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## Economic Commission for Europe

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**Review of implementation of the programme of work for 2010–2011:  
improvement of urban environment performance**

### **Climate neutral cities: how to make United Nations Economic Commission for Europe cities less carbon intensive and more resilient to climatic challenges**

#### **Note by the secretariat**

##### *Summary*

The United Nations Economic Commission for Europe (UNECE) Committee on Housing and Land Management organized a seminar on “Climate Neutral Cities” on 23 September 2009 in conjunction with its seventieth session. Among its aims were to explore the overlap between energy efficiency in buildings, spatial planning and urban transport so as to provide member States with policy guidelines on those issues. As a follow-up to the discussion of the outcomes and recommendations of that seminar, the Committee decided to include climate neutrality in its programme of work under the item on urban environmental performance. The Committee also agreed to develop a study, which would identify means and tools for climate change mitigation and adaptation in cities, building upon the work already done by the Committee.

This note contains an extended outline of the issues which will be raised in the proposed study. The study itself is to be completed following the Committee’s discussion of the outline at its seventy-first session, for finalization by the secretariat and submission to the Committee at its seventy-second session for endorsement.

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## **I. New challenges for cities: climate change, cities, and policy agendas**

### **1. Introduction**

1. The study on climate neutral cities will be written to provide policy practitioners, planners and other professionals, as well as the general public with an accessible overview explaining the relationships between cities, climate change and energy and outlining responses which are required to mitigate UNECE cities' energy intensity and carbon footprint, to reduce their vulnerabilities to climatic conditions, and to overall advance their social, economic and environmental sustainability. It is hoped that the study will be a reference guide used for formulating relevant policies at the international, national and, importantly, municipal levels.

2. Starting with making the case for climate neutrality, this study will specify a range of measures for a progressive transformation towards low-energy, low-carbon, highly resilient and ultimately climate neutral cities. The outlined measures will have broader positive multiplication effects, allowing UNECE cities to address many of their social, environmental and developmental challenges.

## 2. Climate change, cities and policy agendas

3. One of the most pressing challenges of the present century is to respond to the immediacy of climate change, without compromising the principles of sustainable development. This should involve, above all, limiting greenhouse gas (GHG) emissions through a radically reduced energy use from fossil fuels (decarbonized economy) and also coping with the remaining unavoidable effects of climate change to minimize costs to people and infrastructure, as well as to natural ecosystems.

4. There are many implications for cities here. Cities are responsible for a significant part of GHG emissions — both directly as generators of such emissions and indirectly as end-users of fossil fuel-based energy and other goods and services, the production of which generates emissions elsewhere. But urban communities are also themselves vulnerable to changing climate. Concentrating people and infrastructure (often already in hazard-prone areas), these areas will experience some of the largest human and economic losses from natural disasters, as well as other negative consequences, and it is the poorer and more disadvantaged people that will suffer most. Cities must therefore embrace socially oriented policies of adaptation to minimize the negative impacts of those events.

5. Both sides of climate change policy — mitigation (locally responding to global climate change) and adaptation (responding to the local implications of climate change) — are integral parts of a comprehensive urban strategy for climate neutrality. Climate neutrality is a goal to which all UNECE cities should aspire; it suggests: (a) that cities achieve net zero emissions of GHG by reducing GHG emissions as much as possible and developing trade-off mechanisms to offset the remaining unavoidable emissions, and (b) that the cities become climate-proof, or resilient to the negative impacts of the changing climate, by improving their adaptive capacities. Efforts should be geographically focused, so that the balances of the GHG emissions are considered within the boundary of a given territorial unit with most offset mechanisms being implemented locally, while sufficient mandate is provided for the management of the climate neutral policies at the local level. This territorial approach also presupposes a change from fragmented sectoral-based regulations and projects to an interrelated matrix of comprehensive actions integrated at an urban scale.

6. It is estimated that the UNECE region is responsible for as much as half of total global greenhouse gas emissions (UNECE, 2009a, p. 10). As, overall, it is a more economically developed region than those of the other United Nations regional commissions, UNECE cities inevitably bear a great responsibility for decarbonizing their built and economic environment, while at the same time improving the resilience of the whole region and delivering leadership to the rest of the world. In fact, UNECE cities already possess good institutional prerequisites, namely, local administrations and spatial planning, for an effective construction and delivery of integrated territorial policies for climate neutrality. There are indeed many successful examples in the region of city-focused responses to the climate neutrality agenda. However, the existing situation leaves much room for improvement both in the west and in the east of the region. Even those cities that are considered to be advanced in their climate change policies are far from fully realizing their potential for low-carbon and high-resilience transformation, while others may not have sufficient political will, information or resources to follow leaders even in the same national context. Furthermore, ageing and badly maintained physical stock and energy-inefficient practices in many cities of transition countries of the region, coupled with limited awareness and capacities, represents a serious barrier in terms of both resilience and mitigation. That said, the very diversity of the experiences of cities in the UNECE region represents an important source for mutual learning, capacity-building, advocacy and the consequent diffusion of innovative practices both within and beyond the region.

7. But climate neutrality is not simply a strategy to respond to global warming; it is also a means to address many other environmental, economic and social challenges. In fact, reducing energy use and associated GHG emissions is an important contribution to the urban sustainability agenda with multiple co-benefits. Policies such as “smart growth”, transport planning, increased green spaces and energy efficiency are all elements of urban sustainability strategies that predate the international quest for climate neutrality. The need to reduce GHG emissions and related international commitments only strengthen the

importance of these policies (see UNECE, 2009c). Furthermore, climate neutrality, as this study will show, is a great opportunity to promote national and local economic competitiveness, to enhance energy security, to improve quality of life and to tackle poverty. To be sure, benefits from climate neutral cities represent a “multi-win” situation, with positive effects at different scales — from the global community as a whole, to national economies, to cities, on down to individual citizens who will enjoy an improved living standard, better health and more job opportunities. The explicit pursuit and advocacy of these co-benefits are also crucial to generating sufficient support to climate neutral policies among different stakeholders.

## **II. General policies and institutions**

8. This chapter of the study will review institutional and cross-sectoral/territorial mechanisms that underpin mitigation and adaptation strategies as far as cities are concerned. More specifically, it will review the role of international and national policies and those of city governments, as well as of urban planning and building control policies, and will outline urban resilience policies. It will also provide recommendations regarding governance frameworks for the development and implementation of relevant policies. Measures will be identified in this chapter to better inform Governments about the institutional mechanisms that should be in place at the different levels. These measures will also be considered in chapter IV for the “City Road Map for Climate Neutrality”, which will outline necessary actions to be implemented in the UNECE region at the city level.

### **1. International and national policies**

9. At the international scale, regulatory regimes for climate neutral cities are linked, above all, to the architecture of global climate governance shaped by the United Nations, including the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The reduction of energy consumption and emissions in urban areas constitutes important measures to comply with the Protocol. As the commitment period of the Kyoto Protocol expires in 2012, there are international negotiations on a regime succeeding it. It is apparent, however, that countries will have to commit themselves to ambitious reductions in GHG within a post-Kyoto agreement.

10. UNECE has taken a number of initiatives relevant to the field of climate change in the built environment. Several framework documents are particularly noteworthy for the purpose of this study. First, the UNECE has recently prepared a draft Action Plan on Energy-efficient Housing in the UNECE Region. It develops a comprehensive programme of work for a progressive transformation towards a low-energy and ultimately carbon-neutral building/housing sector. It outlines three policy areas as constitutive elements for such a transformation, including energy-efficiency governance, technology integration and access to energy efficiency. Second, the Transport, Health and Environment Pan-European Programme (the PEP) was adopted in 2002 as a joint programme of UNECE and the World Health Organization (WHO). The PEP considers how - through the development to of clean and efficient public transport, improving the coordination between spatial and transport planning and providing infrastructure for walking and cycling, on the one hand, and improving energy-efficient and clean transport modes, on the other hand, - to decrease the impact of transport on health and the environment and to reducing transport-related GHG emission. Third, the UNECE Strategy for Education for Sustainable Development (CEP/AC.13/2005/3/Rev.1) promotes integration of sustainable development into the education process at the national level. This promotes climate change as a priority issue by integrating its economic, environmental and social aspects into educational policies and curricula.

11. Some regulatory developments can be seen at the European Union (EU) level. In 2009, the EU adopted an integrated package of energy and climate policy, which includes the commitments to be reached by 2020 (known as 20-20-20).

12. At the national level, most Governments in the UNECE region have their own strategies and laws, which are translated into regional and local policies. As well as regulatory instruments, a number of financial, educatory and voluntary instruments can be found across the region. The workability of the national and regional initiatives, however, varies considerably. In many countries energy efficiency and climate legislation and strategies remain declarative or are limited in scope. The following policy instruments can be used at the level of national Governments in order to advance the transition towards climate neutral cities.

- (a) Sectoral and cross-sectoral instruments of national Governments:
  - Regulation: legislation, performance standards, regulations for utilities and the public sector, national action plans.
  - Financial and fiscal incentives: grants, subsidies, tax incentives, social/welfare assistance.
  - New markets: the establishment and promotion of a carbon market, green markets, energy efficiency services.
  - Strategic programmes: research and development, programmes for the public sector.
  - Advocacy and capacity-building: educational programmes, information facilitation, awareness-raising.
- (b) Territorial instruments of national Governments:
  - Observing the national policies and targets via territorial agencies.
  - National spatial planning and building regimes.
  - Interspatial fiscal redistribution regimes.
  - Area-based investment programmes: infrastructural and environmental programmes, special programmes for vulnerable areas.

## 2. City governments

13. City governments represent an important laboratory for innovation in climate policy and practice. As a number of sectors important for GHG emissions are located in the urban territory, city governments can play a crucial role in influencing the transformation of those sectors. Indeed, even in the absence of dedicated policy regulations at the national level, city governments have long been developing their own responses to global warming. There are examples of cities from the UNECE region that have committed themselves to stronger emission targets than their respective nation-States. Some cities even target climate neutrality, thus bringing that ambition closer to reality. City governments are also the key to local adaptation measures. They are designing and implementing most of the measures in this field, which indeed concern their wellbeing.

14. As many studies indicate, key factors for city governments' climate policy development are collective awareness and individual leadership. Other factors explaining the variation in local responses include different fiscal capacities of municipalities. But even those local governments that do demonstrate proactive strategies often face a legislative vacuum from a national policy perspective. They often have to go beyond their legislated capacity, raising concerns over policy sustainability and effective implementation. National government has to delegate enabling capacities and mandates to local governments in this relation and to involve them in different ways in building a coordinated response to global warming.

### 3. Spatial planning and building control

15. Spatial planning (including urban planning and land use zoning) is relevant for all sectors of the urban economy and is a principal instrument for their integration into one spatial strategy. Indeed, spatial planning today finds itself right at the heart of climate change adaptation and mitigation. This is a unique challenge that has no direct comparisons with the past and so new approaches need to be developed. Nevertheless, spatial planning as an instrument of public policy, does not need necessarily need to be reformed if it is already well established and follows the UNECE guidelines on spatial planning (see UNECE, 2008); what is needed is its adjustment to climate policies.

16. Energy-efficiency and climate change considerations should be integrated in spatial planning at different levels with the general aim of reducing urban areas' energy demand and carbon footprints. Energy demands are determined by many spatial characteristics, such as the design and spatial orientation of buildings and green areas, their relationship with surrounding areas (including transport flows) and the spatial organization of neighbourhoods and communities in general. Spatial planning can consider certain levels of residential density, mixed-use developments, attractive public transport and non-motorized transportation options, as well as integrated district heat-cooling-electricity systems. It is important to remember that decisions on land use and urban reform very often have impacts lasting for centuries.

17. Building (development) control is a powerful tool to complement public-led spatial planning. Contrary to spatial planning itself, which may be opposed by some political ideologies as "excessive" public interference and the scope of which may therefore be limited in certain regions, building control is more easily accepted as a regulatory regime. Building control may, consequently, ensure the presence of planning targets in the actual construction practices, including in the private sector.

### 4. Strengthening urban resilience

18. Climate neutral cities are not only cities that are climate friendly, but are also cities that manage to be exposed only to a friendly climate, i.e., that are protected from climate change's negative effects. The latter represents a serious challenge in itself, as the painful effects of climate change are already being recorded in the UNECE region. UNECE cities are increasingly exposed (depending on their area) to intensified heat waves, droughts, storms surges and floods, as well as to rising sea levels (in coastal areas), melting permafrost (in northern areas), and other climate-induced local geomorphologic hazards. These manifestations typically involve significant cost to human health, physical capital and natural habitats, further leading to public and private costs associated with aid, rehabilitation, resettlement, or conflict resolution.

19. A key aspect in mitigating the negative impacts at the local level is improved resilience. The Intergovernmental Panel on Climate Change (IPCC) defines resilience as the "ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change" (IPCC, 2007, p.86). Urban resilience (vis-à-vis climate change) can, then, be understood as a product of successful policies towards achieving such levels of adaptive capacities by cities (as human and technological systems) that they are able to withstand climate challenges with minimal losses to their functionality.

20. How is it possible to improve urban resilience? On the one hand, there are external changes, rapid or slow, which expose cities to new situations, even to shocks. On the other hand, there are internal capabilities and capacities of urban systems to withstand these changes, to minimize negative impacts and to maximize benefits. While the anticipation of the external shocks is important for prioritizing certain fields or directions (e.g., increased protection for the most vulnerable urban areas or social groups, mitigating heat islands effects, the establishment of early warning and contingency systems), it is the physical condition of the city's internal socio-economic infrastructure that will eventually determine the city's overall vulnerability. Since this infrastructure has a large degree of inertia due to its long life cycle and massive scale, it is not possible to make resilient cities overnight; but resilience should be

purposefully and progressively added up through being incorporated into all capital investment decisions for the different sectoral elements as described in the subsequent chapters.

### III. Actions for priority sectors

21. This chapter provides an overview and more targeted guidelines for the individual sectors of the urban economy, including urban energy infrastructure, buildings (housing, commercial and industrial), urban transport, green spaces and water systems, as well as waste management. The discussions of the sectors will also be illustrated by examples of good practices from across the UNECE region and beyond it. Each sector will be discussed as per the following elements, while making reference to the UNECE region:

(a) *Relevance to the climate neutral agenda.* Why is this particular sector important for urban mitigation and adaptation? What is the sector's existing status with regard to climate neutrality? Why should the sector be prioritized in the corresponding policy agenda versus other concerns and necessities?

(b) *Strategies and actions for the transformation towards climate neutrality.* What functional and operational performances does the sector need to demonstrate in a resilient, energy-efficient and climate-friendly city? What general policy options exist for the sector, and what specific actions need to be implemented in line with the transformation of the city towards greater levels of climate neutrality? What is the role of governments at different levels (national, regional, local) with regard to these policy actions?

22. Policy recommendations in this chapter will be developed further in the “City Road Map for Climate Neutrality” presented in chapter IV, which will summarise actions for city governments.

#### 1. Urban energy infrastructure

23. There are two sides of sustainable energy in the city — supply and demand. The main challenge on the supply side is a transition to renewable types of energy, while that on the demand side is energy conservation and energy efficiency. This section briefly overviews these topics, as well as some aspects of sustainable energy to cities that are not covered in other sectoral sections on urban energy users.

#### 2. Building and housing sectors

24. This section will discuss the relevance of the building and housing sector to climate neutrality policies and will outline a range of policy options available. While doing so, this section will be based, in particular, on the proposed UNECE Action Plan for Energy-efficient Housing in the UNECE Region.

25. The building sector, including the housing sector, is one of priority areas in relation to climate neutrality. First, buildings are responsible for a substantial share of total energy demand — over one third of the total energy consumption in the UNECE region. Much of that energy is used by the residential sector (20–30 per cent of total final consumption on average). The building sector remains characteristically wasteful in terms of energy use across the UNECE region. While technology available provides a highly feasible potential to achieve drastically reduced energy demand, the sector generally maintains inefficient practices and is also one of the major factors driving towards even higher levels of energy demand. Second, buildings are among the longest-lasting and most expensive human technological infrastructure. Thus, measures taken today, or the lack of them, will leave a substantial legacy for many decades. Third, as an essential element of both the built environment and the organization of social life in general, buildings represent a key focus with respect to adaptation to changing climate and any resilience strategies. Fortunately, adaptation and mitigation with respect to buildings clearly intersect, as improving energy efficiency can be considered as their common denominator. Thus, improved physical conditions

and insulation of buildings not only decreases energy demand in the sector, but also makes them climate-proof.

26. In comparison with other energy end-use sectors, the building sector offers one of the greatest existing potentials for energy and carbon savings. Most of the energy savings may be achieved by appropriate technological solutions, from the simple to the more advanced, such as plus-energy buildings ECE/HBP/2009/6, which produce renewable energy and deliver excesses over their own needs to the energy grid, thus using less energy over a year than they produce. But even less sophisticated and yet cost-effective retrofitting projects in the UNECE region typically demonstrate 40 per cent and more savings in energy (UNECE, 2009b).

### **3. Transport: urban form and low-carbon mobility**

27. In the UNECE region 33 per cent of energy is consumed in transport (UNECE, 2010, p. 53). Transport is consequently also accountable for a large portion of GHG emissions. Most of transport emissions are direct, arising from in situ fuel combustion. Relative to other sectors, transport has been less effective in terms of reducing its GHG emissions, so that its relative contribution has been increasing over the past years. Yet, several areas can be identified, which show somewhat different dynamics, including: short-distance, long-distance, freight and air travel. It is the short-distance travel that is most relevant to the city scale and will be discussed in this section.

28. There are three vectors for the transformation of city transport towards carbon neutrality, all of which require multi-stakeholder and multidimensional efforts: (a) reducing average travel distances through land use planning and sprawl control; (b) reducing the intensity of the use of motorized transport through public transport and transportation demand management; and (c) promoting cleaner and more efficient technologies in transport. This section will review these policies and will develop policy recommendations for the UNECE region, while making use, where possible, of the findings of the PEP (ECE/AC.21/2002/9).

### **4. Greenspaces and water systems**

29. Urban forestry and habitat restoration are among simple means for both carbon sequestration and urban air quality management. Vegetation removes carbon dioxide during photosynthesis and produces oxygen. Urban green infrastructure is also a key measure to respond to the urban heat island effect through evaporative cooling and shading, creating cooler microclimates. Large urban parks are in fact the “cool island” within cities, which also enhance local wind patterns in cities through the so-called “park breeze” effect. The best practices for using green infrastructure for adaptation and mitigation control include traditional sustainability measures, in particular creating and protecting an interconnected network of main green spaces and further greening of the urban environment to the most possible extent. If this system is furthermore diverse and includes different elements, such as forested parks, grassland, water areas, and wetlands, it will have a greater resilience potential itself. Some of the innovative approaches, although with a long history behind them, include greening roofs and walls.

30. Water management is another element for urban climate-proofing as it can mitigate the risks of flooding, droughts and heat waves. It includes surface and groundwater systems, watercourse corridors and engineering infrastructure to manage them. Water systems should be integrated with green infrastructure as much as possible and planned on the basis of coherent ecosystem-hydrological relationships. For example, vegetation reduces surface water run-off, offering the potential for flood control management. Furthermore, if the urban green system includes low-lying areas, such as wetlands, stream corridors and ponds, it reduces the need to build expensive alternative infrastructure for piped drainage and decreases the risk of soil erosion. At the same time, the engineering infrastructure should become more “intelligent” to be itself integrated with the urban ecosystem-hydrology relationships.



## 5. Waste management

31. Waste management involves collection, transportation, processing and recycling of manmade waste materials from domestic, commercial, and industrial users. Waste can be of solid, liquid, gaseous, radioactive and other types. The management of solid waste is particularly relevant for the municipal GHG emission minimization strategies. First, the anaerobic decomposition of waste in landfills is one of the most important contributors to the anthropogenic emissions of methane. Secondly, waste management is responsible for direct carbon dioxide emissions via both the burning of waste and the transportation of waste to disposal sites with corresponding fuel combustion. Third, the waste is itself the end of the life cycle of products, the continual reproduction of which consumes environmental and energy resources.

32. Consequently, effective waste planning, recycling, composting and energy recovery from waste are important environmental and climatic strategies and will be discussed in this section. However, effective coping with the challenge of wastes is not possible without a due management of the full life cycle of products and materials, including the very beginning of the life cycle. Zero waste strategy is one of the best practices here and is growing in popularity. It not only encourages recycling of products, but also aims at the restructuring of the very design, production and distribution of systems to prevent waste from emerging in the first place.

## IV. Post-carbon transitions

### 1. City Road Map to climate neutrality

33. This section will develop a “City Road Map for Climate Neutral Cities” based on the study and its main policy recommendations. It will summarise the actions for policymakers at the city level, so that the City Road Map will clearly and directly frame their activities within an institutional framework in the relevant field. The Road Map may include elements related both to (a) the establishment of an overall organizational framework at the city level (this element will be based on the findings of chapter II on the study); and (b) a framework for actions in priority sectors (this element will be based on the findings of chapter III of the study), as outlined below.

#### (a) *Key city-level actions for organizational framework*

- Identify or set up a climate change unit which will supervise and deliver policies and strategies at the city level, including through interdepartmental links.
- Facilitate multi-stakeholder partnerships including the private sector, developers, landlords, local/community governments and public participation.
- Draft the city’s profile for climate and energy, based on inventory and analysis of the city’s climate footprint and vulnerabilities and local energy plans, including social vulnerabilities and energy and green technology affordability.
- Based on the city profile for climate and energy, develop an integrated climate action plan, which will set up a hierarchy of goals, including emission reduction targets, resilience and social support and the time frames for the climate-neutral transition. In the action plan, outline actions to achieve those goals. The actions may be developed in correspondence with item (b) below.
- Mobilize financial resources for the implementation of the action plan and pilot projects; determine the potential sources of funding, including from the private sector and from national and international levels.
- Implement the action plan and incorporate the action plan into revised spatial planning and land-use zoning instruments.

- Educate the public, professional associations, business and industry about climate change, energy efficiency, vulnerabilities and climate solutions; establish advice centres. Assist the development of green markets in the city.
  - Address skills development needs and provide capacity-building programmes for various groups.
- (b) *Key city-level actions for priority sectors*
- Increase the use of green energy. Stimulate building-level and other forms of decentralized renewable energy generation, as well as intelligent city electric grid. Use energy-efficient technologies for city facilities. Introduce district heating-cooling systems, including trigeneration (combined cooling, heat and power). Establish energy services companies (ESCO).
  - Use spatial planning, zoning and other instruments to reduce and prevent sprawl and stimulate mixed-use compact communities. Implement protection and resilience measures to vulnerable zones.
  - Promote the use of bicycles and walking and develop public transport. Provide disincentives for using cars in the city. Install or improve speed control and congestion pay systems. Install alternative fuels infrastructure (electricity, hydrogen, biofuels) and increase the fuel efficiency of municipal fleet vehicles.
  - Improve energy efficiency and physical resilience of buildings via the promotion of low-energy solutions, climate-proof development and retrofit and whole-building design solutions. Improve building and housing conditions and strengthen the quality of building and housing management and maintenance systems. Integrate energy efficiency measures into the city's housing programmes. Promote local building materials.
  - Preserve and expand green and open space and greenbelts and promote tree planting and green roofs. Consider measures to mitigate the urban heat island effect.
  - Increase recycling infrastructure in the city and install waste to energy technologies. Promote sustainable cycles of materials via design control.
  - Promote demonstration projects, set up "champion" projects in the public sector, award "champions" in the private sectors.
  - Establish exemplary zero-carbon climate-proof zones/neighbourhoods/development in the city and constantly expand their pattern as long as the capacity develops in order to eventually embrace the whole city.

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