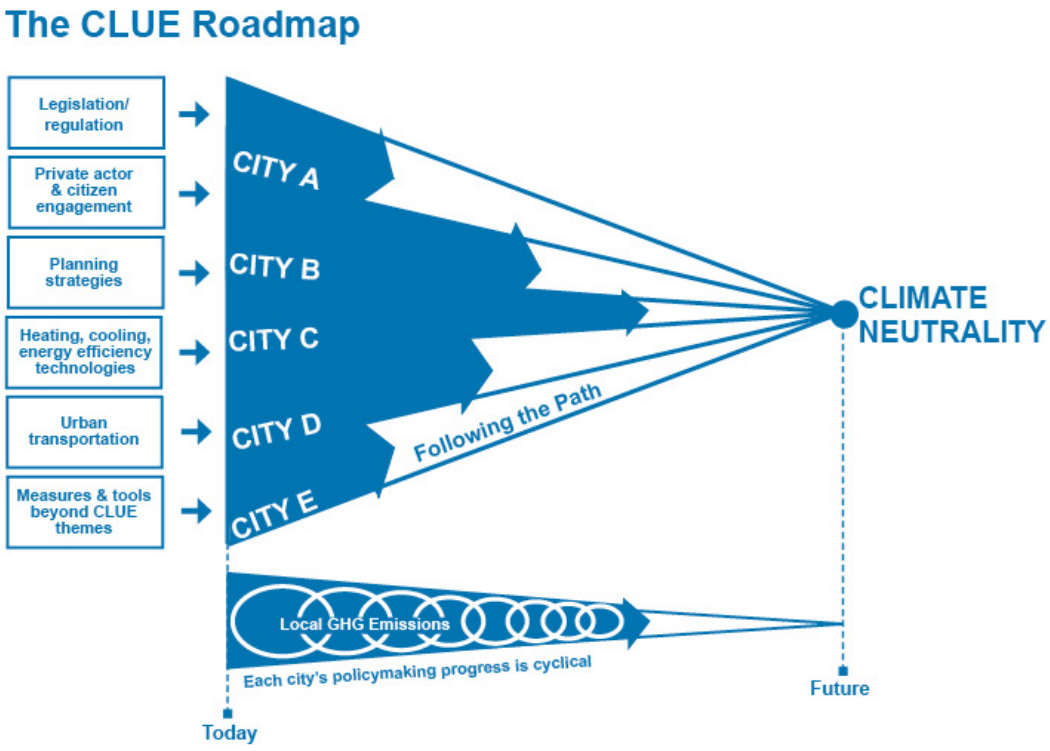


Figure 8: The CLUE roadmap to climate neutrality

which need to be addressed to become climate neutral. The necessary data is collected and a baseline for the following process is created. The roadmap itself contains the measures and tools that are vital for the transformation process towards renewable energy use, energy savings and reduced GHG emissions. It also includes suggestions on where to become active outside the city/urban district in order to balance emissions that cannot be avoided within the city or the district.

Following a roadmap and becoming climate neutral in a city or urban district tackles many aspects in parallel, and these different aspects are highly complex and interlinked with each

other. When following a roadmap approach it is crucial for cities to have a coherent guiding vision and long-term political commitment towards these abstract goals. In the visioning processes, stakeholder participation methods which contribute to awareness raising and behavioural change, scenario work including forecasting and back-casting as well as further future studies methods can be used. Also, an appropriate accounting tool with a suitable indicator and evaluation scheme has to be worked out. Furthermore, the connection to politics, local planning and private investors has to be established. Next to the involvement of the political level, it is necessary to develop a functioning business plan, ensure long-term public financial support, build broad coalitions and to exploit the opportunities of co-creation (new partnership models between citizens, businesses and the public administration) as well as establishing system thinking and life-cycle perspectives. On top of that it is necessary to proceed with a dedicated communication strategy over a very long time.

As a matter of course the roadmap has to be frequently reviewed and adapted to changing circumstances, framework conditions and new knowledge. This allows for the needed openness and flexibility of long-term oriented processes. It is crucial to avoid roadmaps turning into rather rigid and closed "blueprints" which prevent discussions and continuous learning from discussions.

From climate neutral urban districts to climate neutral cities

Climate neutral urban districts can function as stepping stones in the transition process to the climate neutral city. As test beds and role models they try out and illustrate future urban development. However, they are not the end of the process but only a means to reach the overall goal of climate neutrality on the city and societal level. Climate neutrality should not be limited to a low number of districts but spread to within the city thus making the whole of the city climate neutral. For this reason, the roadmap targets the climate neutral city and overall climate neutrality respectively, not at realizing climate neutral urban districts. Furthermore, when it comes to governmental and administrational structures there is no district level. The lowest level of governmental responsibility is usually located at the local level of city councils, i.e. cities are the ones who act when it comes to realizing local climate mitigation goals

and measures. National and international frameworks should actively support local activities. Therefore, the addressee of the roadmap and the policy recommendations outlined in chapters 4 and 5 are cities and (city) regions.

3.5 Evaluation, benchmarking and scenarios for climate neutral urban districts

The CLUE university partners worked with tools and methods for cities to promote the development of climate neutral urban districts and cities. The work focused on benchmarking and evaluation tools and indicators as well as scenario methods. The universities' work also included an analysis of some selected urban districts in the partner cities that strive for climate neutrality such as the Stockholm Royal Seaport, Wilhelmsburg in Hamburg and Vienna's Aspern+. Furthermore, they addressed the topic of how to include social aspects into planning when implementing climate neutral urban districts (see even the final report of the CLUE university partners: Beyond the green showcase - European cities moving towards Climate Neutrality).

The initiatives that have been taken thus far to mitigate the climate impacts of cities differ very much in ambition. Early adopters of the climate change agenda offer critical insights into how "green" and "eco-sensitive" interventions in the built environment can tackle adverse effects of global warming, by saving more energy and reducing more carbon emissions relative to their counterparts. In this respect they set a baseline for further progress. There are now a number of cities throughout Europe who are keen to capitalise on the progress of the early adopters by aiming for climate neutrality. It represents nothing less than a step-change in the type, scope and range of policies adopted to deal with climate change. This shift emerged because green buildings or neighbourhoods (no matter how green or ecologically sensitive they are) are insufficient to move to climate neutrality. Climate neutrality calls for a range of policies that make it possible to transcend the level of green buildings and green neighbourhoods. The urban district as a unit of intervention allows setting up innovative infrastructures and new forms of organising district services. Citizen participation in deciding what changes should be made, is of key importance as the social and technological changes in the urban district are strongly interrelated. Citizen participation in decision making could also facilitate their participation in the operation and maintenance of CLUE systems.

Climate neutrality in urban districts should replicate itself to achieve climate neutrality at the level of cities. District focussed measures that have proven to be successful should be translated into statutory measures as a crucial step to climate neutral cities. This means the innovative cities should no longer focus on voluntary measures at either the building, or neighbourhood scale, but gradually shift to measures being promoted by statutory bodies. This adaptation process in turn calls for structures to support innovations in urban development.

Long-term oriented planning allowing for different scenarios of the future

Planning and realising a successful CLUE does not only require new, clean technologies and technological systems, it also demands new processes to plan and implement them. There are several instruments and innovations that must be combined to pave the way towards climate neutral urban districts and areas. Although a widely accepted accounting and measuring framework for establishing climate neutrality is still absent, no real CLUE exists today. Additionally, measures that cut down GHG emissions today might lead to barriers for progress in the future, because investments in infrastructure can lock development onto a specific development path. Long-term orientation can help prevent such 'lock ins.' However, it requires takinglong-term global societal challenges and impacts into regard.Scenarios are excellent tools for this aim.

Planning CLUEs involves taking into account expertise regarding various future conditions and impacts that could diminish GHG emissions. Scenarios are a good tool, not just for taking future conditions into regard and for evaluating options in the planning procedure, but they can also provide the content for dialogue with citizens and other stakeholders. Such active stakeholder participation can prevent group and wishful thinking in planning, and can create wider support for measures. When it comes to the cities' work, "internal scenarios" can be implemented that are based on a consistent set of agreed upon topics and approaches which focus on the interplay of actors within the city. Internal scenario preparation is not just about getting information, it is also the beginnings of stakeholder interaction within a city's institutions. External scenarios, on the other hand, specifically focus on processes and changes beyond the control of the city.

The CLUE project experience shows that CLUEs can only be sustainable if they are also socially vivid urban areas. Such a characteristic is hard to plan. Citizen participation in planning might contribute to creating lively districts, but there is no guarantee that it does. However, the people and enterprises' acceptance and the "right" use of climate neutral solutions are important preconditions which can help make a CLUE work in every day life.

Benchmarking and evaluating progress on the way to climate neutrality

Various frameworks for measuring climate impact are discussed internationally. The available frameworks still lack uniform and unambiguous definitions. From a city perspective, a widely accepted GHG emission evaluation framework is crucial for evaluating the outcomes of policy measures and to monitor progress towards climate neutrality. Evaluation contributes to learning and improving the goals of a city's mitigation work by quantified feedback loops which canenhance goals and measures. Cities also have to consider not only quantifiable goals, but also other aspects like awareness raising, life style aspects, consumer behaviourwhich help contribute to the functionality of CLUEs. Furthermore, the financial and organisational implications of evaluation structures have to be considered.

One of the important mechanisms to foster progress in mitigation work is to benchmark the achievements of cities. Benchmarking can also boost competition which in turn can foster improved performance. Therefore, an internationally accepted GHG emission framework is crucial for progress towards CLUEs.

GHG emission frameworks will probably never be able to give a complete account of all GHG emissions related to a district. However, imperfect systems tend to reward shifting GHG emissions to sources that are unaccounted for. What is required for measuring the progress and benchmarking of CLUEs, is an internationally standardized framework, with clear indications of its limitations (to create awareness of 'shifting behaviour') and high transparency (to provide indications for improvement). This should allow for open access and exchange of data. Progress is hard to establish. Measures might even be counterproductive, as increased energy efficiency tends to foster energy consumption (e.g. extended use of electric devices

in households). Moreover, these measures might create a blurred picture of reality. The urban district might transfer its ‘CO2 emissions elsewhere’, which can be worse, for instance by inducing additional transport. Therefore, a reliable GHG emissions framework is crucial for establishing progress.

Climate neutral urban districts can function as stepping stones in the transition process to the climate neutral city. As test beds and role models they try out and illustrate the future urban development.

4 Good practices for transition to CLUEs

The CLUE partner cities and regions selected and analysed good practices in five thematic work groups:

- Legislation and regulation,
- Private sector and citizen engagement,
- Planning strategies,
- Technologies for heating, cooling and energy efficiency and
- Urban transportation.

The result of this work is presented in the following sub-chapters 4.1 to 4.5. The chosen thematic foci of the project are very important for developing and implementing climate neutral urban districts. They deliver technical solutions to increase efficiency and reduce the carbon intensity in the energy consumption of buildings and urban transportation systems on a district and city level. Thus, they make an important contribution to decarbonizing the energy production and consumption on the local level. However, climate neutral urban districts require more than just technical solutions. Therefore, three out of the five work groups focus on municipal instruments and processes that support and promote the successful implementation of CLUEs.

Hence, the work of the project partners also focused on delivering strategies and instruments for integrated urban planning on the district level. This is crucial for developing and implementing localized and integrated solutions which fit specific local conditions with regard to building structure, institutional framework and local population, while generating and exploiting synergies and co-benefits of local climate mitigation measures. Moreover, tools and processes for private sector and citizen engagement were identified to enable the involvement of non-municipal actors in the planning and implementation process. These foci are supplemented by policies, strategies and programmes identified in the work group “legislation and regulation” which establish a supporting framework on the city level. Overall, the good practices selected and analysed in the five thematic fields of the CLUE project address important factors which help cities proceed towards climate neutrality on a district and city level. However, they do not deliver universal solutions which can be copied and transferred to different cities and districts.

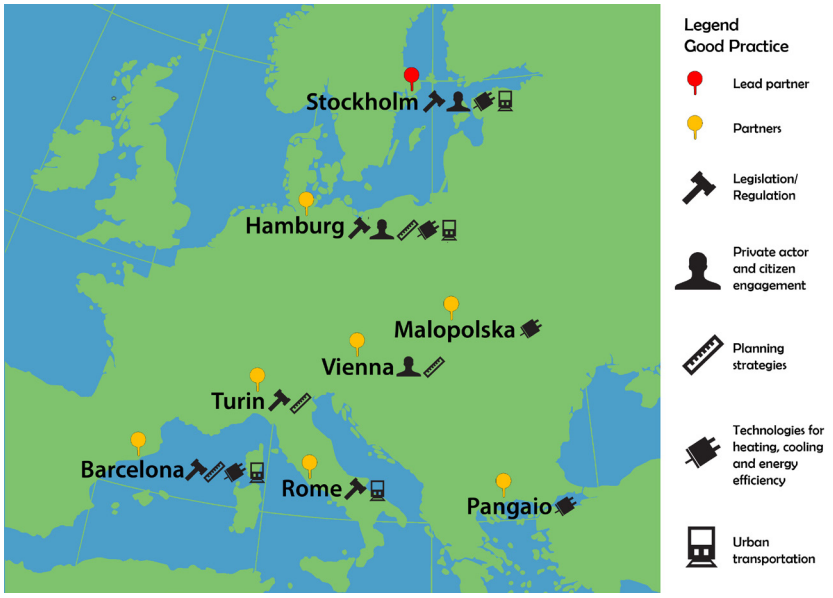


Figure 9: Good practices of the CLUE partner cities and regions

The process of good practice selection and analysis

Each work group in the CLUE project looked for good practices within their thematic field and within the consortium (see figure 9). These good practices all contribute to carbon emission reductions in one way or another and can function as part of the solution for new climate neutral urban districts. The project partners developed criteria together (see Appendix) to evaluate the their compiled good practices (overall 83). As the relevance of the criteria differs from work group to work group, each work group decided which priority (no priority = 0, medium priority = 1, high priority = 2) to attach to each criterion. Each work group then evaluated their good practices, ranked and selected a small number of good practices for the detailed analysis. Overall, 25 good practices were selected for the subsequent process of analysis (see figure 10 and Appendix). The CLUE good practices correspond to the experiences of the participants in CLUE project. Therefore, they are not an exhaustive representation of technologies, strategies, instruments and policies. Further experiences and technologies can also contribute to achieving climate neutral urban districts, based on the practical experiences of the CLUE project partners. The selected good practices are considered to be effective at reducing local carbon emissions and contributing to the development of carbon neutral urban districts and cities.

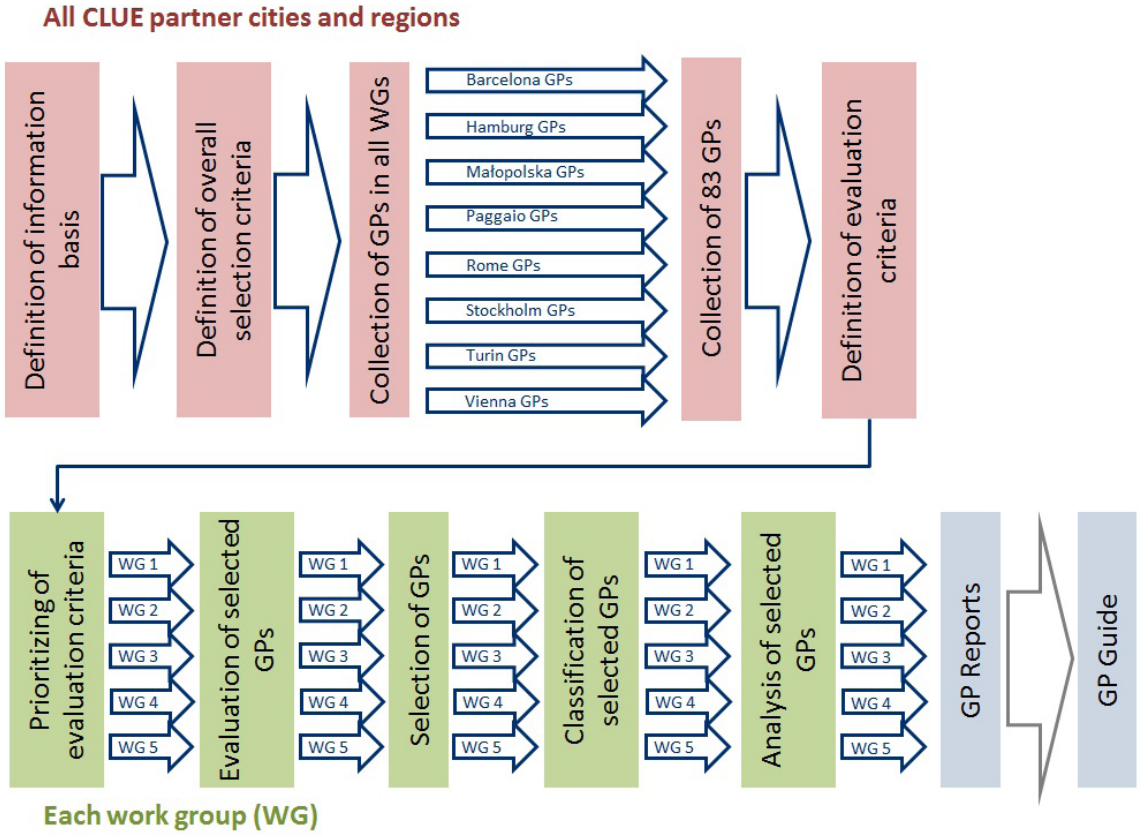


Figure 10: The process of good practice selection and analysis

4.1 Legislation/regulation in the planning process

Legislation and regulation of planning and development in cities is a diverse issue and of utmost importance for the development of climate neutral urban districts and climate neutral cities. This topic is very varied in nature and ranges from EU or national legislation for environmental goals in planning and construction to regional or municipal legislation or, more often, regulation on which energy standards are to be applied in the development of districts or neighbourhoods.

The focus of the CLUE project regarding legislation and regulation lies primarily on regulation and policy making on the municipal and district level. There are three general themes among the analysed good practices: the most common sub-topic is plans aimed at climate change, sustainability and energy use. These plans are focused at city level planning but with goals and activities affecting city district development. The goals include carbon dioxide reduction, energy management and similar issues

in city-wide planning. The second sub-topic is focused on the regulation of building standards and building attributes. This is a more practice-oriented sub-topic with concrete energy and climate standards for development and buildings. This topic also includes certain regulations for local energy production facilities. The third sub-topic includes strategic measures for managing traffic in order to reduce dependency on fossil fuel consumption.

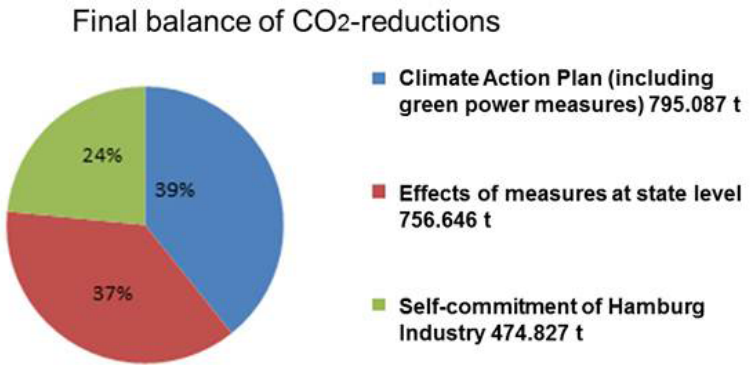
In order to lead cities towards integrated sustainable urban development it is important to integrate sustainability principles into local policies and actions. In this context it is very important to analyse which kinds of scenarios regarding carbon emission reductions could be achieved and which impacts are connected with technologies and innovations that have been introduced. Changes to legislation and regulation can widely shape cities and have several impacts on different sectors and actors. Therefore, every proposed policy or strategy should be analysed with regard to its impacts, implications and side effects. Overall, the selected good practices in the field of regulation and implementation focus on the problem at hand of reducing local CO_2 emissions while tending to neglect other aspects. The economic impacts of local regulations and the integration of social and socio-economic aspects are often less strongly covered in local climate mitigation policies. This demonstrates the challenge that a holistic view and an integrated approach to sustainable urban development presents for local policy makers.

Name of Good Practice	CLUE Partner	Stage	Character	Scope
Thermo Solar Energy Regulation	Barcelona	Implementation Implementation	Policy	City
Hamburg Climate Action Plan 2007-2012 (update: Master Plan Climate Action)	Hamburg	Updated (Implementation)	Strategy and Funding Programme	City
The Urban Quality Protocol	Rome	Implementation ementation Implementation	Policy	City
The Stockholm Royal Seaport Project: Overall Programme for the Environment and Sustainable Urban Development	Stockholm	Policy Development / Planning / Implementation	Strategy	District
Energy-environmental Annex of the Building Regulations of the City of Turin	Turin	Implementation	Policy	City

Name: Hamburg Climate Action Plan 2007-2012 and Master Plan Climate Action
CLUE Partner: Free and Hanseatic City of Hamburg

In 2007 Hamburg defined its own goal towards CO_2-reduction (40% CO_2 reduction by 2020 compared to the emissions level of 1990). The Hamburg Climate Action Plan started in 2007 as a first step to realize the CO_2-reduction goals. It was the first plan in a consecutive row of documents which are regularly reviewed and updated. As the Hamburg Climate Action Plan ended in December 2012, the Hamburg senate adopted the Master Plan Climate Action in 2013 including a long-time vision for 2050 as well as an action plan for the years up to 2020. As Hamburg only included measures which can be influenced by the City itself, Hamburg now aims to achieve a substantial contribution to the national goal of a 40% CO_2 reduction by 2020 and wants to reduce CO_2 emissions by 80% until 2050. The plans address not only technical measures of sustainable energy generation, energy efficiency and savings but also support measures of awareness raising, information and communication as well as adaptation to climate change.

The main target of reducing the CO_2-emissions by 2 million tons was reached. The results show that the different fields had contributed stronger or less strong than expected. More CO_2 had been saved through measures at federal level than anticipated (e.g. federal funding, laws, etc.). In addition to the measures from the climate action plan itself which were funded by the Hamburg senate, the self-commitment of several large Hamburg companies to implement measures for CO_2-reduction was very successful.



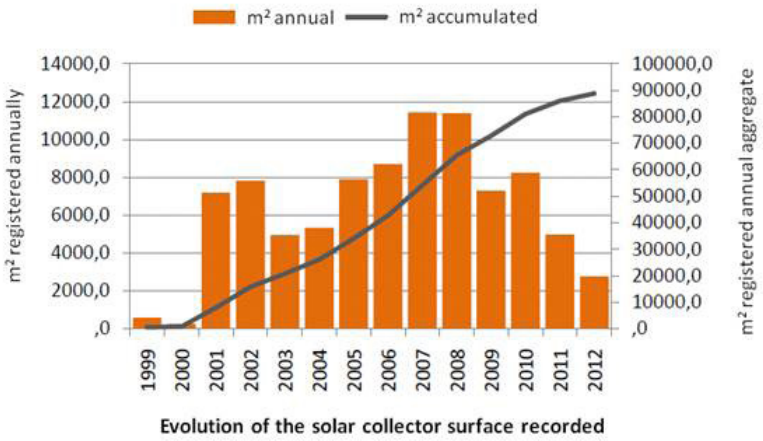
Source: Freie und Hansestadt Hamburg

http://www.hamburg.de/masterplan-klimaschutz

Name: Thermo Solar Energy Regulation (Barcelona Solar Thermal Ordinance)
CLUE Partner: Barcelona Regional

With the Solar Thermal Ordinance (STO), Barcelona increases the use of renewable energy by regulating the introduction of solar thermal collectors. These are used in order to produce domestic hot water in publicly or privately owned buildings. The ordinance is part of the energy policy of the local government for fostering renewable and clean energies, enhancing efficiency of energy systems and reducing CO_2 emissions. The STO is mandatory and affects newly built, rehabilitated and fully reformed buildings and those seeking to implement a change of use, with a forecasted volume of sanitary hot water demand equal to an average annual energy consumption of over 292 net MJ. This regulation applies to buildings intended for residential, health-care, sports, commercial and industrial use and, generally, any activity involving the existence of dining rooms, kitchens, laundries or other circumstances that lead to a large consumption of hot water.

The STO is a powerful instrument to reduce CO_2 emissions on the local level. Strong political commitment is the basis for the development and implementation of the policy. Furthermore, to be successfully implemented, the legally binding policy needs to be accompanied by communicative and participatory instruments as well as training schemes (more than 500 professionals were trained). Since the adoption of the STO until 31 December 2012 88,755 m^2 new thermal solar installations were processed (97% due to the STO).



Evolution of the solar collector surface recorded

Source: Agència Energia de Barcelona

http://www.barcelonaenergia.cat/eng/operations/ost.htm

Developing and implementing legislation and regulations for CLUEs

Starting out with political commitment

Local policies, strategies and programmes need to be adopted at the political level in order to be legally binding and democratically legitimized. As legislation and regulation can function as strong interventions in local processes, which bind the activities of public and private actors they need to be thoroughly designed in order to reach the desired effects. Therefore, defining the content and extent of local regulations is complex and work-intensive. Wide political commitment must therefore be the starting point for policy development in order to make sure that the policies can be adopted after finalising the process of policy formulation. Moreover, in order to be fully effective, local regulations need to be in place for more than one legislative period, especially when targeted at influencing relatively slow processes of construction and urban development. Therefore, a wide political commitment towards climate mitigation across party boundaries forms a sound basis for long-term oriented, consistent measures. Thus, a shared understanding of goals and basic approaches can support (but not guarantee) the consistency of policies even beyond political changes. Furthermore, the implementation of local regulations usually requires the provision of financial resources from the municipal budget. Therefore, the political decision is needed to provide sufficient funds for policy implementation.

Establishing communication and cooperation with citizens and stakeholders

Climate neutrality requires more than just the actions of public actors. Increasing the energy efficiency of municipal buildings, technical infrastructures and public sectors is a good starting point for local climate mitigation. However, limiting activities to these areas is not sufficient to reach climate neutrality. Behavioural change of citizens is crucial for reaching extensive GHG emissions reductions. Cooperation with private actors can be crucial for policy and project implementation and takes advantage of win-win situations. Therefore, providing information and establishing dialogue and processes of cooperation raises awareness, creates ownership and acceptance, allows mutual learning and improves the effectiveness of the resulting policies.

Setting the strategic orientation

Climate neutrality requires consistent actions and a holistic approach on the city level. Municipal legislation and regulation should define a framework within which different actors can work towards climate neutrality. Long-term goals are needed to guide and integrate the activities of public and private actors and to make sure that these contribute to common goals. A strategic approach towards climate neutrality fosters synergies and avoids conflicting objectives and measures. Therefore, defining abstract, long-term goals and a common vision for the future development of the climate neutral city, forms the basis for deriving mid- and short-term oriented objectives on a city and district level.

Developing tailor-made interventions

Municipal legislation and regulation are legally binding instruments which can greatly affect the activities of public and private actors. To be fully effective, reach desired goals and minimize unwanted side-effects these need to be designed thoroughly and tailored to local needs and the local institutional framework. Therefore, legislation should be accompanied by information provision for affected stakeholders to support implementation and raise awareness. More intense communication and cooperation may also be beneficial. Training courses for (local) craftsmen, engineers and architects can enable them to implement ambitious technical measures. Involving stakeholders in cooperative policy development can result in more effective policies through increased ownership and acceptance of non-municipal actors and mutual learning.

Adapting administrational structures and processes

New policies, strategies and programmes may require changes in administrational structures and processes to be successfully implemented. Processes such as the issuing of building permits and other procedures may have to be adopted to work with new regulations. Furthermore, creating one institution within the municipal administration which is responsible for implementing, evaluating and updating policies, strategies and programmes creates the basis for consistent actions in the long run. This institution bundles necessary expertise and communicates and promotes climate mitigation within the municipal administration and beyond. Therefore, it plays an important role in the inter-

departmental integration of activities and provides a competent point of contact for municipal employees, stakeholders and citizens. Overall, establishing this institution increases the capacity of the municipality to act in the field of climate mitigation and thus contributes to the possibility of reaching climate neutrality in the long run.

Evaluating and learning

All policies, strategies and programmes targeted at climate neutrality need to be evaluated and updated on a regular basis. The objectives need to be specific, measurable, accepted, realistic, linked to a defined period and ambitious in order to form a valuable basis for evaluation. Evaluating and updating municipal policies is very important in order to make sure that they are oriented towards long-germ goals and visions and allow for the adjustments depending on new circumstances, experiences and knowledge. All processes of policy development and implementation need to be open for technical, organisational and social innovations and learning. They must create room for trying out new solutions. In order to learn from the evaluation of experimental solutions, feed the results back into municipal policies, strategies and programmes are crucial.

Factors of success	Barriers & challenges
Strong political commitment	Inconsistent (local) policy framework
Constant evaluation and updating	Lack of integration of (sectoral) goals and measures
Integration of technical, organisational, social innovations	Mismatch with the wider institutional framework
Experimenting and trying out new solutions	Mismatch with local conditions
Establishing a responsible institution within municipal administration and employing experts	Lack of financial resources
Creating synergies and co-benefits	Lack of communication and cooperation with stakeholders and citizens
Inclusion of awareness raising measures and education targeted at stakeholders and citizens	Limitations to technical measures and the public sector

Name of good practice: The Stockholm Royal Seaport Project: Overall Programme for the Environment and Sustainable Urban Development (PES)
CLUE Partner: City of Stockholm

In 2009, the Stockholm City Council decided that the area of Norra Djurgårdsstaden (Stockholm Royal Seaport = SRS) should become one of Stockholm's three new environmental profile areas. SRS is an important harbour and industrial area including a former gas work, an energy harbour including a combined heat and power plant, a cruise terminal, a freight harbour and an oil depot. A vision for SRS was developed in 2009. In the SRS project, the City of Stockholm aims to transform 236 hectares into a sustainable city district with 12,000 new dwellings and 35,000 work spaces. The Overall Programme for the Environment and Sustainable Urban Development (PES) of 2010 is an important steering document for this project. One of the overall goals is to become fossil fuel-free by 2030. Other goals relate to climate adaptation, minimise the use of resources, circular economy, participation processes and a limited impact on health and environment.

First evaluations indicate that developers are complying with the requirements stated in development agreements. First calculations show a 50%-reduction of CO_2-emissions based on the requirements applicable for the first 10 phases. The main strength of the PES is that it was developed together with relevant stakeholders from the early start on, e.g. various city administrations/departments, energy and water utilities, the public transport company, developers and property owners. This process of involvement was one of the most important pillars for creating acceptance and understanding and resulted in a common vision and goals.

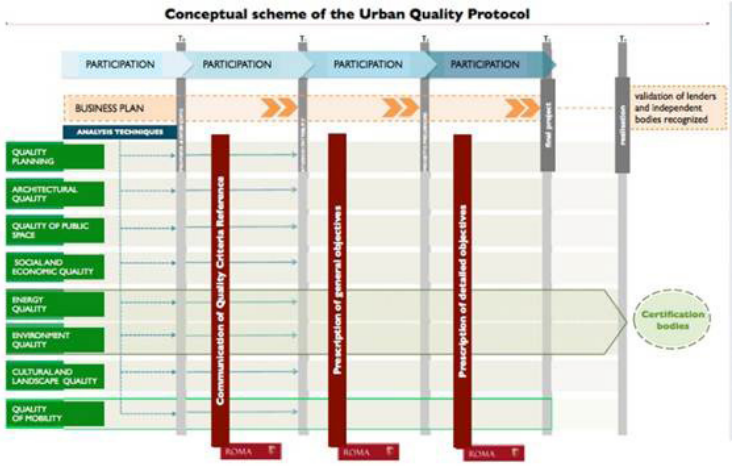
Source: City of Stockholm, Norra Djurgårdsstaden/flickr

http://www.stockholmroyalseaport.com/en

Name of good practice: urban quality protocol of roma capitale
CLUE partner: city of rome

The Urban Quality Protocol of Roma Capitale is a tool to be applied to projects of the Strategic Development Plan to ensure the quality of the urban development and the life of the city's inhabitants. The tool is designed to confer greater certitude to the municipal administration as well as the enterprises, citizens, and investors involved in urban redevelopment projects. It is a process innovation that establishes new, cooperative processes for the preparation of plans and projects. Its goals are to ensure: 1) environmental sustainability; 2) high quality of buildings; 3) certain and effective administrative procedures (incl. streamlining of procedures and process times by about 50%). Urban redevelopment projects are examined by an Interdepartmental Commission based on the structure and criteria established by the Protocol in order to improve the quality of the projects.

The Urban Quality Protocol encourages the achievement of the European climate and energy targets for 2020 at Urban Plan level. It also prepares the local building sector for 2021 when all new buildings have to be "nearly zero energy" buildings. When applied to the "Museo di Roma" with a covered area of 30,400 sqm and a current energy consumption estimated at 120 kWh/sqm (annual energy consumption: 3,7 million kWh corresponding to 1,600 tons of CO_2 produced per year) it has been estimated that about 40% of its energy consumption can be reduced, an equivalent to saving approximately 600 tons of CO_2.



Source: Risorse per Roma

http://www.risorse-spa.it/en/100-attivita/pdq/926-the-protocol-of-the-urban-quality-of-rome-capital.html

Policy recommendations for legislation and regulation for CLUEs

Policy recommendation	Purpose	Effect/impact	Responsibility
Develop tailor-made strategic approaches for CLUEs	Creating a long-term oriented framework for local action	Long-term orientation of measures, exploiting synergies and avoiding contradictions	City government (adoption)
Use CLUEs as test beds and role models for innovations	Exploring and demonstrating alternative solutions of sustainable development	Learning about alternative and innovative approaches and solutions	City administration
Provide incentives for CLUEs	Supplemenwting regulatory instruments with softer measures to further promote CLUEs	More effective promotion of CLUEs by designing supplementing instruments	City government (adoption) National government (adoption of supporting incentives)

Policy recommendation: Tailor-made strategic approaches for clues

- Realize a strategic approach to climate neutrality on the city level which is tailor-made to the institutional framework, local actors and local conditions and allows for the alignment of short- and mid-term oriented measures and plans towards long-term, overall goals.
- Enable the integration of different sectoral plans and measures relevant to reach climate neutrality and thus avoiding contradictions and creating synergies of goals, plans and projects.
- Evaluate processes and projects in order to allow learning and the adjustment of long-term oriented iterative processes towards climate neutrality.

Policy making for climate neutrality requires a long-term perspective which promotes fundamental changes. An overall approach to promote climate neutrality on city level is needed that promotes renewable energy generation, energy efficiency and the decarbonisation of energy consumption while offsetting (unavoidable) CO_2 emissions as much as possible. The adjustment to the local starting situation and specific framework conditions is crucial.

Measures for climate neutrality should not be considered in isolation. Urban strategies for CLUEs should follow an integrated approach on the city level. Social, economic and other environmental implications of intervention have to be considered. The underlying principle of sustainability should be applied to guide urban development and policy formulation. Integrating regulation targeted at climate neutrality with other planning goals allows the generation of synergies and the prevention of conflicting goals.

Adjustments to local changes and the effects and side effects of measures and processes is necessary. The evaluation of strategies, plans and measures and the establishment of a monitoring process are crucial. The evaluation should be comprehensive and capture not only measures, but also their context in a continuous follow-up process, which was already designed for during the development of the plan. Legislation and regulations should be regularly revised. It is crucial to develop transparent indicators to evaluate and compare measures.

Policy recommendation: Use clues as test beds and role models for technical and organizational innovations

- Promote innovative technical solutions in the field of energy generation, distribution and consumption at the city, district and building level through cooperation with R&D institutions and other stakeholders.
- Use CLUEs as test beds for technical and organizational innovations to explore their functionality and side effects and to illustrate the practical implementation of the overall strategy to climate neutrality.
- Promote organizational innovations regarding the administrational structures and the planning processes of CLUEs through the adaptation of structures and processes and the involvement of citizens and stakeholders.

Social, organisational and technological innovation is crucial to reach extensive CO_2 emissions reduction. Municipal legislation and regulations should aim at promoting new forms of communication and collaboration among municipal and private actors including new forms of financing measures.

The city should take a forward-looking, pro-active role in promoting climate neutrality and sustainable development. Promoting learning and innovation may benefit from the change

of administrational structures. Creating a responsible institution within the municipal administration, which is responsible for integrating different sectoral plans and measures and to mainstream climate mitigation in all municipal departments, is important to realize an integrated approach. This institution should bundle all municipal activities which contribute to climate neutrality, gather the needed expertise and thus increase the capacity of a city to deal with climate change. Furthermore, the responsibility for evaluating measures, feeding back results to different administrational departments and sectors and updating the overall strategy to climate neutrality should also lie within the responsibility of this institution.

Policy recommendation: Incentives for clues

- Increase the effectiveness of legislation and regulations to promote CLUEs by complementing legally binding interventions in local processes with (financial) incentives to influence the behaviour of local stakeholders.

- Develop incentives such as shorter planning approval processes, lower infrastructure costs, subsidies, etc. targeted at specific stakeholder groups to further promote activities of stakeholders towards climate neutrality.

There is no single path to climate neutrality. Many different regulations are necessary. Local laws and regulations should be supported by softer measures such as information, financial incentives, etc. promoting desired behaviour of individuals. Legally binding and softer measures should be designed to increase each other's effects. Thus, they promote climate neutrality more effectively than individually.

The municipal administration is responsible for designing a policy tailored to local framework conditions and groups of actors. As mitigating climate change is a challenge for society as a whole, the burdens should not solely be placed on municipalities. These need support by the national government. National legislation should guide local activities towards climate neutrality and provide further financial incentives to promote climate neutrality measures at the local level.

4.2 Private sector and citizen engagement

The participation of private actors and citizens in urban development processes is very important for developing and implementing climate neutral urban districts. In recent years many European cities have been assigning increased importance to participation and public involvement in urban development, thus going far beyond the time-tried urban planning concept of simply weighing different interests against each other. Today's decision-making processes in urban planning must take into account the diversity of civil society as a conglomerate of different individual interests as well as the varied interests of private-sector actors. Thus, the public sector defines itself increasingly as being part of multiple forces within a highly complex cosmos of interactions that all influence urban development.

Reaching climate neutrality not only depends on technological innovation, but relies significantly on users' behaviour as well as on the adoption of innovations by the cities' inhabitants. Irrespective of the technological or planning solutions and innovations chosen, the behaviour and consumption of private households and individuals contribute essentially to resource consumption. Participation and the use of different communication tools are instruments of awareness creation that can influence the behaviour of individuals and hence resource and final energy consumption, thus significantly contributing to reductions in CO_2 emissions. Furthermore, the strong and joint commitment of all concerned actors and stakeholders is needed in order to reach the ambitious goal of climate neutrality. Participation is used in urban planning to enable residents, stakeholders and different interest groups to take part in decision-making processes. In this context, communication must be seen as the foundation of any form of participation.

It is necessary to explain, translate and communicate long term visions as well as short term gains in order to raise knowledge and awareness and promote joint action. The early involvement in planning processes enables an integrative and mutually beneficial process of development by an inter-institutional unity to attain ambitious aims. Depending on the intensity and nature of the communication paths (and/or the resulting participation options), three different stages of participation may be distinguished: information, consultation/dialogue and cooperation. Information is considered the very basis of all forms of participation. It is characterized by one-

sided information provision which does not guarantee an actual share in decision-making processes. Consultation and dialogue is based on two-way communication, i.e. information is provided but also gathered; and different opinions and needs as well as emotions (concerns, worries) become visible. Thus, consultations promise new findings and information which can be obtained by learning about the other side's perspectives and by exchanging information.

Finally, cooperation aims at the targeted involvement of actors in decision-making processes where actors have equal footing. Decision-making competencies and areas of responsibility are shared in partnerships. Cooperation in urban planning makes it possible to define objectives for the city as a whole on the basis of multidisciplinary and interdepartmental consensus. Furthermore, cooperation opens up new, cooperative financing methods. The level, type and method of any form of participation is contingent on its target group.

Name of Good Practice	CLUE Partner	Stage	Character	Scope
Royal Seaport – Capacity Development Programme (CDP)	Stockholm	Implementation	Project	District
Citizens' Solar Power Plant	Vienna	Implementation	Project	City
Mitte Altona - Citizen participation	Hamburg	Planning	Project	District
Smart City Wien – Stakeholder Process	Vienna	Planning	Policy/ Strategy	City

Name of good practice: Royal Seaport Capacity Development Programme (CDP)
CLUE partner: City of Stockholm

The Royal Seaport Capacity Development Programme (CDP) was established to ensure that the environmental requirements set for the development of the Royal Seaport by the City of Stockholm will be met. The development programme aims at directly providing the developers with knowledge and tools to attain the energy targets for each phase of the project. The CDP encompasses several topics including a green-space index, storm water management, sustainable transport, eco-cycle systems (waste and wastewater), sustainable living, building materials, indoor climate, etc. With a view to the multiple stages of participation, the CDP can be seen as a co-operation model to enhance public-private collaboration for the exchange and creation of knowledge, thus promoting the implementation of a district with new standards and making the development more efficient. This participation tool targeted all developers involved in the Stockholm Royal Seaport project.

The CDP generates insights into cutting-edge projects and a better understanding of the City's requirements and increases the ambition to comply with these requirements. Thus it contributes to raising the knowledge on sustainable urban planning, provides insights into R&D and good practice as well as contributing to an exchange of experience.

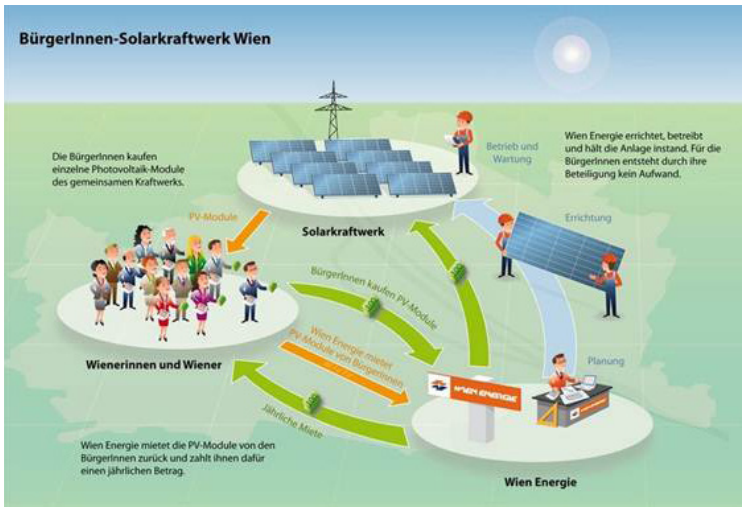
Source: City of Stockholm, Norra Djurgårdsstaden/flickr

http://www.stockholmroyalseaport.com/en/

Name of good practice: Citizens‘ Solar Power Plant
CLUE Partner: City of Vienna

Vienna's Citizens' Solar Power Plants are an opportunity for citizens to partake in promoting and exploiting renewable energy, especially for those who live in rented flats (i.e. around 80% of Vienna's population). This is the first project that allows all citizens to actively participate in the setting-up and construction of solar power plants in Vienna's urban area by acquiring shares. Thus citizens could buy panels for the price of € 950 for one panel, with installation, operation and maintenance included in this calculation. With this special participatory concept, Wien Energie promotes not only green-mindedness among citizens and encourages customers to develop an interest in expanding power generation from renewable sources in general. In fact, with this financing model, people are enabled to take an active part in the expansion of renewables and make a personal contribution to climate protection.

The implementation of Vienna's Citizens' Solar Power Plants is a very important project with a positive result showing how much citizens actually are interested in contributing and actively participating in efforts to meet environmental and climate challenges. Up to now altogether 16 power plants in Vienna and in the neighbouring communities have been realized.



Source: Wien Energie

http://www.buergerkraftwerke.at/eportal2/

Developing and implementing participation processes for CLUEs

Applying a pro-active approach

Participation can be a means to avoid conflicts through open processes of discussion, planning and cooperative decision making. However, to be able to function like this, citizens and stakeholders must be involved at an early stage of the planning process. This can increase the acceptance of a planned project among citizens and stakeholders. Waiting until a later stage within the planning process may prevent productive discussions and thus hamper the whole participation process. Following this approach requires an open and communicative attitude of the municipal administration. Furthermore, the whole process should be transparent and clearly communicated to all participants. To avoid wrong expectations of targets, scope and decision making processes must be clearly defined and communicated from the beginning.

Creating win-win situations

Climate mitigation is often not the highest priority of private actors and citizens. Therefore, engaging them in participation processes which require them to invest their time and resources may be difficult. Especially because cooperation processes may be relatively more time consuming and work intensive for all actors involved, than more traditional information and consultation formats. Creating win-win-situations where both the municipality and the stakeholders benefit from the process and the outcome is therefore very important considering the willingness of actors to participate. Framing and designing the participation process should consider this from the beginning. There are various ways to create win-win-situations which highly depend on locally specific characteristics such as the institutional framework, local actors and actor networks, etc. Thus, these cannot be copied but must be tailored to local specifics and targets. Possible gains for private actors can be to allow them to influence building and urban design, gaining competitive advantage through knowledge exchange and mutual learning, and through economic incentives such as the reduction of infrastructure fees for participation, etc.

Creating organisational structures and networks

Establishing persistent channels of communication and exchange allows citizens, stakeholders and municipal staff to constantly learn from each other and cooperatively work towards mid- and long-term targets. As climate neutrality can only be reached over the long-term, establishing and promoting persistent forms of cooperation is beneficial. There are various participatory formats which may be used, such as establishing forums or advisory boards for different stakeholder groups and/or topics, and conducting workshops or web based discussion forums. Ongoing cooperation may even be further developed into persistent actor networks with their own organisational structures initiated by the municipality, citizens or stakeholders. Furthermore, establishing a contact point within the district to be (re-)developed is beneficial. This promotes ongoing processes of communication and exchange and symbolises the openness of the city towards suggestions and constructive criticism.

Developing participation strategies

Climate neutral urban districts require trying out very innovative solutions in a laboratory situation. Learning from these experiences is crucial and participation can be seen as a means to an end in this regard. It can be used to transfer the knowledge of stakeholders and citizens gathered while trying out innovative solutions to the municipality. This may result in better planning decision making and improved urban design in the future. Designing a participation process which is closely connected to the stages of the development process is crucial to be able to feed in lessons learnt throughout the preceeding planning stages. Furthermore, the whole participation process needs to be integrated in a strategic manner which is tailor-made to the district in question and to the goals and contents of the participatory process. This should provide a structuring framework and define how the participation results are supposed to be fed into planning and decision making processes.

Tailoring to target groups, targets and local specifics

All forms of communication and cooperation need to be tailored to specific targets, contents, target groups and local characteristics to be able to reach the desired goals. As mentioned above, integrating participatory tools in a strategic approach helps define targets, contents, and target groups at

an early stage of the decision making/planning process and safeguards that participatory decisions can be fed back into planning processes. Regarding climate neutrality, participation can be used to raise awareness, create acceptance, promote behavioural change, co-develop and implement measures to reach ambitious goals and more. Participation specifically targeted at one group of stakeholders which develops, discusss and decides on specific measures within a cooperative format can widely spread information which can reach and inform all citizens and stakeholders within the city about planned measures. The participatory tools used must reflect the variety of targets, contents, and target groups.

Engaging private actors and citizens with the transition process

Many citizens are very conscious about the need for climate mitigation, environmental protection and sustainable lifestyles. They are very engaged in contributing their share to the transition towards sustainability. This willingness and commitment should be used to promote the transition process through creating opportunities for citizens and private actors to participate and contribute to climate neutrality. Measures limited to the public sector and infrastructure is not sufficient. Therefore, offering opportunities for interested actors to participate, such as the development of cooperative investment programmes for renewable energy generation are needed. Furthermore, this process can be further promoted through measures of awareness raising, education and by providing information to citizens and stakeholders.

Communicating results and success stories

As mentioned above, participation must be transparent in regard to its scope and its influence on formal decisions and planning processes. Moreover, to motivate citizens and stakeholders to participate, positive outcomes of earlier participation cycles must be clearly communicated, such as the number of photovoltaic panels installed through the investment of citizens and stakeholders. Awareness is the basis for active participation and cooperation.

Factors of success	Barriers & challenges
Tailor-made participation in regards to target group, site-specific characteristics and goals	Existing conflicts may interfere with intended topic and participation goals
Transparency in regard to content and influence on formal decision making processes	Lack of win-win situations for stakeholders and municipality
Open attitude of municipal staff towards participation	Mismatch of targets, contents and target groups
Evaluation of participation processes which allow improvements	Lack of a strategic framework for participatory engagement of citizens and stakeholders

Name of good practice: Mitte Altona
CLUE Partner: Free and Hanseatic City of Hamburg

Mitte Altona with its potential surface of 75 hectares is the second-largest inner-city urban development scheme of Hamburg. The "Mitte Altona" urban development scheme is a project of sustainable urban development through conversion of land previously used by railway lines. As this new development is situated in-between areas where a mix between living and working is provided, many different stakeholders are involved. Thus, the City of Hamburg decided very early in the process that open and proactive integration of all stakeholders into the project would be crucial for its success and duly developed a participation process to integrate the local community in a proactive manner. Different forms of participation targeting different groups of stakeholders were applied and combined to reach all stakeholders at the local level: city officials organized various formats of participation in the development area. These range from general information events to workshops, each addressing different themes, such as traffic, housing or open space. The Mitte Altona participation process led to the critical review of planning targets, the further development of thematic focuses (e.g. request for the establishment of a neighbourhood management office, integration of the inclusion theme into the planning process, demand for car-independent housing). Furthermore, the outcomes of participation events were discussed by politicians at the district and city levels. However, it is too early to determine if the Mitte Altona participation process and the experience made with it will influence broader strategies and decisions at city level.

Source: André Poitiers Architekt RIBA Stadtplaner, arbos Freiraumplanung GmbH & Co. KG

http://www.hamburg.de/mitte-altona/

Policy recommendations for private sector and citizen engagement for CLUEs

Policy recommendation	Purpose	Effect/impact	Responsibility
Establish a mindset of participation	Establish a positive attitude towards participation within the municipal administration	Increased internal and external communication and cooperation	City administration
Learn to use participation as a tool	Use participation tools adapted for specific targets and target groups	More effective, tailor-made participation processes	City administration

Policy recommendation: Establish a mindset of participation

- Act as a role model: establish interdepartmental cooperation within the municipal administration.
- Extend your horizon: establish direct communication and collaboration with stakeholders.
- Go broad, reach the city: Establish opportunities for participation and cooperation for citizens.

Municipal strategies, plans and projects require thematic consistency and inter-institutional unity, i.e. smooth internal communication and co-operation between administrative units to be able to reach climate neutrality. This is the only way to prevent redundancies and contradictions and to arrive at a consistent position. The city should act as a role model, to be perceived as one by the general public. Therefore, cooperative structures within the municipal administration have to be established.

Establishing participation as an attitude calls for institutional networking and collaboration between municipal actors and relevant external stakeholders. The goal is to enhance the mutual understanding of different perspectives. Scenarios can be used to deepen the understanding of different perspectives and opinions in the planning process. Learning experiences gained in cooperative processes should be used to further improve the environmental performance of newly developed climate neutral urban areas.

Today's urban planning and development requires combining experts' specialised knowledge with citizens' everyday know-how and to jointly formulate solutions with the greatest added value for the majority of persons concerned. Participation, understood as the engagement of a broad audience, i.e. of the citizenry, must be well planned regarding both the content discussed and the timeframe. Moreover, it must be internally consistent. Planners as experts must be willing to step back from their own, specialised perspective and enter into an open-ended process. Thus, participation needs a specific attitude or mindset. Citizens must be seen as partners, knowledge has to be shared and the citizens' know-how must be accepted as equivalent. Establishing an open attitude towards participation is a slow process which needs to affect all of the municipal administration. Individual changes of mindsets and attitudes of municipal employees will in sum lead to more open planning and decision making processes within the city, enabling the influence of stakeholders and citizens.

Policy recommendation: Participation is a tool – learn to use it!

- Communication is the key: simplify and translate "expert" knowledge as a basis for successful communication.
- The more strategic, the more there is to translate: for a successful participatory process, abstract and complex contents have to be made accessible and easy to understood for citizens and stakeholders.
- Be honest, be trusting, be transparent: design clear-cutt participation processes and clearly communicate goals and contents to participants.
- Be experimental: allow and enhance creativity by developing and trying out new forms of participation.

Participation is built on transparency and on the communication of information: an objective and a clearly comprehensible information base should be provided equally and continuously for all population groups. Planners must foster an understanding of the complexity of interacting factors and sequences that make up planning processes.

Communicating requires considering to whom and what you want to communicate. Participation, particularly of citizens, is more challenging the more abstract and complex the field

or topic is or the less place bound. To get stakeholders and the public aboard you have to simplify the complexity of complex concepts and processes such as climate neutrality, city wide topics and urban planning and translate these into day-to-day life and language. Different forms of communication may need to be combined to reach who and what you desire.

Participatory processes must be clearly structured and attractively designed. The possibilities and intentions of participation should be clearly defined and delimited; goals of participation processes must be clear-cut. All parties must be aware that there are also limits to the scopes of action and open-endedness of these processes. Everybody involved should know which questions are or are not subject to negotiation, since the early and clear-cut communication of such limits can help to prevent later moments of frustration. This also includes the necessity of providing information about who is going to make the final decision and when.

Climate neutral urban districts and cities require innovations. However, innovation is not limited to innovative technical solutions. Social and organisational innovations are just as important. Thus, developing new forms of participation which involve residents in the planning process is one type of innovation needed for climate neutrality. Experimenting with new formats of participation is beneficial. Furthermore, public participation and stakeholder engagement can create new ideas through shared knowledge and experiences. Thus, it can play an important role in fostering creative solutions. Openness towards trying out new approaches is therefore crucial.

4.3 Planning strategies

Urban planning is not only a technical process concerned with the use of land and the design of the urban environment, it is also a highly political matter of guiding the development of settlements and communities. It is a highly complex field of action which concerns research, analysis, strategy development, urban design, public participation, policy implications, implementation of measures and management of processes and structures. Pursuing climate neutral urban districts comprises a new challenge in city development. Many of the issues with today's cities' lack of sustainability lie within their existing structures. This urban framework is usually not very flexible and hence does not allow for a complete transition to achieve

climate neutrality at this point in time. It is in the creation of the new city, or in strategically retrofitting existing buildings, that new ideas and technology can be optimally implemented, where solutions can be included in the design from the start. In order to achieve this, cities need innovative planning methods and tools. When striving for climate neutrality by improving the energy performance of the built environment, the building scale is not the most appropriate. The issue has to be managed at the district level where it is possible to profit from potential synergies. The main advantages to adopt district level approaches are the exploitation of synergies among buildings, the possibility to use residual energy (of industrial and other processes), the possibility to establish a more efficient use of renewable energy sources within a neighbourhood or district, the use of cogeneration and district heating, etc. Furthermore, district level planning allows integrated solutions which influence the energy consumption of buildings and create synergies with urban transportation, energy generation and distribution. The district approach is consequently more suitable for reaching high resource efficiency.

However, ambitious climate mitigation cannot be the only goal of sustainable urban planning. It is rather one of several corner stones needed to achieve the balanced development of a city district. Beside environmental issues (energy, water, emissions, use of land, materials, etc.), the social (urban mix, well-being, culture, access to services, equity, social inclusion, etc.) and economic (impact on the local economy, employment, etc.) aspects of planning have to be equally considered. The district has to be regarded as a complex system and its sustainability has to be reached through a holistic and inter-disciplinary approach. This may result in integrated solutions which have a significant impact on the overall sustainability of the district not only on its climate impacts.

Integrated strategic planning can be considered a process to define a direction and to make decisions on allocating resources in order to reach desired goals. The CLUE work group analysed five good practices of strategic planning approaches targeted at the district level. These can be separated into two concepts: One set of strategies was developed to guide the comprehensive redevelopment of bigger inner-city areas while the other form a more abstract frame to guide the development and implementation of individual measures and projects, spanning across several city districts.

Name of Good Practice	CLUE Partner	Stage	Character	Scope
Vallbona Ecodistrict	Barcelona	Baseline analysis/ Planning	Project	District
Urban 3 Barriera di Milano – Variante 200	Turin	Planning/ Implementation	Project/ Strategy	District
Mitte Altona	Hamburg	Planning	Project	District
IBA Metrozones	Hamburg	Implementation	Strategy	District
KLIP – Vienna Climate Protection Programme	Vienna	Implementation	Policy	City

Name of good practice: Urban 3 Barriera di Milano – Variante 200
CLUE partner: City of Turin

The City of Turin promotes the redevelopment of the north east of the city through two strategies:

1) Urban 3 is an integrated program that works on three levels (physical-environmental, economic employment and socio-cultural). Main objectives are to improve energy performances and the overall environmental conditions through a transversal planning approach with the Urban Regeneration Programme "URBAN 3 in Barriera di Milano", to improve administrative procedures considering the use of public procurement of eco-innovation and to stimulate improved energy consumption patterns and eco-friendly behaviour of citizens.

2) Master plan: Program feasibility of interventions with economic and financial sustainability about Variante 200.
The intention of the City of Torino is to promote the development of new eco-neighborhoods. For this reason a specific requirement has been introduced: all the new and retrofitted buildings in the area have to reach the minimum score of 2.5 according to the Italian rating system Protocollo ITACA.

The integrated use of quantitative indicators at building, cluster and neighbourhood scale represents and innovative and unique experience in the Italian context. This approach will open a new way to manage sustainability issues in urban planning for Italian cities. It is also the first time that a mandatory minimum score on the base of a building rating system (Protocollo ITACA) has been included in a urban plan. These indicators will also facilitate the communications and the transparency of the transformation targets with all the stakeholders.

Source: City of Turin

http://www.comune.torino.it/urbanbarriera/

Name of good practice: IBA Metrozones
CLUE Partner: City of Hamburg

The "IBA Metrozones" is a planning strategy developed as part of the International Building Exhibition (IBA) Hamburg, taking place from 2007 to 2013 in the districts Wilhelmsburg, Veddel and Harburg. The IBA is a large-scale urban development project which German cities use to set new impulses for the (re-) development of a defined area of a city. The area contains harbour areas next to residential districts and derelict industrial sites and a high number of traffic arteries. Overall, it covers an area of 35 km².
The land ownership is as diverse as the land use of the area with a high proportion of privately owned properties. The IBA planning strategy tries to set new impulses for the development of the area by transforming these inner peripheries into neighbourhoods worth living. The IBA Metrozones strategy tries to find innovative solutions for the creation of attractive living and working spaces next to traffic arteries, areas of harbour and industrial uses. To reach this goal, the strategy realized mixed uses of light industry and residential uses in new buildings and redevelopment areas, applied innovative technical solutions of energy efficient and flexible construction to adapt to changing uses while contributing to climate mitigation.
The IBA process which is the underlying concept of the "Metrozones" is transferable to other districts. Working towards a defined goal within a set timeframe and the organization and coordination of the planning process through a private (city-owned) company (like the IBA Hamburg GmbH) is also applicable to other districts or cities. Bundling the planning process in the IBA Hamburg GmbH (separate from the day-to-day planning) provides an opportunity to create a more creative, integrative and cooperative planning process.

Source: IBA Hamburg GmbH

http://www.iba-hamburg.de/en/story/themes-of-the-iba/metrozones.html

Developing and realizing planning strategies for CLUEs

Exploring opportunities

Developing holistic strategies that fit the preconditions of a specific district and the requirements of its residents is a challenging task. Often, brownfield developments provide a great opportunity to develop more sustainable districts relatively close to the city centre. However, comprehensive analyses of the existing structures of the district in question, available technical solutions, problems and opportunities of the existing urban fabric and local population structure, climate impacts and other environmental conditions, etc. need to be the basis for the planning process. All CLUE good practices in this thematic field are based on comprehensive studies and analyses. Just as copying planning strategies from other districts is impossible (even within one city) these analyses safeguard the development of strategic goals and measures that fit local specifics.

Planning strategically on different levels

Districts are woven into the complex structure of the city. Therefore, strategic planning should not be limited to the district level. Rather, strategic planning approaches for specific districts should correspond to and contribute to reaching the goals of overall urban development strategies on the city level. Often cities develop a set of strategies at different scales in order to work towards desired long-term goals and avoid contradictions. This allows for defining structural principles for both the city and the district. In this regard, strategic district level planning allows for redefining overall strategies and emphasising and promoting specific aspects which are considered crucial or suitable for the specific district. Thereby, a relatively broad strategy on the regional or city level becomes more specific and tangible.

Guiding by visioning

Developing a vision for the future development of a district can be a good start for deriving overall goals and subsequent steps and measures to reach these goals. Thus, a vision can play a big role in integrating goals and measures. Furthermore, it helps communicating the project and its purpose to citizens and

stakeholders, can raise awareness and may motivate different actors to contribute to reaching the vision. Developing a vision based on the existing qualities of a district can play a great role in guiding strategic activities.

Involving communities

Districts are not only functionally connected technical infrastructures and buildings but also important reference points and living spaces for citizens. The local population identifies with their district and wants to participate in planning processes concerning their living environment. They have to accept new technologies and infrastructures, and have to be aware of the opportunities of innovative solutions and of the impact and importance of their behaviour for developing climate neutral urban districts. Therefore, participation and cooperation with community members is a crucial part of developing and implementing strategies for climate neutrality (see also chapter 4.2). This communication must be open to new initiatives and bottom-up movements in order to be able to take advantage of opportunities which may result from this kind of engagement. Climate neutral urban districts cannot be planned in closed processes limited to the municipal administration.

Cooperating with developers

The local administration has to play a leading role in guiding the development of climate neutral urban districts. However, as the municipality cannot realize the (re-) development on its own, it depends on private investors and developers. Especially if the municipality strives to realize very ambitious standards in regards to the energy efficiency of buildings, localized renewable energy generation, etc. Cooperation with developers is crucial as they have to realize these ambitious goals. Depending on the legislative framework, the city may have the opportunity to force developers to realise certain measures. However, developers cannot be obliged to realise developments. Therefore, they will only accept the additional costs and planning efforts of innovative technologies and measures when they benefit from these. Often this will only be the case when the (re-)development is economically attractive. Negotiating measures and projects based on cooperation, can lead to solutions that allow the developer to realise the development with sufficient economic benefits while also realising ambitious climate mitigation goals. Furthermore, cooperating in planning

processes may also result in mutual learning among developers and the municipality and thus improve technical solutions (see also chapter 4.2). As mentioned above, the negotiating position of the municipality strongly depends on the economic attractiveness of the (re-)development. The ownership of the land which is to be (re-)developed plays an important role in this regard. The position of the municipality is particularly strong when they own the land and the (re-)development is economically attractive. Land allocation agreements give the municipality the chance to define conditions for selling the land, thus, contractually obliging developers to realise high standards and innovative technologies.

Evaluating and improving sustainability

Learning is crucial to be able to develop climate neutral urban districts. Only technological, social and organisational innovations will make the implementation of a climate neutral district possible. Therefore, guiding concepts such as climate neutrality and sustainability need to be operationalized in order to define the basis for evaluation. A set of indicators needs to be defined. These have to fit the respective goals of the district's planning strategy. This allows the establishment of a constant follow up process which makes the improvement of measures and processes possible. Furthermore, these can be used to communicate targets and accomplishments and contribute to transparent processes and projects.

Planning strategies for CLUEs

Factors of success	Barriers & challenges
Sound analysis of local conditions in terms of building stock, infrastructure, population, etc.	Low economic attractiveness of (re-) development sites
Supportive legislative framework e.g. providing incentives for individual investments	Realizing ambitious standards above the legally defined standards (on national level)
Co-development and co-financing of measures with developers	Mismatch with local conditions
Participation of the local community	High investment costs and economic risks
Establishment of evaluation criteria and processes to allow learning and improvements	Lack of acceptance among local citizens

Policy recommendations for planning strategies for CLUEs

Policy recommendation	Purpose	Effect/impact	Responsibility
Establish a holistic, integrated, multi-level approach towards sustainability	Integrate local climate mitigation measures into a broader framework of sustainable and urban development	Supplementing projects and developments, prevention of contradicting measures, creation of synergies	City administration
Involve stakeholders and innovative business models	Implement innovative technical solutions and co-finance measures	Costs and gains of (re-) developments are distributed among municipality and stakeholders	City administration
Integrate assessment systems into urban plans	Establish indicators and performance targets to assess urban development	Transparent and easy to communicate planning goals through comprehensible targets	City administration

Policy recommendation: A holistic and integrated, multi-level approach to sustainability issues in urban planning

- Establish a holistic, multi-level approach towards sustainability.
- Integrate sustainability into different levels of planning and consider the different levels of detail needed to reach comprehensive plans on the district level.
- Stress the importance of setting climate mitigation efforts in relation to other goals of sustainable and urban development.

Striving for climate neutrality requires both the integration of goals and measures with other relevant aspects of sustainable development and different levels of planning within and beyond the city. A holistic approach to urban planning at multiple levels of detail, from comprehensive strategic planning on the city level to detailed planning of projects is necessary in order to find the best solutions for functional, climate neutral urban districts. These should not only be designed to reach climate mitigation goals, but also be well in line with broader strategic goals of urban development. Supporting instruments and funding sources of higher levels of government (regional, national, European) should be systematically exploited.

Only the adoption of an integrated approach which simultaneously addresses the environmental, social and economic dimensions of sustainability allows the creation of synergies in planning and implementation. Environmental

objectives that generate high costs for developers and future residents are likely to fail. Also, creating neighbourhoods with very high building and living standards may result in social exclusion and increased segregation. Only the right equilibrium between the three dimensions allows the city to succeed.

Policy recommendation: involvement of stakeholders and innovative business models

- Promote the adoption of new solutions and technologies in a district through close cooperation with private businesses and stakeholders.
- Develop innovative business models to realize innovative solutions.

Private stakeholders with expert knowledge need to be involved in planning and implementing climate neutral urban districts. Especially as innovative technical solutions may not be well known by the municipal administration and experiences from actual implementation might be limited. Therefore, available solutions and their benefits have to be explored, which requires close communication and cooperation between administration and private businesses.

The development and implementation of suitable business models and tools of financial support for stakeholders and property owners can very effectively promote the development of climate neutral urban districts. Business models need to be specified according to the possible sources of funding, the expenditures and costs, the savings and the partnership constellation. Financing can be in the form of grants, co-investment, lease-back arrangements, etc. These can be bundled with other energy and utility services.

Developing novel business models can involve establishing new, complex relationships between different bodies, and may need the design of agreements and contracts which are both attractive to private partners while allowing public bodies to retain sufficient control over the initiative. A crucial aspect is to understand the rates of return and risk management that investors and developers require, possibly at different stages of the projects, and ensure that the business models optimize them. New business models may also allocate responsibilities and incentives to the different stakeholders involved and may therefore have significant impacts on the scale and distribution of costs and benefits.

Policy recommendation: Integration of assessment systems in urban plans

- Promote the integration of assessment and rating tools at the building and urban scale in urban planning.

Assessment tools should support decision makers to make well-informed decisions based on achieved results and experiences made. These tools should capture all relevant issues for sustainable urban development: urban form and infrastructures, environmental, social and economic impacts of measures, etc. Assessment tools enable the setting of reliable, measurable and verifiable performance targets for urban areas. The assessment tools can be used to support design and planning activities, to verify compliance during the construction phase and to monitor the real performance of an urban area in operation. They allow improving and measuring the social, environmental and economic sustainability of urban districts, neighborhoods and clusters. Furthermore, assessment tools provide a common reference framework for the stakeholders involved in the (re-) development of neighborhoods and districts.

- Define an objective and transparent way to evaluate and pursue sustainability goals and targets.

Assessment tools have to be contextualized in a way to reflect local priorities and standard practices. Specific weights have to be assigned to sustainability issues while context related benchmarks have to be set for each criterion included in the system. The tool has to be flexible enough to reflect the unique challenges and opportunities of the specific development site. Overall, assessment tools facilitate the interaction between stakeholders early in the planning process and help to find consensus among key actors. The tools can be used to engage the community in the planning process as they clearly communicate comprehensible objectives and goals about future urban development.

4.4 Technologies and systems for heating, cooling and energy efficiency

Technologies and systems for heating, cooling and energy efficiency for climate neutral urban districts include all the technologies, systems and methodologies for energy production or consumption processes that help mitigate carbon emissions by avoiding or offsetting emissions within urban development. Climate neutrality for energy production or consumption processes is difficult to reach doing business as usual and is very difficult to reach within the boundaries of a neighborhood or in an urban redevelopment site. Only increasing the use of renewable energies and energy savings can get us close to climate neutral urban districts. However, there are many other technologies, systems and tools needed to further reduce direct and indirect carbon emissions.

The introduction of passive measures in construction to achieve energy savings, such as reducing consumption through high efficiency systems, using local resources, both renewable and waste (waste to energy technologies), implementing high efficiency centralized heating and cooling systems and integrating holistic models in urban planning are examples of measures that may have a significant contribution to reducing CO2 emissions. None of these measures are enough to achieve climate neutrality, but all of them contribute to urban systems nearly reaching the objective if they are implemented with further supporting measures. In this sense, it is important to follow a system approach instead of only focusing on specific measures, in order to move towards durable CLUEs. This allows identifying and using different synergies between projects, or existing uses as well as expanding technical infrastructure systems in the surrounding city and region.

The CLUE good practices regarding technologies and systems for heating, cooling and energy efficiency can be grouped into five concepts: integrated planning strategies that develop holistic approaches which take advantage of synergies on the district level, district heating and cooling systems which are more efficient and easier to manage than building-based systems, geothermal technologies and other renewable energy generation as climate friendly energy sources, and low energy construction to increase the energy efficiency of buildings. Active measures are not enough and face only part of the problem. Reducing energy consumption is necessary in order to be able to supply

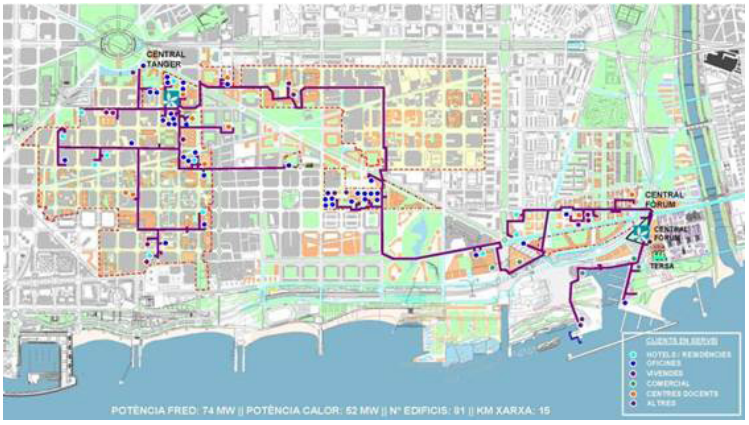
the demand with renewable sources, waste and high efficiency systems. Moreover, low energy construction materials or technologies can be used relatively easily for new construction or (re-)developing districts. However, the biggest challenge is to ensure that existing districts become more efficient. Energy refurbishment is key here. Moreover, the promotion of electrical power generation by renewables, waste and high efficiency systems and the life cycle analysis of building materials i.e. the energy and CO2 that is used for extracting, producing and transporting construction materials is needed. It is important to also consider and address social aspects such as the user behaviour as it determines the efficiency and effectiveness of various technical solutions.

Name of Good Practice	CLUE Partner	Stage	Character	Scope
CO_2OI Bricks - Internal Insulation - Wall Tempering System	Hamburg	Finished	Project	Building/ district
Geothermal field Akropotamos	Paggaio	Planning	Project	District
Zona Franca District Heating and Cooling	Barcelona	Consolidated	Project	District
Fòrum -22@ District Heating and Cooling	Barcelona	Ongoing	Project	District
IBA - Energy Bunker	Hamburg	Consolidated	Project	Building/ district
The Stockholm/ Hammarby Ecocycle model	Stockholm	Consolidated	Plan	District
Geothermal energy in Zakopane	Małopolska	Consolidated	Project	District

Name of good practice: Fòrum -22@ District Heating and Cooling
CLUE Partner: Barcelona Regional

The main goal of this system is the use of the residual energy from the waste incineration plant at the Fòrum. Part of the steam produced in the incineration plant is used to generate the heating and cooling demanded for connected buildings. These kinds of technologies are common in the north of Europe, but in the Mediterranean area, and especially in Spain, centralized systems are not usual. This system has two power plants (Fòrum and Tànger) with an installed capacity of 46,6 MW of heating and 69,2 MW of cooling, a network of 13,4 km and 68 buildings connected to the system (631.000 m^2), most of the tertiary sector but also some residential uses.

The use of these technologies represents a significant reduction in the consumption of fossil fuels and CO_2 emissions. In 2011 savings of 61.9 GWh/year of fossil fuels were achieved reducing CO_2 emissions by 10,961 t/year. This system is still growing so these reductions will be increased year after year.



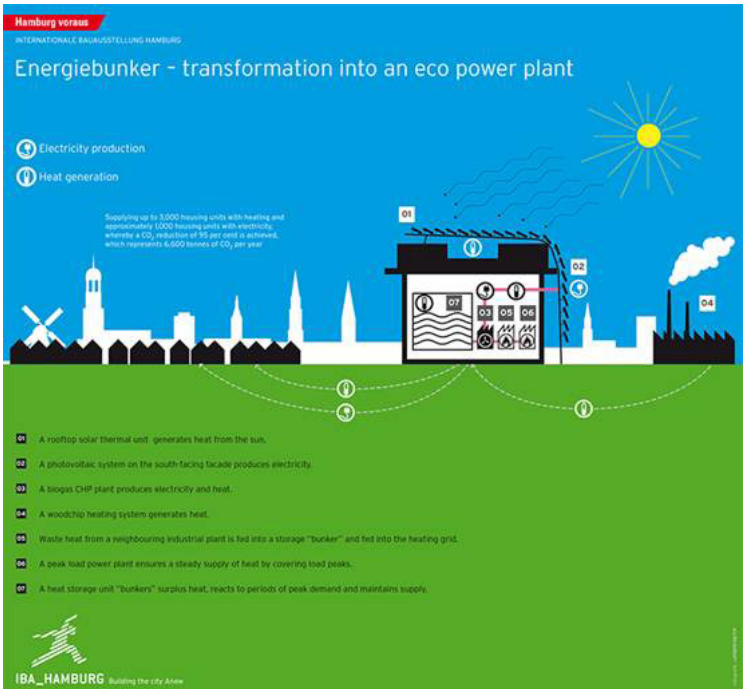
Source: Barcelona Regional

www.districlima.com

Name of good practice: IBA - Energy Bunker
CLUE Partner: City of Hamburg

The IBA energy bunker combines different technologies of sustainable energy generation (solar thermal units, photovoltaic system, biogas CHP plant, woodchip heating system) within one building which is a former flak bunker. Furthermore, it functions as energy storage and converts electricity generated of renewable energy sources into heat for the local heating network ("power to heat") during periods with high electricity production (therefore avoiding to be forced to switch off wind power stations). Moreover, it functions as a symbol for the transition to sustainable energy generation integrated into the city.

Production in total: 22,42 GWhth/year and 3,1 GWhel/year
The project has been realized in 2013; therefore it is too early to determine effects and proven outcomes. The forecast within the Climate Protection Concept "Renewable Wilhelmsburg" assumes greenhouse gas reductions of about 95%. There is big (national and international) interest in the energy bunker and the related technical concepts. Furthermore, the Energy bunker functions as symbol for the transition to sustainable energy generation perceived by local residents, city officials, professionals, and media.



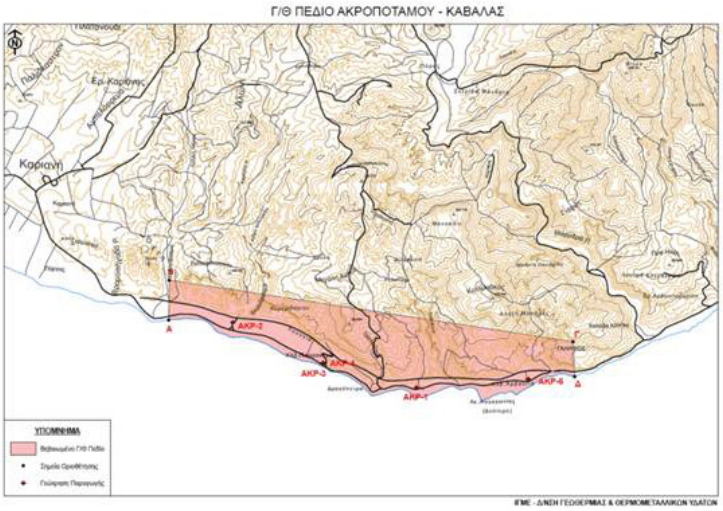
Source: IBA Hamburg GmbH

http://www.iba-hamburg.de/en/projects/energiebunker/projekt/energy-bunker.html

Name of good practice: Geothermal field Akropotamos
CLUE Partner: Paggaio

The Municipality of Paggaio has prepared a business plan about the management and exploitation of the geothermal field of Akropotamos. At the moment the case study is in progress and the final business plan of the project has been completed. The geothermal field would cover the municipality of Paggaio of 31,920 inhabitants (Census 2011). The potential of electric energy production from the Geothermal field of Akropotamos is 4,000 MWh per year. The annual thermal energy production potential is estimated at 54,000 MWh. The annual amount of CO_2 produced is 4,800 tn.

In the current drift of the case study the success of the project is being measured in terms of economic benefit for the citizens and for the Municipality (comparing the costs to the oil price, the decrease would be 72%, compared to the gas price 53%).
As the project has not been implemented yet, it is too early to be evaluated. However the project is very innovative in the area and will have many environmental and socio-economic benefits for the Municipality and its citizens.



Source: Paggaio Municipality

http://www.dimospaggaiou.gr/

Developing and implementing technologies and systems for heating, cooling and energy efficiency for CLUEs

Thinking in circular material and energy flows

Pursuing climate neutrality requires not only to reduce the direct emissions produced within a city or district but also to mitigate the GHG emissions originating from materials produced outside the city boundary (see chapter 3.3). Therefore, it is necessary to consider the whole lifecycle of materials and to close the loops of production, consumption, recycling and reuse of materials and energy which are consumed on the district level. Producing energy in a decentralized system and using and reusing materials on the local or regional level as far as possible contributes to reducing the environmental impacts of cities as a whole. However, this approach has to be established from the beginning of the planning process to influence all the following steps and thus be fully effective.

Integrating institutions, systems and technologies

Isolated technical measures to enhance renewable energy generation or energy efficiency and savings are not sufficient to reach climate neutrality. Rather, it is necessary to develop and implement well established and new technical solutions in an integrated way on the district level. Only by combining and integrating technologies and systems within a holistic approach that considers local preconditions such as the existing urban fabric, existing infrastructure and available energy sources, will climate neutral urban districts become possible. In order to be able to develop integrated measures, a guiding framework with a clear vision and common goals has to be defined at the beginning of the planning phase. The experiences made with the Hammarby Sjöstad Ecocycle model illustrate that these goals have to be binding for all municipal departments as well as private actors involved in the (re-)development processes. This ensures that all the activities of individual actors contribute to common goals and the realization of the district-specific concept.

Co-financing of measures with developers and investors

Implementing technologies and systems for heating, cooling and energy efficiency requires high investments. If the costs are only to be borne by the municipality the implementation of measures are strongly limited by the financial resources available to the local level. However, these will often not be sufficient for measures that could reach climate neutrality. Therefore, new business models have to be developed which allow co-financing measures with developers, investors and other institutions. Funding opportunities made available by national and European programmes should also be systematically used to support activities on the local level. Creating win-win-situations for public and private actors, using existing or creating new incentives to stimulate activities of stakeholders and citizens and taking advantage of existing funding opportunities allows financing measures to enter into a broad cooperation with various actors.

Analysing and planning for technology systems

As mentioned above, integrated technology systems on the district level are needed for climate neutral urban districts. For instance, local heating and cooling networks only contribute to reducing GHG emissions when they are connected to a local source of renewable energy. Thus, production and distribution has to be developed together to be fully effective. Planning these complex infrastructure systems requires significant effort. Extensive knowledge about the technology to be implemented and the local characteristics is needed. If possible, technology systems should be incorporated from the beginning of the planning process when (re-) developing urban areas. The thorough analysis of the local feasibility and demand has to be the basis of a sound planning process. As technology systems require high investments, these studies are needed to reduce financial risks and allow for a design based on the characteristics of the district and the demand of local residents. Available, feasible and effective resources and measures can be identified and possibilities for their usage can be explored. Furthermore, possible win-win situations and synergies can be explored at a very early stage allowing for the development of integrated measures.

Considering the users

The effectiveness of many technologies regarding their actual impact on GHG emissions depends on the acceptance and behaviour of the final users. The analysed CLUE Good Practices show that how citizens use techniques and infrastructure is crucial for their success. Therefore, measures should not be limited to technical issues. Rather, it is also necessary to address technolgoy users in order to try to influence their behaviour. Measures of information, awareness raising and participation can be used for these means. It is very important to factor in the users' behaviour from the very beginning of the planning process. Analyses and concepts should consider the influence of users on the effectiveness of measures.

Implementing in cooperation

Cooperating with different actors while planning and implementing technologies and systems for heating, cooling and energy efficiency is beneficial for several reasons: developing innovative technical solutions benefits from close cooperation with research and development (R&D) institutions and high financial costs may be easier to bear when measures can be co-financed with private stakeholders (in public-private partnerships) and funds from other governmental levels (regional, national, EU). Cooperation across different administrational departments promotes the development and implementation of integrated concepts and measures (see chapter 4.2). Furthermore, integrating citizens and stakeholders in cooperative planning processes raises awareness and may result in better planning decisions and results.

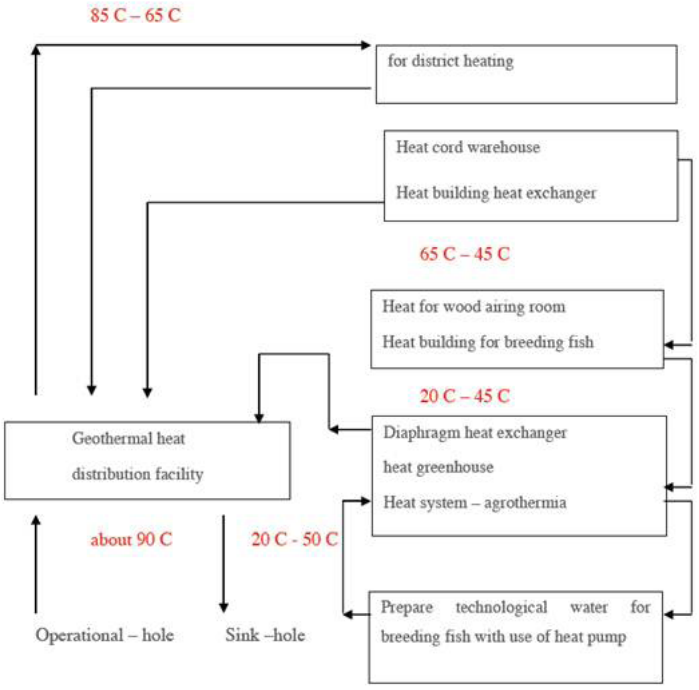
Factors of success	Barriers & challenges
Sound analysis of local conditions (feasibility and demand studies)	Attracting new users for district heating & cooling networks (especially if they are not very common)
Supportive legislative framework e.g. providing incentives for individual investments	Great planning effort is needed
Inclusion of awareness raising measures and education targeted at stakeholders (such as developers and building companies) and citizens	Competition of renewable energy sources, technologies and infrastructures with "cheap" carbon intensive energy sources and technologies
Co-development and co-financing of measures with stakeholders	Mismatch with local conditions
Integration of different technologies and systems on the district level	High investment costs and economic risks
District-specific, holistic concepts as a basis for the development and implementation of measures	Lack of district level integration of technologies and systems

Name of good practice: Geothermal energy in Zakopane
CLUE Partner: Małopolska

Geothermal energy in Zakopane is a long term project which started in 1981. It consists of a cascade system using geothermal energy. The feed zone of thermal water supply are the Tatra Mountains (an area of approximately 350 km²). Rainwater penetrates into the crevices systems of the Tatra Mountains and moves generally toward the north.

1000 m (Zakopane) – water temperature of about 26°C
2000 m (region of Bańska and Biały Dunajec) – water temperature above 80°C.

Cascade system using geothermal energy: A geothermal plant uses the hot water to produce heat. Water at a high temperature (85-75°C) is directed to the heat exchanger where it is cooled down by 30°C. Heat discharge water at a temperature of 40 – 45°C is used for fish farming and vegetable growing in soil heated polytunnels. Geothermal in Zakopane involves about 1,500 recipients (receivers) in several municipalities. It helps to replace the energy form coal by usage of geothermal energy for heating and it also helps to reduce CO_2, PM 10 and SO_2 emissions. Reduction of CO_2 emissions from 1999 to 2012 were more than 300,000 tons.



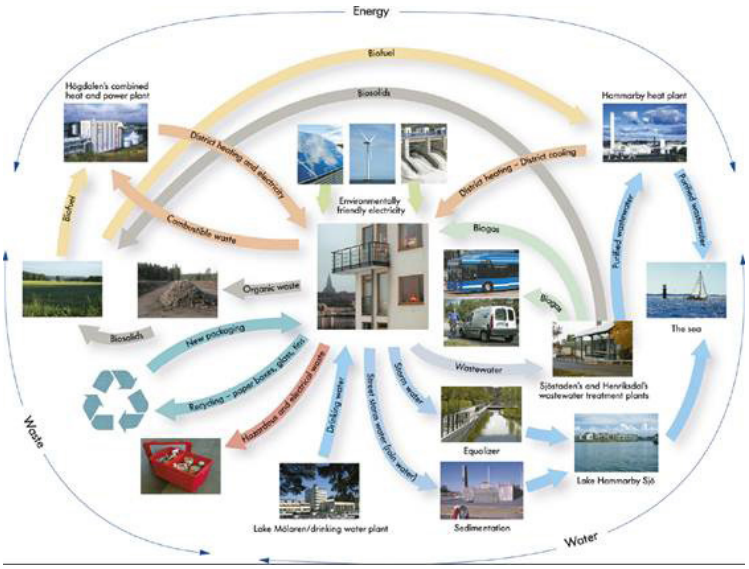
Source: Malopolska Region

http://www.malopolskie.pl/

Name of good practice: The Stockholm/Hammarby Ecocycle model
CLUE Partner: City of Stockholm

Hammarby Sjöstad, built on a former industry/harbour site, has become a pioneering example for sustainable urban development and eco-cycle thinking. Major goal is to develop Stockholm's leading global environmental position in smart urban techniques, climate mitigation and good living conditions. To assist and structure this work of becoming an eco-district, the so called "Hammarby Eco-model" was used as a planning tool. The "Eco-model approach" is about sustainable city development, highlighting increased energy efficiency, increased renewable energy use (biogas, solar), and climate mitigation by enhanced collaboration (public-private and triple helix). It is a show case to influence behavioural changes concerning the use of resources and transport. Most important in the usage of the model is the dedicated use of new technologies in an urban fabric of new and old buildings and infrastructure. Innovative is foremost the thinking together of many urban planning and technological aspects as well the creation of synergy effects.

The eco-district of Hammarby Sjöstad demonstrated that the specific preconditions of a new urban district must be taken in account early when choosing technical systems and infrastructure. The choice of technology and solutions must reflect the possibilities of future technologies and urban planning of a new generation with strong involvement of many stakeholders from the beginning. It also must be connected with already existing systems in the city. This applies both to infrastructural systems such as public transportation and local energy systems.



Source: City of Stockholm

www.hammarbysjostad.se

Policy recommendations for technologies and systems for heating, cooling and energy efficiency

Policy recommendation	Purpose	Effect/impact	Responsibility
Integrate technological solutions in strategic and district level planning	Promote integrated technological solutions through strategic local planning	More effective technological solutions through ex-ploitation of synergies and awareness raising among energy users	City administration
Foster district heating and cooling systems	Implement innovative technical solutions and co-finance measures	Costs and gains of (re-) developments are distributed among municipality and stakeholders	City administration
Promote “passive systems”	Establish indicators and performance targets to assess urban development	Transparent and easy to communicate planning goals through comprehensible targets	City administration
Invest in renewable energy generation	Promote the use of local renewable energy sources	Exploitation of climate neutral energy sources within a district or city	City administration
Promote the redevelopment of existing urban infrastructure	Apply a mix of instru-ments to reduce climate impacts of the building stock	Reduction of the climate impact of existing buildings	City administration
Internalise societal and environmental costs	Costs of products and services reflect their societal and environ-mental impacts	Products and services with low societal and environmental impacts become more attractive	National and international policy makers

Policy recommendation: Integration of technological solutions

- Increase the efficiency of urban structures and reduce the cities’ carbon footprint through the implementation of energy generation technologies in strategic planning, urban development and design, construction and use of buildings.

Urban planning has to plan for integrated technological solutions on the district level. District level energy solutions such as district heating and cooling systems should be promoted and implemented.

As the final energy efficiency or consumption of a building greatly depends on their users, it is crucial to raise their knowledge and awareness about the relevance of their decisions

and actions. The municipal administration should gather and communicate the necessary information and data regarding the influence of individual behaviour on energy consumption to the final users.

The municipal administration should use its competence in creating regulations and economic incentives to promote the implementation of integrated solutions. Furthermore, the private sector (especially the IT sector) has to be involved in the development and implementation of efficient technologies. Citizens need to be an essential part of it as receivers of knowledge, data, and awareness to promote smart decisions.

Policy recommendation: implementation of measures to promote district heating and cooling systems

- Increase the efficiency of urban structures and reduce its carbon footprint through the implementation of District Heating and Cooling Systems (DHC).

- Foster integrated planning at the district and city level which takes advantage of synergies and local and residual resources.

The centralization of DHC services can increase the efficiency of thermal generation processes compared to individual systems and simultaneously allow for more optimal management of the energy resources and demand. Legal requirements to centralize thermal production of the buildings would increase the energy efficiency of buildings and facilitate the potential connection to DHC as the best energy solution. Especially DHC solutions that work with residual or renewable energies should be promoted. Once a DHC is constructed, further measures are needed to favour the connection of the end users to heating and cooling networks in the area.

The municipal administration has to develop legal requirements and foster the most efficient solutions in each case. The private sector has to be involved in order to co-finance new DHC systems (see above) in public private partnerships and to promote the connection of industries and company buildings to the system.

Policy recommendation: Promotion of “passive systems”

- Promotion of passive systems as constructive and system methods incorporated into the structure of buildings that decrease or remove their energy demands without the need to use active systems to guarantee thermal comfort.

- Facilitate passive systems and adaptations to local specifics and climate conditions.

Passive measures in buildings are long-term investments as they are a no energy consumption option. Passive measures must be taken into account from the initial design of buildings and neighbourhoods. Therefore, they must already be considered from strategy development on.

There are some experiences designed and constructed, but there are only a few constructed solutions and they are not adapted to all climate conditions. Future research and experimentation is needed: on how to adapt passive systems to different climate conditions or different local conditions, on innovative technologies and on how to promote their implementation through suitable incentives and other instruments.

Policy recommendation: Enhancement of renewables as a future investment

- Increase the share of energy generated using fossil free options such as renewables.

- Promote the use of local resources.

Renewables and high-efficiency systems (including the use of waste sources) are crucial for developing new and existing carbon neutral urban districts and neighbourhoods. There are many forms, systems and technologies for renewable energy generation available. These should exploit available local and regional resources. Their feasibility and efficiency of implementation and use has to be considered in each case. The municipality should develop regulations and incentives to promote the use of renewables.

Policy recommendation: Rehabilitation of existing urban structures

- Provision of incentives and instruments for the rehabilitation of existing urban structures.

Existing urban structures have to be transformed to become more climate friendly. Incentives are needed to favour the rehabilitation of the existing building stock rather than the demolition and construction of new buildings. In this sense many different kinds of incentives have to be developed and adopted in an integrated approach, from regulations to financial incentives and the promotion of further research on climate friendly materials or building methods. Instruments such as energy services companies and energy audits must be implemented and regulated. Specific instruments have to be developed in order to promote the rehabilitation of rental buildings with multiple households or buildings with multiple owners.

Urban density can be a parameter that allows cities to be more efficient in different ways, but negative impacts on the quality of life of their inhabitants are also possible. There are many good practices around for planning eco-districts with low urban density but innovative concepts and strategies are needed on how to build a dense climate neutral urban district with a high quality of life.

Policy recommendation: Internalization of energy and environmental costs

- Favour a greener economy and a low carbon society through the internalization of societal and environmental costs in addition to the economic costs of products and services.

The economic cost of products and services do not correspond to their real costs as there are many environmental and societal impacts associated in the extraction of raw materials, manufacturing, transport, development and commercialization that are not considered. This results in choosing the most cost-efficient measures without considering their externalities and neglecting other solutions with more benefits considering this more holistic perspective.

This requires a supranational agreement at the international or European scale. Partial solutions or agreements would

discriminate those places that adopt an agreement like this. Internalising environmental and societal costs would foster, for instance, construction materials with less energy requirements and less impacts along the whole life cycle. Thus, it would be a powerful instrument to promote the use of more sustainable materials. The main responsibility for developing and implementing an agreement like this falls on policy makers at national and international levels.

4.5 Technologies and system solutions for urban transportation

Urban mobility accounts for approximately 40% of GHG emissions in cities. At the time being, there is a fundamental reliance on fossil fuels as the main energy source for vehicles all around the world. In some parts of the world, we are witnessing however, transformation towards cleaner options, such as electric trains and cars, or using bio-fuels as a replacement for petroleum. However, this is not enough to reach climate neutrality. Along with the large negative effects on the climate, the traffic structure of today also means degraded air and noise quality in cities with negative health impacts for urban citizens. Traffic infrastructure occupies big areas of valuable land and may lead to the fragmentation of urban spaces. Furthermore, congestion is a common condition which extends travel times and contributes to a loss of potential income.

Mobility in cities is strictly linked to urban planning and infrastructural/innovative systems, implying a cross-sectoral approach and cooperation in dealing with this issue. Urban planning in many cities has put a spotlight on the importance of achieving a sustainable city, aimed at fitting services and infrastructural systems on several territorial and social aspects such as local climate and environmental conditions, social dynamics, demography, social behaviour and economic development, taking advantage of their better exploitation and organization. Therefore, promoting a change in the modal split, that is, transforming the way we travel and move goods and reducing the reliance on motor vehicles, is one of the major challenges for cities both in terms of promoting a climate neutral transport sector as well as reducing its immediate environmental effects. Among the challenges for the health of our cities, the development of mobility and intermodality in an integrated system, through technological and management innovation applied to collective and individual transport, plays

an increasingly strategic role in the promotion of a culture of sustainable mobility and climate neutrality.

The CLUE project has identified several projects and good practices for how to deal with mobility and transportation that is also sustainable in terms of both climate mitigation and direct environmental impact. These cover the aspects of urban logistics, enhancing carbon neutral modes of mobility and integrated planning to enhance carbon neutral mobility on the district level. The city district has been identified as a geographic limitation that can be of use when analysing which policy measures are most suitable in the city in question. However, the field of urban mobility is much broader with several aspects not covered by the CLUE good practices such as parking management and regulations, car sharing systems, low emission drive technologies, public transportation, information and awareness raising.

Name of Good Practice	CLUE Partner	Stage	Character	Scope
Royal Seaport - strategic traffic prioritization	Stockholm	Planning/	Project	Building/ district
Bicing	Barcelona	Implementation	Project	City
StadtRAD	Hamburg	Implementation	Project	City
LOGeco	Rome	Planning/	Project	District

Name of good practice: Strategic traffic prioritization of Stockholm Royal Seaport
CLUE partner: City of Stockholm

In order to reach the goal of being fossil fuel free by 2030, the current transport habits have to change and the mode of transport for the people living and working in the SRS has to be primarily public transport and cycling. The Strategic traffic prioritization policy approaches this issue by setting standards for traffic in city district planning and development. The space available for transport has to be optimised to prioritise efficient modes to transport of people and goods. The prioritisation between different modes of transport will be apparent in the allocation of road space, the accessibility to a district by motorised vehicles and public services such as consolidation centres and transport information in public open spaces. The motto is that it should be easy to make the right choice.

There is not yet a working evaluation system and implementation of traffic measures have just been started so no concrete results on emissions can be presented. However, the number of parking spaces has been reduced from 0,7-1 cars/apartment to about 0,5 cars/ apartment and car pools are in place even in the early stages of the project. A logistics centre has been built for the construction phase. Planning efforts for bicycle and public transport are well under way.

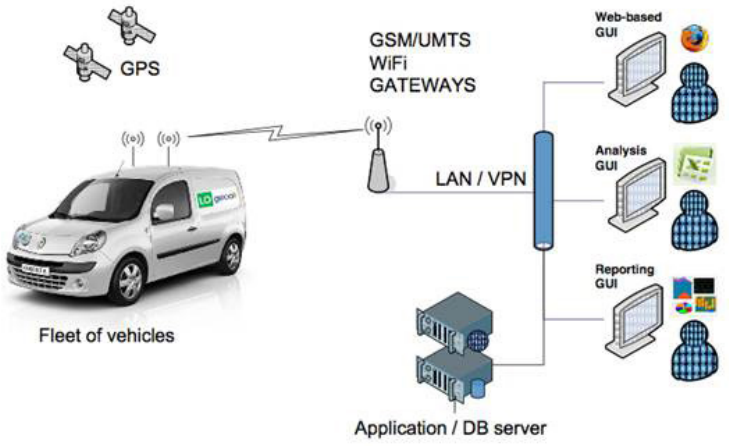
Source: City of Stockholm, Norra Djurgårdsstaden/flickr

http://www.stockholmroyalseaport.com/en/

Name of good practice: LOGeco
CLUE Partner: City of Rome

The LOGeco project aims to design and validate a new model for urban logistics solutions which entails innovative and sustainable actions. LOGeco involves all the relevant public and private stakeholders operating in the different distribution chains affecting the urban freight sector, and defines sustainable transport solutions for the 'last mile' in the city centre, mainly by electric vehicles transporting goods on demand from a local cargo hub to recipient businesses in the city centre. This policy aims to reduce greenhouse gas emissions but also improved liveability and attractiveness for tourists and businesses, through reduction of air and noise emissions and increase safety. Designed for long-term economic sustainability, it is not dependent on public funding.

Being implemented in 2012, LOGeco is in the early stages of adoption. The first phase has been completed and results show that LOGeco contributes substantially to reduced consumption for logistics. During the test period, 218 kg of CO_2 reduction/vehicle was calculated. The vehicles, according to monitoring and user reports, have been reliable and appropriate for the intended activity:
• A good 20 % margin on battery capacity.
• 5 times less cost/kilometer as compared to equivalent diesel transports.



Source: www.logeco.it/

http://www.logeco.it/

Developing and implementing technologies and system solutions for urban transportation for CLUEs

Going beyond the local level

Planning should not be limited to the district level when developing and implementing technologies and system solutions for low carbon urban transportation. Transportation is a complex topic with various implications and interrelations on the city and regional level. Measures implemented on the district level should be part of an integrated system of traffic infrastructure, modes and flows on the city and regional level. Local measures should work within these overall systems and contribute to reaching the goals of comprehensive traffic strategies on city and regional levels. Therefore, planning for climate neutral transportation should not start (nor end) at the district level but at the city or regional scale.

Integrating traffic modes and infrastructures

Low-carbon traffic modes can only provide an attractive alternative to individual car use when they are integrated in a functioning network of traffic infrastructure that promotes public, active and low-carbon mobility. For instance, bike sharing systems not only require rental bikes and stations but also a dense network of good quality cycling paths, a high density of rental stations at the right locations (e.g. close to train stations) in addition to local regulations that strengthen the position of cyclists in every-day traffic. Electro mobility requires the provision of infrastructure for charging stations at the right locations within the city considering the limited range of e-cars. This demonstrates that public, active and low-carbon transport needs to be integrated in an overall traffic system that supplements and reinforces the use of climate friendly modes of transportation, making the change from one low-carbon mode of transportation to another easy while traveling across the city. Isolated measures, however, are likely to fail as they do not deliver integrated solutions.

Making low-carbon mobility easy

Reducing private car ownership and use is one of the major tasks ahead in order to reach climate neutral urban districts. As regulating private ownership by law is not a viable alternative in Western society, planning for a society which does not have to rely on car travel is essential. The planning process should be guided by an idea of how future citizens can move about the city and within the district in a sustainable manner. Having a specific strategy for future personal travel is innovative due to the fact that it raises awareness of what the individuals can accomplish by choosing the right form of travel, while at the same time offering planners a way to aid future residents in sustainable travel behavior.

Developing financing models

Implementing and maintaining traffic infrastructure is costly. Therefore, developing new financing models is important. One way to do that is to cross-finance investments in low-carbon transportation through revenues generated by other fields. The CLUE good practice Bicing Barcelona provides one example on how this may be possible: The implementation of bike sharing stations is financed through users' payments and by a surplus from a roadside parking programme that introduced fees for parking within the city centre. Thus, travelling to the city by car is discouraged while alternative, less carbon intensive modes of transportation are provided. Other possibilities to generate new incomes are graduated prices depending on the intensity of use of the system or mobile advertising e.g. on rental bikes. Another opportunity provides the financing of measures in cooperation with private actors (in public-private-partnerships). This requires mutual benefits for the city and the investor. The City of Hamburg, for example, co-finances new bike sharing stations at locations of big employers when these bear a share of the costs.

Communicating with citizens and users

Transportation systems need to fit the needs of the users. Furthermore, users have to accept and understand new technologies and forms of transportation in order to pick them up. Therefore, information and dialogue is crucial. On the one hand, this is needed to influence the behaviour of individuals towards choosing low-carbon modes of transportation over conventional ones. However, awareness, behaviour and values

only change slowly. On the other hand, communicating with the designated users of transportation systems and technologies helps understand their demand and may thus lead to better (i.e. well accepted and well working) plans and concepts. Especially when a complex concept is developed that involves various actors in implementation, operation and maintenance of the system, user and stakeholder cooperation is crucial for developing a functioning system. The CLUE good practice LOGeco is an example where affected actors such as industrial associations, retailers, shop owners, transport operators are part of the cooperative process of concept development.

Factors of success	Barriers & challenges
Integration of measures on the district level in an overall strategy at the city or regional level	Land-use conflicts in dense urban areas
Reinforcing “hard” (i.e. infrastructural) and “soft” (i.e. communicative) measures	Lack of integrative transportation systems on a city and regional level
Creating synergies and co-benefits to co-finance measures with private actors	Mismatch with user demand
Inclusion of measures of awareness raising and education targeted at stakeholders and citizens	High investments and maintenance costs
Monitoring and evaluation of traffic systems	Lack of communication and cooperation with stakeholders and citizens

Policy recommendations for technologies and system solutions for urban transportation for CLUEs

Policy recommendation	Purpose	Effect/impact	Responsibility
Provide functional and effective alternatives to car use	Develop and implement integrated alternatives to car use such as public and active transport	Climate friendly modes of transportation are attractive and conveniently located	City administration
Adapt urban logistics to environmental needs	Develop a climate friendly system for the 'last mile' of delivery	Reduced carbon emissions and air and noise pollution in city centres	City administration
Establish broad political support for the strategic transformation of the modal split	Establish a sound basis for the long-term transformation of the transportation system	Consistent action and provision of funds oriented towards a long-term goal	City administration Local politicians

Policy recommendation: Introducing functional and effective alternatives to car use

- Provide functional and effective low carbon alternatives to car use.
- Raise awareness and promote behavioural change among urban travellers.

Car owners need to be provided with attractive alternative modes of transportation with low carbon emissions and environmental impacts. An integrated, long-term oriented approach is needed that promotes a change in the modal split where personal car use is counteracted. Introducing functional and effective alternatives on the district and city level is one way to reach this.

Key factors for success depend on convenient locations, easy access and availability at all times and low costs for the users. The transport alternatives also have to be considered to be safe and quick. They have to be integrated in the structure of the city and/or district. The urban form has to be adapted to the use of climate friendly modes of active and public transportation. Inter-modal changes from different modes of transportation have to be easy all across the city and beyond.

This requires an integrated approach on the district level which has to be well connected to the city in general so that the climate

friendly transportation system can be used throughout the city. The public sector is the main responsible actor to lead planning and implementation. However, it can be beneficial to integrate cooperative elements into planning such systems in order to be able to adapt and develop the system in accordance with public demand. The citizens as potential users have to be included in the development and evaluation of the system.

Individual transport choices are crucial for the climate impacts of urban mobility. Individuals have to decide to switch to climate friendly modes of transportation for the system to be utilized. Therefore, the use of alternative, more climate friendly modes of transportation has to be supported by measures of information, education and awareness raising.

Policy recommendation: Adapting urban logistics to environmental needs

- Design and validate a new model for urban logistical solutions which entail innovative and sustainable actions for making urban logistics environmentally friendly.

Providing low-carbon alternatives for the so-called ‘last mile’ not only reduces CO2 emissions but also reduces air and noise pollution and helps organising the distribution of goods within a dense urban area with high retail activity more efficiently. Reloading goods from ordinary trucks to smaller electric vehicles at specific terminals within the city allows crossing the ‘last mile’ and reaching the customer in a more climate friendly manner. Emissions are reduced while the liveability of the urban environment and the attractiveness of the city for tourists and commercial activities are increased.

Any city with a large enough central business or shopping district could make use of such a system. The chosen system needs to be adapted to the local conditions and the character of the local businesses that are involved. The design of the system should be specific to the local conditions. It should be the result of a cooperative development process involving affected businesses and service providers. All relevant public and private stakeholders operating in the different distribution chains affecting the urban freight sector should be involved in order to develop and implement a sustainable solution for ‘last mile’ deliveries.

Policy recommendation: Broad political support for a strategic transformation of the modal split

- Apply a strategic and comprehensive approach towards traffic planning. This can be introduced at a district level but needs to be integrated in strategies at the city or regional level.

Long-term support for strategies and investments in transport is of upmost importance for the successful implementation of climate friendly transportation systems. Changing transportation systems and routines is a transformation that requires long-term oriented, step-by-step actions. In order to establish long-term support for the chosen actions, applying a strategic and comprehensive approach towards traffic planning is needed. The goal is to transform the traffic system of the whole city. The traffic system of a carbon neutral city has to consistently promote walking, biking and public transport and counteract personal car use. This requires diverse measures such as the adoption of bike- and car-sharing systems, better public transport, a reduced amount of parking spaces and a city district whose urban fabric and functionality has been adapted to these new preconditions.

The success of this strategy lies in broad political support. Urban and traffic planners rely on political support for applying new and innovative solutions in designing the urban fabric. The content and extent of the strategic approach needed highly depends on local conditions and political will. Efforts have to be developed in cooperation with politicians and the municipal administration. Primarily, the responsibility lies with the city planning and traffic planning administrations to propose a traffic strategy that would be reasonable for politicians and the public. A public debate about the future of the city's traffic future could be of great value.

Developing climate neutral urban districts requires an integrative approach which accomodates various measures and instruments as well as constant learning, evaluation and adaptation.

5 Approaching climate neutral urban districts and cities

Over the last years, more than 2,000 public institutions across Europe have been learning from each other through cooperation in about 200 interregional policy development projects within the INTERREG IVC programme. This is a very valuable basis for policymakers all across Europe. It is important to find evidence to support future actions as local and regional authorities do not necessarily have the resources to try out different policy practices without knowing if they have worked anywhere else.

While the policy recommendations presented in chapter 4 were directly derived from the work in the five CLUE work groups, this chapter illustrates overall policy recommendations on how to approach climate neutral urban districts and cities on a more general level.

5.1 Urban policy making towards CLUEs

As stated in chapter 3.1 and proved by the findings of the CLUE work groups (see chapter 4), local policies play an important role in fostering urban societies as they work towards climate neutrality. In the chapters above, it also becomes clear that cities in Europe have varying preconditions when it comes to climate change mitigation efforts and their endeavouring to realize a low carbon or climate neutral development. This also implies that policy choices and their implementation embrace very different aspects in each city. Important from a CLUE perspective is, however, that cities continuously improve their mitigation efforts by creating urban districts that consume less energy and resources, achieve shrinking GHG emissions and use clean technologies in a context of an even greener economy.

There is plenty of good advice for policy making from different projects, programmes and networks within nations, the European Union and globally. In the framework of this report it can only be recommended that these sources should be considered when working towards combating global warming and substantially decreasing GHG emissions. Within the CLUE project there is however a focus on recommendations for policy making that delivers starting points for establishing, maintaining and evaluating climate neutral urban districts. They present

some guiding steps to be adopted by local policy makers in the transition process towards climate neutrality.

The policy recommendations concentrate mainly on the first phases of the policy cycle i.e. problem definition and agenda setting – but partially also to later phases (see also chapter 3.1 and figure 4). However, the two first phases are the most meaningful and will be highlighted within the context of CLUE as the conditions across the various European countries are too different to make suggestions for implementation and evaluation. Those cities that have already started to work with dedicated climate neutral urban districts are only a few, but they are good guiding examples on how to "get started" and set up a roadmap approach (see chapter 3.4) in order to establish a CLUE.
On a general level there are some important policy recommendations made by the CLUE project that present a guiding proposal to establish and work with climate neutral urban districts:

- Convincing important decision-makers to go for CLUEs

The starting point needed to establish a structured approach with targeted measures towards a climate neutral future is to set up clear climate change mitigation goals for a city. One way to pursue such goals on the local level is to establish one or several climate neutral urban districts within the city boarders. Such a decision is not easy to reach as many constraints can hinder it. However, as the CLUE project has shown, it is worth it for cities to try out new ways of combating global warming. For making this a reality, a specific city administration should take the lead. It should consequently work on creating a broad and shared understanding of the advantages of a CLUE. Good examples and benchmarking results from cities that already work with CLUEs can help to convince decision-makers to support the necessary step towards establishing a CLUE within their own national framework. Once a politically legitimised decision has been adopted, the CLUE concept has to be anchored within the municipal budget. In the following process, the coordinated engagement of different relevant administrations within a city is as important as involving external consultants, developers and investors, academia as well as NGOs.

- Ensure cross-political support

Establishing CLUEs is a long-term process that requires consequent action. Broad political support by the majority of the local politicians needs to be its basis. Starting with raising awareness and mobilising support for the transition process among politicians, the city's government has to ensure a strong political commitment over a long period of time. Otherwise there is a significant danger that the city reduces its efforts when political majorities change after elections. The membership in international (city) networks and concluding self-binding agreements can help to establish and maintain political support.

- Roadmaps as an overall approach

Roadmaps are a concept to structure short-term actions on the way towards the long-term goal of climate neutrality. Roadmaps are a promising approach to establish a transparent process with a high number of coherent and subsequent measures to achieve climate neutrality. Each city must develop its own roadmap as local preconditions differ, but they must always keep climate neutrality as the destination. These roadmaps should include all the issues specified in this report, from legislation and regulation, via cooperation and participation, to implementation of innovative urban solutions. As mentioned above, roadmaps of this kind need long-term commitment, financial means and innovative processes and measures so as not to lose momentum towards the final goal of climate neutrality. The most important step is to set up a roadmap in order to get started with the work towards climate neutrality.

- CLUEs' achievements to be transferred city-wide

Climate neutral urban districts are beneficial as they are proven to have many co-benefits regarding sustainable urban development. They are very good test beds for new "smart" technological concepts, social experiments presenting new life-styles and new business models integrated in urban development processes. They are, however, not the only solution for reaching climate neutrality, but their results can give important guidance for the transition process in the entire city as lessons learnt can be transferred to other districts and neighbourhoods. To ensure the dissemination of CLUE results in a city, it is necessary to embed routines for the active transfer of new experiences. This can enhance municipal planning and budget schemes towards climate neutrality.

- Fundamental changes, not only technical innovations

CLUEs can have an important role in creating knowledge and offering fundamental solutions and changes towards a more sustainable city, i.e. the conversion of the urban fabric towards climate neutral structures. As striving for climate neutrality requires tackling climate change mitigation from many different angles, this approach can open up opportunities for many (necessary) changes within that process. Creating effective combinations of indispensable measures, considering social necessities, making up new business models, avoiding sub-optimisation and establishing synergies between various sectors and stakeholders are crucial preconditions for making in depth changes possible. In other words, CLUEs should not solely focus on technical innovations alone. This would be far insufficient. Therefore, the responsible administration and/or project leaders of a CLUE must be very careful with their decisions when defining the scope, borders and roadmap for their CLUE work.

- Learning schemes to be established from the beginning

No matter how successful a CLUE can be, climate neutrality at the district level is not sufficient. Following a CLUE approach is not an end in itself. It is foremost an experiment that should lead to learning and better understanding of system needs (energy and resource flows, transport, eco-systems, environmental systems and social aspects of climate mitigation such as gentrification within a city) and necessary investment decisions. Cities also should avoid the "sustainable island effect" where a district becomes a forerunner but the rest of a city is "forgotten". The responsible city administration and the political decision-makers have to ensure that the results should be diffused into the city and society at large. The planning process of CLUEs (and the implementation processes within a CLUE) have to be directed right from the start with that target in mind. The necessary institutional learning effects should be documented (including the mistakes and failures!). Successful and best solutions (technical, social, environmental) should be further optimized and be made part of statutory requirements. The city's government and the involved stakeholders both from the public and private side are responsible for this.

- Integrated planning/synergies between sectors

To establish a CLUE, many different fields of action have to be taken into account. They should not be dealt with separately, when establishing a CLUE a holistic approach has to be taken. While planning for CLUEs, all sectors have to be considered into account (the efficiency of the buildings, energy use and production, transport solutions, information and participation of citizens, etc). An integrated approach also helps to take the right path on the roadmap to climate neutrality. This means that the city's administration which is in charge must be aware that the necessary framework must be established right from the beginning.

Policy recommendation	Purpose	Effect/impact	Responsibility
Convincing important decision-makers to go for CLUEs	Reach early adopters as well as stragglers to start work with a CLUE	Setting CLUE as a perspective and goal in a city's budget and administration	City government
Ensure cross-political support	Have political backing not only from the prevailing majority	Ensure long-term support which is needed for establishing CLUEs	City government, administration that leads the CLUE work
Roadmaps should be chosen as an overall approach	Finding a functioning approach to structure a CLUE initiative	Setting goals and measures into a systematic scheme including feedback loops	City government, administration that leads the CLUE work
CLUEs achievements to be transferred citywide	Learning from a CLUE on an institutional level	Improving the city's overall planning and implementation work	Administration leading the CLUE work as well as many receiving stakeholders
Fundamental changes, not only technical innovations	Create a framework for fundamental changes towards a low carbon society and green economy	Incremental transformation of a city's structures and different subsystems	City government, administration that leads the CLUE work and many others that make the change possible
Learning schemes to be established from the beginning	Improving competence and work skills of a city's institutions and stakeholders	Making a city more resilient, avoiding sub-optimisation and bad solutions	City government, administration that leads the CLUE work
Integrated planning/ synergies between sectors	Include all relevant fields of action	An integrated approach helps to take the right path within the road map to climate neutrality.	Administration that leads the CLUE work

5.2 The way ahead

The concept of climate neutral urban districts is a young field of discourse and a new planning approach facing many challenges. Climate neutral urban districts can make a valuable contribution to the necessary transition towards a low carbon society. However, ambitions and reality diverge. Decision-making and practice in cities has so far not been ready for the full implementation of a big number of necessary measures which are needed to reach climate neutral urban districts. However, there is a growing awareness of low carbon issues in discussions, strategies and arguments pertaining to urban development. It is, however, important that low carbon and climate neutrality policy considerations are being mainstreamed in urban politics, planning and implementation in order to bring about the necessary transition.

CLUEs can be regarded as "forerunner districts". They are about smart urban solutions but cities and their districts are above all about people, i.e. the daily life, exchange and socializing within a city. Smart solutions and other technological innovations are therefore not enough, as they are just one layer of a necessary and holistic approach to sustainable urban development. The resilient city of the 21st century is hence not only about technological innovations and solutions. The question is rather what institutional structure would be necessary in order to ensure legitimacy, political leadership, long-term commitment to climate change and the indispensable stable socio-economic foundation for transition towards climate neutrality? One way of getting this process started could be developing CLUEs which function as test beds for physical, economic and societal change.

CLUEs can be very sustainable urban districts as they stipulate climate neutrality and thereby have many other effects which relate to sustainable urban structures. Such districts create many co-benefits including new and intelligent urban solutions. The significance of CLUEs is therefore high, despite their limited geographical scope. This is due to the fact that such districts are experimental areas which comprise integrated planning and system integration (technical and socioeconomic systems) in parallel. They stand for high sustainable ambitions, especially in the area of environmental efforts. Last but not least, such districts can considerably contribute to behavioural changes of urban citizens. These positive factors alone would be enough to motivate the necessary designated urban interventions and related investment costs. However there are risks that such

districts also become islands of sustainability with very high standards and therefore high costs for housing and technical infrastructure.

As this report shows, CLUEs are in the technological forefront by definition and are showcases for sustainable urban development with an emphasis on climate mitigation and climate neutral development. While there are no realized, truly climate neutral urban districts in the world as of yet, such showcases are greatly needed in order to direct enormous investment decisions in the light of climate change. The necessary global investment in low-carbon energy and energy efficiency technologies was around 214 billion EUR in 2013, down 12 percent from 2012, and far short of what is needed. The International Energy Agency believes that to keep the global temperature rise below 2°C, the level deemed critical by scientists to avoid a global climate catastrophe, overall 27 trillion EUR, or 761 billion EUR annually are needed in clean tech investments by 2050, and foremost in cities. Financing and making green growth a reality is thus the key challenge of the urban future!

The climate neutral city of the 21st century is not only about technological innovations and solutions. The question is rather what institutional structure would be necessary in order to ensure legitimacy, political leadership, long-term commitment to climate change and the indispensable stable socio-economic foundation for the transition towards climate neutrality.

6 Appendix

Criteria
Examples should contribute to INTERREG's goal of a low carbon society, EU 2020 and other guiding European policies and framework
Representative district or neighbourhood with characteristic features (unique and urban)
High degree of visibility and transferability
Ongoing or finished project/programme or part of it, to be characterized as 'laboratory'
Integrated approach of sustainable urban planning
Establishing new and innovative approaches
Involvement of CLUE partner itself during project time
Data, Information, Monitoring should be available or planned to be established
Measures and activities to be undertaken in the initiative should be described
Link city development and energy/climate issues, and contribute to the following themes:
Sustainable city development
Reduced energy use and increased energy efficiency (e.g. ambitious building codes)
Increased renewable energy use
Climate mitigation and adaptation to climate change (e.g. cooling systems)
Enhanced collaboration (public-private, public participation)
Green economy
Positive social effects
Contributes to behavioural changes

Figure A1: Criteria to evaluate and select good practices for climate neutral urban districts

Name of Good Practice	CLUE Partner	Stage	Character	Scope	Thematic field	Link
Thermo Solar Energy Regulation	Barcelona	Implementation	Policy	City	Legislation/ regulation	http://www.barcelonaenergia.cat/eng/operations/ost.htm
Hamburg Climate Action Plan 2007-2012 New: Master Plan Climate Action	Hamburg	Updated Implementation	Strategy & Funding Programme	City	Legislation/ regulation	http://www.hamburg.de/masterplan-klimaschutz/
The Urban Quality Protocol	Rome	Implementation	Policy	City	Legislation/ regulation	http://www.risorse-spa.it/en/100-attivita/pdq/926-the-protocol-of-the-urban-quality-of-rome-capital.html
The Stockholm Royal Seaport Project: Overall Programme for the Environment and Sustainable Urban Development	Stockholm	Policy Development / Planning / Implementation	Strategy	District	Legislation/ regulation	http://www.stockholmroyalseaport.com/en/
Energy-environmental Annex of the Building Regulations of the City of Turin	Turin	Implementation	Policy	City	Legislation/ regulation	http://www.comune.torino.it/en/
Royal Seaport - Learning programme	Stockholm	Implementation	Project	District	Private actor and citizen engagement	http://www.stockholmroyalseaport.com/en/
Citizens' Solar Power Plant	Vienna	Implementation	Project	City	Private actor and citizen engagement	http://www.buergerkraftwerke.at/eportal2/
Mitte Altona - Citizen participation	Hamburg	Planning	Project	District	Private actor and citizen engagement	http://www.hamburg.de/mitte-altona/
Smart City Wien – Stakeholder Process	Vienna	Planning	Policy/ Strategy	City	Private actor and citizen engagement	https://smartcity.wien.at/site/
Vallbona Ecodistrict	Barcelona	Baseline analysis/ Plang.	Project	District	Planning strategies	www.bcnregional.com
Urban 3 Barriera di Milano - Variante 200	Turin	Planning/ Implementation	Project/ Strategy	District	Planning strategies	http://www.comune.torino.it/urbanbarriera/
Mitte Altona	Hamburg	Planning	Project	District	Planning strategies	http://www.hamburg.de/mitte-altona/
IBA Metrozones	Hamburg	Implementation	Strategy	District	Planning strategies	http://www.iba-hamburg.de/en/story/themes-of-the-iba/metrozones.html
KLIP – Vienna Climate Protection Programme	Vienna	Implementation	Policy	City	Planning strategies	https://www.wien.gv.at/english/environment/klip/
CO2OI Bricks - Internal Insulation - Wall Tempering System	Hamburg	Implementation	Project	Building/ district	Technologies for heating, cooling and energy efficiency	http://www.co2olbricks.eu/
Geothermal field Akropotamos	Paggaio	Planning	Project	District	Technologies for heating, cooling and energy efficiency	http://www.dimospaggaiou.gr/
Zona Franca District Heating and Cooling	Barcelona	Consolidated	Project	District	Technologies for heating, cooling and energy efficiency	http://www.ecoenergies.cat/es/
Fòrum -22@ District Heating and Cooling	Barcelona	Implementation	Project	District	Technologies for heating, cooling and energy efficiency	www.districlima.com
IBA - Energy Bunker	Hamburg	Consolidated	Project	Building/ district	Technologies for heating, cooling and energy efficiency	http://www.iba-hamburg.de/en/projects/energiebunker/projekt/energy-bunker.html
The Stockholm/Hammarby Ecocycle model	Stockholm	Consolidated	Plan	District	Technologies for heating, cooling and energy efficiency	www.hammarbysjostad.se
Geothermal energy in Zakopane	Malopolska	Consolidated	Project	District	Technologies for heating, cooling and energy efficiency	http://www.malopolskie.pl/
Royal Seaport - strategic traffic prioritization	Stockholm	Planning/ Implementation	Strategy	District	Urban transportation	http://www.stockholmroyalseaport.com/en/
Bicing	Barcelona	Implementation	Project	City	Urban transportation	https://www.bicing.cat/
StadRAD	Hamburg	Implementation	Project	City	Urban transportation	http://stadtrad.hamburg.de/kundenbuchung/
LOGeco	Rome	Planning/ Implementation	Strategy	City	Urban transportation	http://www.logeco.it/

Figure A2: Selected good practice examples of the CLUE project

Imprint

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www.clue-project.eu

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