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Urban sustainability issues — Enabling resource-efficient cities

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Chapter 4 'Transition management in cities' is broadly based on the study 'Urban governance and resource efficiency' done by Stephan Kuhn and Ania Rock from ICLEI-Local Governments for Sustainability.

1 What is this report about?

Resource efficiency is now a key objective of the Europe 2020 Strategy. The flagship 'Roadmap to a Resource Efficient Europe' initiative (EC, 2011a) sets out a framework to support a shift towards a resource-efficient and low-carbon economy in many policy areas. It also gives practical guidance on how to achieve such an economy (EC, 2011b). The Seventh Environment Action Programme, 'Living well, within the limits of our planet', also identifies a resource-efficient, green and competitive low-carbon economy as a key objective (EU, 2013a): its priority 8 is focused on urban sustainability.

Resources are defined as all inputs into the economy (EC, 2011c). 'These resources include raw materials such as fuels, minerals and metals but also food, soil, water, air, biomass and ecosystems' (EC, 2011a). On a planet with finite resources, the challenge is to find a way of delivering greater value and more services with fewer inputs (EC, 2011c).

Cities have a major role to play in delivering the 2020 climate and energy package ([1]) in full and in improving their resource efficiency for diverse reasons.

- *Demography*: Approximately 359 million Europeans — 72 % of the total EU population (Eurostat, 2013) — live in cities, towns and suburbs, and this proportion will continue to increase.

- *Density*: Owing to the density and proximity of the population and businesses, the urban system of organisation is a resource-efficient one. Urban metabolic flows can be reduced by better urban management, design and planning. Density allows economies of scale in citizen-oriented services (utilities) such as collective transport, power, water and sanitation services, waste management and district heating.

- *Innovation*: As the engines of the economy and centres of research and creative activities, cities are fertile ground for innovation in all domains, including social (e.g. sharing instead of owning, new consumers), organisational (e.g. local partnerships) and institutional innovations. Cities provide the critical mass of markets, consumers and businesses to serve as laboratories of innovation. By drawing on local intelligence, cities can develop entirely new solutions to challenge issues such as transport congestion or excess water consumption.

The challenges that cities will face in trying to achieve resource and energy efficiency are not only strategic, technical and financial, but also related to city management and institutional barriers created by the fragmentation of responsibilities and decision-making. All levels of political authority ([2]) — local, regional, national and European — have an impact on urban development. The difficulty is in merging the actions of these different levels of government into a consistent and integrated urban policy.

In this institutionally and spatially fragmented environment, urban governance is further complicated by the number and variety of actors (private and public) operating at different territorial levels (e.g. municipalities, urban–rural region, metropolitan area, city-region) with various competencies (e.g. agencies, service providers) and objectives (Chowdhury and Wessel, 2012).

As well as the public and semi-public sectors, the policy-making process involves heterogeneous actors drawn from the private sector, the third sector and citizens. The private sector includes firms that operate at national (e.g. infrastructure providers), regional, city and individual (e.g. property development companies) levels of activity. The third sector includes

([1]) The EU climate and energy package sets targets for the year 2020: 20 % reduction in greenhouse gas emissions (compared with 1990); 20 % of energy from renewable sources; and a 20 % improvement in energy efficiency.
([2]) Multilevel governance is well documented in the case of the low-carbon society and less studied in the case of resource efficiency.

Box 1.1 Urban areas, cities, urban environment

Urban areas are generally differentiated from other settlements by their population size and functional complexity. Most commonly, they are characterised by a particular human settlement pattern, a critical mass and density of people, a concentration of man-made structures and activities.

For ease of reading, the terms 'urban area', 'urban environment' and 'city' are used interchangeably throughout this report, and no specific distinction is made among the terms with regard to distinct morphologies or administrative boundaries.

non-governmental organisations (NGOs), civil society organisations and non-profit-making organisations (e.g. labour unions, interest groups, ecological associations, neighbourhood committees).

Society needs to be persuaded to embrace common sustainable goals and to accept changes in behaviour. Involving civil society in the decision-making process and in ensuring that policies are effectively implemented is critical. Citizens have to understand how resource and energy efficiency affect their own daily lives and actions at the local scale and the consequences of these choices (even at the global level) (Corfee-Morlot et al., 2014). For policy-makers and decisions-makers, dialogue with citizens is a way not only of understanding society's expectations but also of identifying barriers to and opportunities for transformation.

There is no unique solution. An effective, sustainable pathway needs to take into account the local characteristics of the city (geography, economy, climate, natural capital, social capital, etc.). Each city needs to find its own appropriate solution. Owing to the density of population and economic activities, slight changes in urban management and the behaviour of citizens or businesses can have considerable consequences for the use of natural resources.

Making changes to bring about resource- and energy-efficient cities, and more generally sustainable cities, is a systemic challenge that requires radical transformation of all dimensions of the urban system: technical, social (e.g. values and norms, social practices) and institutional (Lorenzoni et al., 2007). All levels of public authority have a decisive role to play (Jordan, 2008). Local urban authorities have not only to develop better integration of sectoral policies, but also to collaborate with different levels of government and to cut through jurisdictional boundaries. They have to deal with numerous actors at different territorial levels and within each level. In such a complex environment, the challenge is to develop the art of working with actors who have different interests and finding operational synergies.

Furthermore, the urban metabolism must be optimised on all scales from the lowest possible (building) to block, district, city, neighbourhood and region. Generally, actions are led by different individuals and institutions at the same time and on different scales. The main challenge is to avoid conflict between these actions and to take into consideration the entire system, the interactions between the component parts and the long-term impacts. However, despite this complexity, some cities find a way of developing innovative place-based policies and strategies with local actors and of cooperating with neighbourhood municipalities instead of competing. Some cities have adopted ambitious agendas with targets based on a long-term vision. To achieve their goals, they have developed successful transition management based on co-creative and participatory processes to facilitate societal change.

This report analyses the nature of the multilevel institutional setting, how a city can improve resource efficiency in such a fragmented institutional and spatial environment and how to involve society in the process. It is mainly focused on resource efficiency, but in fact it addresses, more generally, all aspects of urban sustainability and resilience. The high degree of complexity of the urban system is a challenge for all areas of resource efficiency (e.g. climate change adaptation, transport).

1.1 Three reports on resource-efficient cities

Local authorities need at the same time to enhance the well-being of society and to preserve natural assets for current and future generations. They have to make the right choices, both now and for the long term, and choose appropriate trade-offs. Although the transition to resource efficiency does not rely only on local factors but also depends on global trends and policy contexts, cities can undergo radical transformation in different domains — energy, housing, transport systems, waste management, green areas, public spaces. Preparing for such transformation now in a controlled manner

will allow us to further develop cities properly, while reducing the levels and impact of our resource use.

The objective of these reports is to support policy development and decision-making. They are targeted at policy-makers, decision-makers and stakeholders involved in urban management at the local and city level as well as at the regional level. They analyse the following:

- Why do resource-efficient urban areas matter?
- What are the main challenges and what can be done to meet these challenges?
- What solutions can be implemented on different scales and across sectors?
- What are the drivers of change?
- How can cities be governed to achieve the transition to resource-efficient urban areas?
- How can we involve society in the decision-making process?

This report is part of the following series of three short reports (see Figure 1.1), based on an overview of recent literature and successful case studies, that addresses resource efficiency issues in urban areas.

1.1.1 What is a resource-efficient city?

The report presents the concept of urban metabolism, the circular model and the role of compactness in urban resource efficiency. Cities requires natural resources and energy to sustain the daily life and activities of the urban population. Nevertheless, there are opportunities to minimise input and output flows. As the urban form shapes the way people live, work and move in urban areas, compactness offers the potential to reduce urban flows. The most well-documented effects of compactness are the reduced need for land and energy for transport. Urban planning, based on a vision of the future, developed with local stakeholders and crossing administrative borders, is a key factor in increasing the density of urban areas, developing mixed land use, avoiding the unnecessary uptake of land and soil sealing, reducing car dependency and encouraging the use of public transport, walking and cycling.

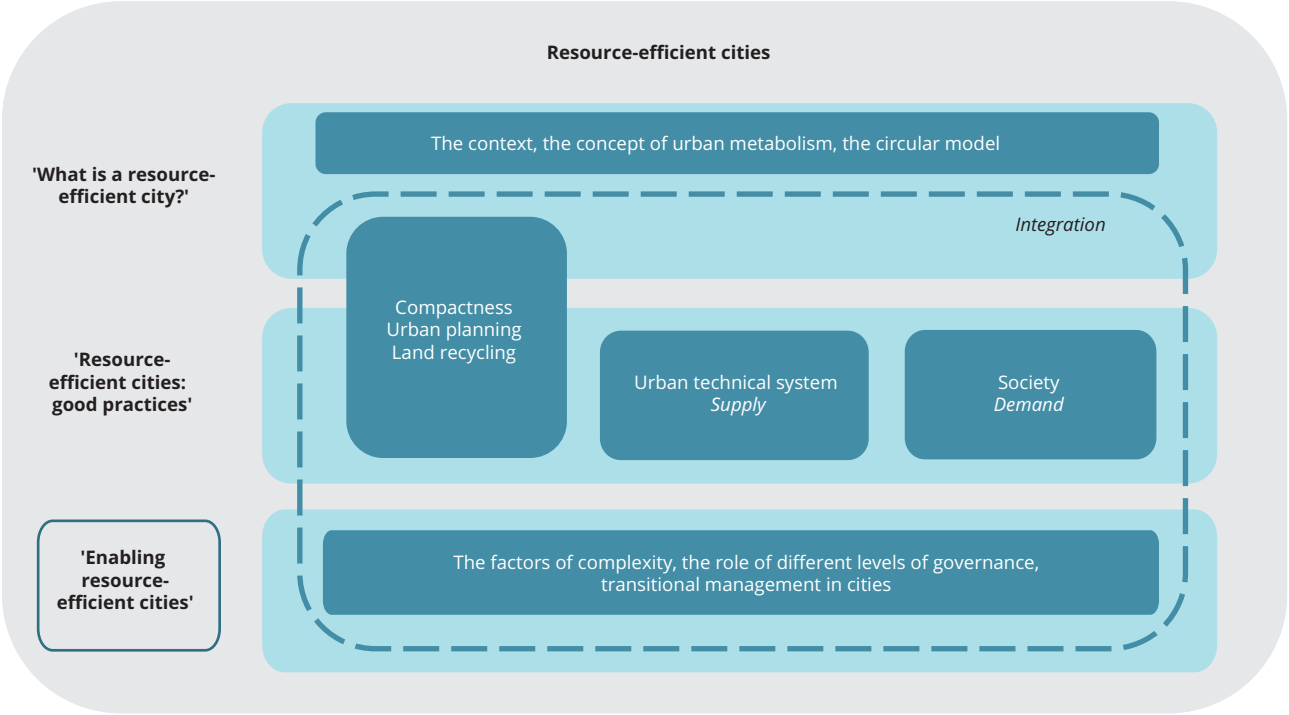
1.1.2 Resource-efficient cities: good practice

Cities are key players in minimising the use of resources and in developing the circular model. Generally, municipalities provide utilities and control public services for citizens and businesses that influence the majority of resource and energy use and the production of emissions and waste. Local authorities have the capacity to implement responses on multiple scales. The main challenge is to scale up actions from the simplest, involving one function, such as a building for housing, or involving one resource, such as water management, to integrated solutions in a large urban area (e.g. an ecodistrict) with many functions (e.g. housing, economic activities, green areas, renewable energy production, water harvesting). Another challenge is to move from the current centralised system, with mono-site and end-of-pipe utilities driven by municipalities or utility suppliers, to decentralised systems in which users are owners and producers. The report analyses both the supply and the demand issues. It is divided into two parts: the first is devoted to how to avoid, prevent and reduce the use of resources, and the second addresses reusing, cascading, recycling and harvesting.

1.1.3 Enabling resource-efficient cities

To achieve resource- and energy-efficient cities, local authorities have to overcome the limitations of policy instruments that are insufficient to deal with the complexity of urban challenges. They face not only strategic, technical and financial challenges but also institutional barriers created by the fragmentation of responsibilities and decision-making, the number and variety of actors (public, private, civil society, individuals) contributing to resource efficiency through their daily decisions and practices and operating at different levels, the challenge of addressing the urban system as a whole, and the characteristics of the city (geography, economy, climate, history, natural capital, social capital, etc.). Despite this complexity, some cities have adopted ambitious policy agendas with targets, managing the city in a far-sighted goal-oriented way, cooperating with surrounding municipalities and other levels of governance, and developing a transition management approach. This is a form of governance that facilitates societal change. It is based on a dialogue between private and public actors (users, citizens, firms, universities, public authorities) that envisages a common future and identifies ways of achieving a resource-efficient society and, more generally, sustainability.

Figure 1.1 The links between the three reports on resource-efficient cities



1.2 Scope of this report

Chapter 2 focuses on the factors contributing to complexity. It concludes that, first, resource efficiency has to become an overarching goal influencing all stages of the policy-making cycle and integrating all sectors. Second, cities have to work with a number of diverse actors and develop effective cooperation with municipalities beyond the limits of their jurisdiction.

Chapter 3 presents the role of the different levels of government, from the European to the local level. It demonstrates that each level of government influences city policy-making, so that both top-down and bottom-up approaches are working at the same time at the urban level. Furthermore, synergies can be developed between the different levels.

Chapter 4 analyses transition management in cities. It describes how, in order to overcome the limitations of policy instruments that are often ill equipped to deal with the highly complex challenges and persistent problems without predefined solutions, city authorities develop explorative governance involving all of society. By defining a long-term vision with ambitious targets and encouraging participation, cutting-edge cities aim to change the ways in which stakeholders and civil society think and act.

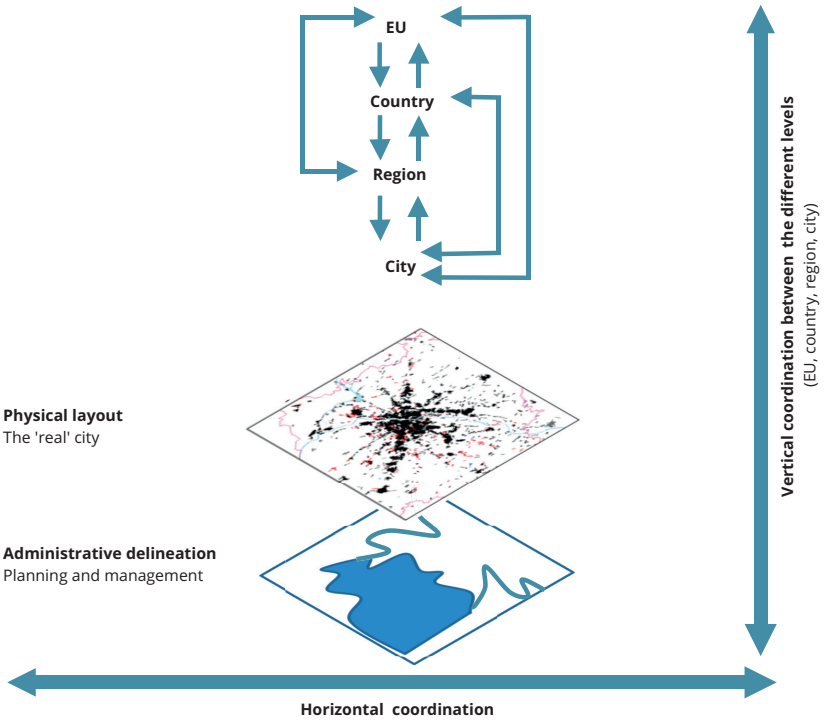
2 The factors contributing to complexity

The notion of government refers to the formal and institutional processes ([3]), more or less through formal rules, that remain an important driver of change (Stoker, 1998). However, there is a divergence between this normative approach and the complexity of the reality owing to the set of institutions, the diversity of actors, the blurring of boundaries and responsibilities, the cooperation between organisations and the existence of self-governing networks.

2.1 Cooperation and coordination challenges

In this context, the hierarchical way of thinking is challenged by governance that is 'the art to work together' (Grisel and van de Waart, 2011). Multilevel urban governance is an arrangement for making binding decisions that engages a multiplicity of politically independent and interdependent actors — private and public — at different levels of territorial aggregation (see Figure 2.1) (Tasan-Kok and Vranken, 2011). The Committee of the Regions' White Paper on Multilevel Governance (Committee of the Regions, 2009) 'considers multilevel governance to mean coordinated action by the European Union, the Member States and local and regional authorities, based on partnership and aimed at drawing up and implementing EU policies'. There are several levels of authority (including neighbourhood/district, city, city-region, region, nation state and the EU). 'Coordination, cooperation, participation and integration' are the key principles of the multilevel urban governance approach. (Tasan-Kok and Vranken, 2011). The White Paper on European

Figure 2.1 Territorial and multilevel approaches



Source: Adapted from EEA, 2012.

([3]) This generally operates at the national level.

Governance defined five key principles concerning good governance: openness, participation, accountability, effectiveness and coherence (EU, 2001).

The practical implementation of this multilevel concept presents a complex challenge for all levels of power. It is a relationship based on a permanent process of 'negotiation–deliberation–implementation' among numerous actors at different territorial levels and within each level (Grisel and van de Waart, 2011). Urban governance is characterised in particular by the need for cooperation among a variety of participants from many domains (e.g. utilities, housing, urban planning, health, culture) and the need to involve stakeholders (e.g. citizens, clients, users) in the decision-making process.

The inclusion of each level of governance in the development of cities is a key idea included in various statements from European Ministers responsible for urban policy. The Leipzig Charter (Informal Meeting of Urban Development Ministers, 2007) considers that 'Every level of government — local, regional, national and European — has a responsibility for the future of our cities' and stresses the importance of coordinating action, including that beyond the boundaries of individual cities. The Declaration of Toledo (Informal Meeting of Urban Development Ministers, 2010) pays attention to multilevel governance mechanisms 'in order to secure better consistency between sectors and levels of government in the territory policies'. The Territorial Agenda (Informal Meeting of Ministers Responsible for Spatial Planning and Territorial Development, 2011) recommends 'applying an integrated and multilevel approach in urban development and regeneration policies'.

'Priority 8' of the Seventh Environment Action Plan, 'Living well, within the limits of our planet', states that 'sustainable development requires effective and efficient coordination between different levels of administration and across administrative boundaries and the systematic involvement of regional and local authorities in the planning, formulation and development of policies which have an impact on the quality of the urban environment' (EU, 2013a).

Both top-down and bottom-up approaches are in force the same time at the urban level (Tasan-Kok and Vranken, 2011).

- Top-down approaches are based on regulatory and economic instruments developed by the EU, national governments and, in some cases, regional governments. They may focus on a general approach (e.g. a flagship initiative on resource efficiency) or on sectoral policies (e.g. energy, waste, water, transport). These vertical interdependencies of actors at different levels of governance occur when higher levels of government are concerned with outcomes at a lower level.
- Bottom-up approaches involve effective participation at the local and society level (e.g. citizens, the city's partners in providing utilities, sectoral actors) in the policy process. It is a way of balancing the wishes of other levels with the needs expressed at the local level.

In addition, subsidiarity is a key principle of the EU system: it states that power should always be held by the level closest to the matter of concern. The EU shall act only if the objectives cannot be efficiently achieved by Member States. However, despite the importance of cities and the local level in the effective implementation of most of the EU's policies, as they put into practice most of the binding European legislation incorporated into national legislation, cities are poorly involved in the conception and implementation of EU policies (EC, 2014a). Furthermore, there are considerable differences across Member States (EC, 2014a) in the manner in which cities are governed, their autonomy, empowerment and involvement in national policy. In Europe, the numbers of administrative tiers or governmental levels range from two to four, and the average population of the lowest tier (communes or municipalities) ranges from fewer than 2 000 to over 150 000 (EC, 2014a).

2.2 Integration challenges

Many obstacles to the development of integrated urban policies can be identified, such as the fragmentation of institutions and thereby the fragmentation of responsibilities (e.g. separate budgets, timelines and goals), the excessive specialisation and overwhelming complexity (e.g. 'silo thinking', incomplete perspectives on urban resource use and the associated costs), single-purpose solutions that fail to address the urban system as a whole, and short-term and narrow accounting formats (e.g. some important elements are not systematically taken into account such as indirect costs and benefits, maintenance costs, replacement costs, all capital assets — ecological, social, economic) (Suzuki et al., 2010)

The shift to resource efficiency needs to occur on many levels and among many stakeholder groups, cutting across sectoral and functional specialisation and jurisdictional boundaries. The inadequate governance arising from the growing mismatch between administrative delineations (often the delineation of 'historic' city) and the 'real' urban structures that extend

far beyond the limits of the municipality of the core city is another factor of complexity. In emerging large polycentric city-regions, urban structure is composed of a network of small and medium urban, peri-urban and rural municipalities located around the major urban centre (EC, 2011d). Urban policies have to be defined on a scale larger than that of the municipality for operational reasons (to provide better services for users, e.g. public transport), for cost-efficiency reasons (to share costs, e.g. of utilities and infrastructure), for strategic reasons (to develop policies on an appropriate scale and with the involvement of key actors, e.g. economic strategies and programmes) and for territorial reasons (take into account the characteristics of the place, e.g. protection against flooding).

To enable efficient policy-making and service delivery, local governments have to develop effective collaboration between levels of government (the vertical dimension) and spatial cooperation (the horizontal dimension).

- The vertical dimension refers 'to the linkages between higher and lower levels of government, including their institutional, financial, and informational aspects. Local capacity building and incentives for effectiveness of subnational levels of government are crucial issues for improving the quality and coherence of public policy' (OECD, 2014).

- The horizontal dimension refers 'to co-operation arrangements between regions or between municipalities. These agreements are increasingly common as a means by which to improve the effectiveness of local public service delivery and implementation of development strategies' (OECD, 2014).

Resource efficiency goals have to become an overarching objective that is formulated, implemented and evaluated at all stages of the policy-making cycle and in all sectoral policies and is vertically and horizontally integrated.

Financial constraints are obvious barriers to making the necessary changes in the urban environment. However, many projects are not identified as addressing the challenges of achieving resource efficiency, despite their positive effects on resource efficiency; this is particularly the case for projects related to urban planning, public spaces and public transport. Transition towards more resource and energy-efficient cities depends not only on expansive developments — except when it is critical to improve old infrastructure and buildings — but also on the transformation of urban organisation and management, dialogue with stakeholders, cooperation at the regional level and with surrounding areas, elaboration of long-term strategies, and development of monitoring tools. It is a more integrated way of thinking — taking a long-term perspective.

2.3 Societal challenges

Shifting to a resource-efficient society requires not only technological change but also systemic change. It is a societal process that assumes fundamental changes in the structure, culture and practices of the societal system (Frantzeskaki and de Haan, 2009). To achieve transition to resource efficiency it is necessary to critically examine institutions (e.g. global markets), the scale (e.g. district, municipality, city, city-region, region), the values and norms of society (e.g. the culture of consumerism), citizens' daily practices (e.g. commuting by car, preference for detached homes) and the characteristics of the place (e.g. territorial capital) (Frantzeskaki et al., 2012). Change needs to occur at many levels, on both the small and the large scale, and among many stakeholder groups. Top-down and bottom-up practice-based approaches are both needed to strategically manage multilevel and multi-stakeholder change processes.

Solutions need to be tailored to local circumstances. This means not only moving away from the usual, established ways of managing cities to thinking in terms of urban planning and cooperating with other municipalities, but also creating new business models and encouraging changes in the practices and behaviour of the end users.

Sustainable development is often considered as a 'wicked' problem owing to the high degree of complexity of the issues to be addressed and the necessity of engaging society. Problems cannot be solved by merely rational solutions: we need to recognise the validity of multiple, subjective stakeholders' viewpoints. The participatory process needs to involve all stakeholders (public and private actors, all kinds of users, providers, scientists, businesses and civil society) even if the consequences of their interaction might be a proliferation of solutions (potentially competing and contradictory) that are difficult to assess (e.g. lack of data, uncertainty, inertia) (Loorbach, 2010; Urban-Nexus, 2014).

3 The role of the different levels of government

To achieve sustainable urban development, and more specifically resource-efficient city government, there are different modes of governance, all of which are crucial. Governance can take the form of the classic formal, top-down, centralised exercise of authority (the hierarchical approach), or the mutual self-adjustment of stakeholders through the price mechanism (the market approach), or the self-coordination of autonomous but interdependent actors (the network approach) (Atkinson and Klausen, 2011). The market and network approaches are gaining in importance (Urban-Nexus, 2014), but regulation is still crucial (Rydin, 2010). Public authorities can at the same time exercise authority, take part in dialogue with stakeholders that allows action and avoids conflicts, and be involved 'at a distance', simply by encouraging stakeholders to adapt their values and actions to match the goals of public policies (governmentality) (Summerville et al., 2008).

The Organisation for Economic Co-operation and Development (OECD) (Bulkeley, 2010) has identified four modes of governance:

1. Government by authority relates to public authorities' ability to ensure compliance through legal instruments (e.g. building regulations ([4])).

2. Government by provision relates to the role of government in delivering services (e.g. providers of utilities).

3. Self-governance relates to the role of government as a consumer and role model. This mode requires resource-efficient procurement and management of public services, in order to control the consumption of resources and to implement good practice.

4. Government by enabling relates to the role of public authorities in encouraging positive action or conformity through, for example, partnership building, incentives and subsidies.

All levels of government and all modes of governance have a role to play in resource-efficient governance (see Table 3.1).

([4]) The term 'regulation' is used in this report in a broad sense, referring to the setting of rules (the most constraining and rigid), standards (which leave a greater range of choice or discretion) or principles (the most flexible) that govern the conduct of public and/or private actors.

Table 3.1 Actions taken at different levels of government with the aim of achieving resource and energy efficiency

European actions	• Defining a long-term vision and strategy • Providing a supportive European legal framework • Integrating resource and energy efficiency goals into different European policy areas (e.g. sectoral policies) • Funding, through Cohesion Policy, action to improve urban sustainability, including resource and energy efficiency • Enabling international exchange of knowledge, experience and good practice • Enabling the 'green economy' (e.g. recycling, reusing) • Funding research and knowledge development on resource and energy efficiency
National actions	• Defining a long-term vision and strategy • Providing a supportive national legal framework (e.g. building standards) • Integrating resource and energy efficiency goals into the different national policy areas • Adjusting the degree of decentralisation of competencies of authorities • Funding local measures • Funding research and knowledge development on resource and energy efficiency • Raising awareness of resource and energy efficiency • Enabling the development of new business models related to recycling and reusing
Regional actions	• Defining a long-term vision and strategy • Providing incentives and putting in place regulations to enable local action • Funding local and citizens' actions • Developing and implementing regional approaches with cities authorities, the private sector (e.g. industrial clusters for recycling) and academia • Setting a good example within the local administration • Ensuring regional coherence of local/municipal plans and measures • Encouraging inter-municipal and urban–rural cooperation on resource and energy efficiency • Facilitating the production of renewables • Informing and raising the awareness of stakeholders
Local actions and territorial cooperation institutions ([a])	• Defining a long-term vision and local strategy • Cooperating with other urban–rural municipalities in the vicinity of the city or in the metropolitan area • Advocating outside jurisdiction • Monitoring and analysing feedback to encourage the learning process • Spatially integrating resource efficiency needs through urban planning • Setting regulations to facilitate implementation within the jurisdiction (e.g. thresholds in urban planning) • Developing affordable and frequent public transport • Upgrading utilities (water, waste management, wastewater management plans, district heating) and buildings (private and social housing) • Organising the production of renewables in the city and its hinterland • Setting a good example within the local administration • Engaging and informing civil society, private actors and academia • Defining the needs of the urban community and encouraging the participation of all residents (including excluded groups) in decision-making • Funding and encouraging neighbourhood projects and citizens' actions • Cooperating with the private sector

Note: ([a]) Territorial cooperation institutions could be an association of municipalities pooling resources to supply services (e.g. water or waste management, public transport) or to enable strategic development (e.g. urban–rural region, metropolitan area and city-region).

3.1 The European level

The EU utilises 'hard' and 'soft' policy instruments and financial instruments. Hard policy approaches, or EU law, come in the form of binding regulations (e.g. directives), and soft approaches refer to convergence between Member States or other actors without the pressure of the law (e.g. sharing experiences, technical cooperation). The impact of soft actions is less visible than that of hard approaches but equally far reaching (Chowdhury and Wessel, 2011). For example, policies related to water have mainly been guided by the Water Framework Directive but also by the creation of organisations such as the European Water Partnership, which promotes dialogue on issues related to water, or the European Technology Platform for Water (WssTP), which brings together players active in the water sector.

3.1.1 Long-term orientations

EU strategies and long-term orientations (e.g. Europe 2020 Strategy, EU 2020 Biodiversity Strategy) provide direction and guidelines to enable Member States to draw up national programmes and actions taking into account the EU strategy. Resource efficiency is clearly identified as a priority of the Europe 2020 Strategy through its flagship initiative 'Roadmap to a Resource Efficient Europe' (EC, 2011b). Local governments, in particular municipalities, are not concerned directly by this general policy framework, but it clearly demonstrates the EU's policy orientation in this domain. The initiative's remit is far-reaching extending to material resources, including metals, minerals, food and feed, air, soil, water, biomass and ecosystems. Its aim is to make the transition to a resource- and carbon-efficient society.

Box 3.1 Binding measures for energy efficiency

The 2012 Energy Efficiency Directive ([5]) establishes a set of binding measures to help the EU reach its 20 % energy efficiency targets by 2020. Under the directive, all EU countries are required to use energy more efficiently at all stages of the energy chain from its production to its final consumption ([6]) and to save energy in buildings, including making central government buildings more energy efficient. EU countries are required to draw up National Energy Efficiency Action Plans that set out estimated energy consumption, planned energy efficiency measures and the improvements that they expect to achieve. They also have to provide annual reports.

Article 4 of the Energy Efficiency Directive requires Member States to establish long-term strategies for mobilising investment into the renovation of national building stocks, including residential and commercial buildings. They also have to establish national plans for renovating their building stocks. These strategies and plans are part of their National Energy Efficiency Action Plans, which provide an overview of the country's national building stocks, identify key policies to stimulate renovation, and estimate the expected energy savings that will result from renovation.

Article 9 of the Energy Performance of Buildings Directive ([7]) requires Member States to develop policies and measures to stimulate the transformation of buildings that are refurbished into nearly zero-energy buildings.

All new buildings must be nearly zero energy by the end of 2020 (by the end of 2018 for all new buildings owned and occupied by public authorities). In addition, Member States are required to draw up national plans for increasing the number of nearly zero-energy buildings.

Note: More information is available online: http://ec.europa.eu/energy/en/topics/energy-efficiency accessed 15 October 2015.

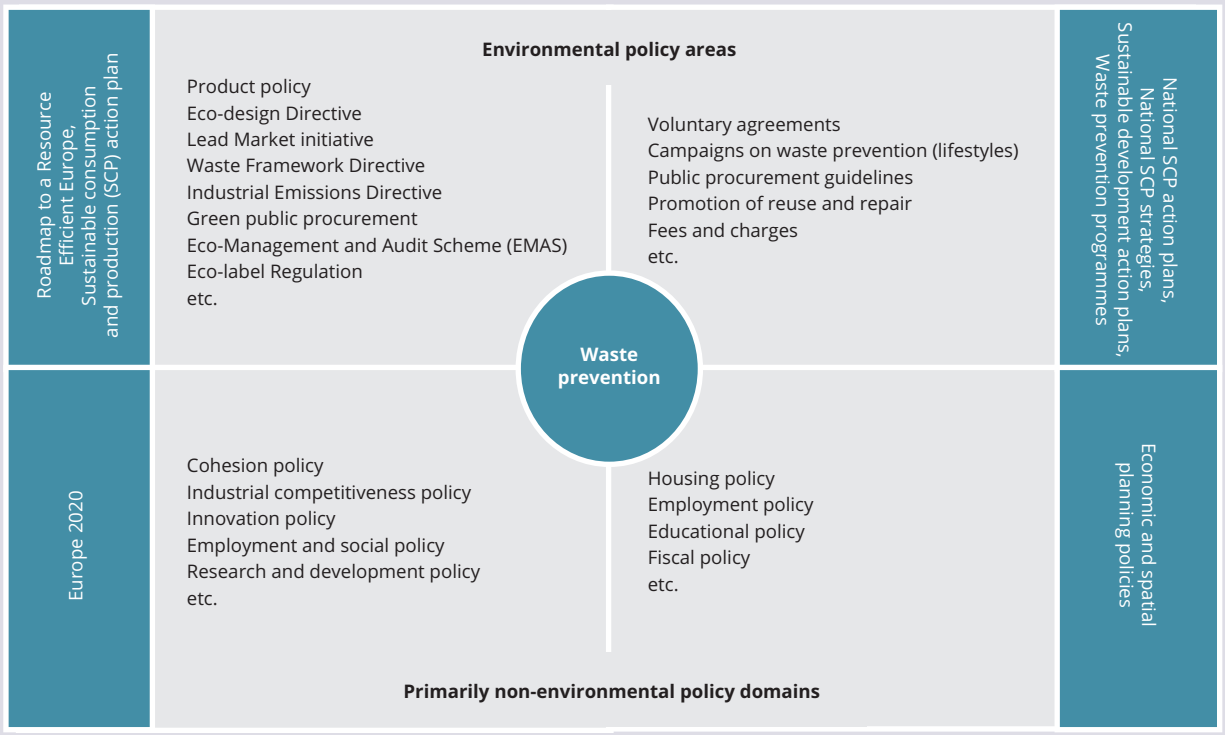
Sources: EC, 2013; Stanaziek et al., 2014.

([5]) Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.
([6]) EU countries were required to transpose the Directive's provisions into their national laws by 5 June 2014.
([7]) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings — European Performance of Buildings Directive recast.

Box 3.2 Waste prevention, a cross-cutting policy area

The waste hierarchy, the guiding framework in EU and national waste policies, gives the highest priority to waste prevention, followed by (preparing for) reusing, recycling, other recovery and disposal. This is reflected in the targets of the Waste Framework Directive (EU, 2008) and the Thematic Strategy on the Prevention and Recycling of Waste (EC, 2005). Related EU policies such as the 'Roadmap to a Resource Efficient Europe' (EC, 2011b) and the Seventh Environment Action Programme (EU, 2013a) also recognise the need for waste prevention. The Roadmap states that by 2020 waste generation should be in decline. The recent Communication from the European Commission, *Towards a Circular Economy: a zero waste programme for Europe* (EC, 2014b) proposes a non-binding target for a reduction in food waste of at least 30 % by 2025, in addition to the development, inter alia, of national food waste prevention strategies.

Figure 3.1 Waste prevention as a cross-cutting policy area



Source: EEA, 2014.

Only Member States are mentioned in the Roadmap. However, cities are key players in implementing the EU's goals in terms of a low-carbon economy (20-20-20 targets) and resource efficiency. They are crucial in improving waste management, public transport, water management and, through integrated urban planning, the efficient use of land.

3.1.2 Sectoral orientations

The EU institutions interact with Member States through several types of legal instrument such as regulations, directives and decisions that are binding. A directive sets out goals that must be achieved by all Member States, but each country decides how these goals will be achieved. Directives have to be incorporated into domestic legislation by Member States. The EC can also spell out its thinking on a specific topic through a communication that is a policy document without having legal effect (e.g. Thematic Strategy on the Urban Environment, Strategy on Green Infrastructure).

EU legislation is incorporated into national legislation and generates specific national plans and programmes. Then, municipalities and inter-municipalities implement the EU's policies through national policies. A wide range of directives, directly or indirectly focused on energy and resource efficiency, have an impact on urban management and planning, even if cities are not explicitly mentioned, on account of the subsidiarity principle.

Municipalities and inter-municipalities are the main players in waste management, water management, building retrofitting, public transport and land use. Cities can also facilitate industrial symbiosis by developing appropriate infrastructure to meet the needs of industry (Massard et al., 2014). In addition, because of their close contact with citizens and the role of municipalities and inter-municipalities in the supply of utilities, local authorities can play an active role in educating the general public (e.g. through information on labels), promoting good practice and steering citizens towards more resource-efficient goods and services.

3.2.3 Cohesion Policy

The new regulation for the programming period 2014–2020 provides tools to be implemented at different levels. At the European level, the Urban Development Network comprises urban authorities involved in European Structural and Investment Funds. The network is not a funding instrument: it provides a platform to enhance capacity-building and exchange between cities, pioneering new techniques and developing integrated investments. Innovative actions ([8]) support and enhance innovative and experimental demonstration projects and studies of particular interest for the whole EU area. They can take the form of pilot projects, demonstration projects or new urban experiments that are of European interest. They should be related to sustainable urban development.

For the first time, at national level, a minimum of 5 % of European Regional Development Fund (ERDF) resources per Member State is allocated to 'integrated actions for sustainable urban development' ([9]) (EU, 2013b), with a degree of delegation to urban authorities. These integrated actions provide the opportunity to use a combination of different funds (ERDF, European Social Fund, Cohesion Fund, European Agricultural Fund for Rural Development, and European Maritime and Fisheries Fund) for the financing of actions (EC, 2014c; EP, 2014a). Community-led local development is a tool to promote the preparation and implementation of bottom-up, local development strategies. It extends the Leader approach from rural into urban areas, promoting community ownership and multilevel governance, both of which are useful in developing integrated place-based strategy, taking into account resources and energy efficiency.

LIFE

The EU LIFE programme 2014–2017 is another source of funding for local projects on resource and energy efficiency. It is the EU's funding instrument for the environment and climate action. The objectives of the LIFE programme (EU, 2014) highlight a resource-efficient and low-carbon economy. Other priority areas can also be relevant, such as 'Environmental governance and information' or 'Climate mitigation'.

Interreg

Interreg is another way of funding projects on resource and energy efficiency. This programme provides funding for interregional cooperation across Europe for the period 2014–2020 (Council of the European Union, 2013). For example, one of the priorities of the Interreg Baltic Sea region programme 2014–2020 ([10]) is the efficient management of natural resources by developing integrated approaches: it supports

Box 3.3 Enhancement of partnership

The principle of multilevel governance was introduced in the Common Provisions Regulation governing the European Social Fund. The specific role of regional and local authorities, and subsequently of the other relevant partners, is clearly recognised. In the previous programming period, the regulation mentioned that partnership was organised 'where applicable'. In the current regulation Member States 'shall' organise a partnership for the new period:

... each Member State shall, in accordance with its institutional and legal framework, organise a partnership with the competent regional and local authorities. The partnership shall also include ... competent urban and other public authorities; economic and social partners; and relevant bodies representing civil society, including environmental partners, non-governmental organisations, and bodies responsible for promoting social inclusion, gender equality and non-discrimination. (Article 5 of Regulation 1303/2013).

Source: Van den Brande, 2014.

([8]) Article 8 of the ERDF regulation: applicants should be cities or groups of urban areas with a minimum of 50 000 inhabitants. Calls are published on the European Commission website.
([9]) Article 7 of the ERDF regulation.
([10]) Interreg Baltic Sea Region: http://www.interreg-baltic.eu/about-the-programme/cooperation-priorities/efficient-management-of-natural-resources.html (accessed 1 December 2014).

Box 3.4 RegioStars Awards 2015

The RegioStars Awards ([11]), run by the European Commission's Directorate-General for Regional and Urban Policy, turns the spotlight on the most inspiring and innovative European projects co-funded by the EU's Cohesion Policy.

In the category Sustainable Growth: Mobilising investments in energy efficiency for the benefit of citizens and society, different projects have been selected:

- *MILD HOME:* This project highlights resource-efficient building techniques and locally available skills that make 'mild homes' affordable in terms of both purchase price and operational costs. It has developed solutions for nearly zero-energy residential buildings that can be constructed from locally available materials. It has also created local supply chains for building energy-efficient structures and organised a series of training sessions for architects, urban planners, engineers, real estate agents and ecologists.

  http://www.mildhome.eu (accessed 14 October 2015).

- *PICSA:* The Sustainable Construction Programme, in Andalusia, Spain, seeks, through saving energy and using renewable energy, to promote the energy refurbishment of buildings, rehabilitate urban areas, improve the competitiveness of companies in the construction sector, create skilled employment and reduce energy poverty. The project has saved 62 000 tonnes of carbon dioxide.

  https://www.agenciaandaluzadelaenergia.es/ciudadania/programa-de-impulso-la-construccion-sostenible-de-andalucia (accessed 14 October 2015).

- *London Green Fund (LGF):* This is a 'financial instrument' that uses EU and other public funds to attract private capital and boost investments in low-carbon infrastructure projects in London with the key objectives of reducing carbon dioxide emissions in the city. The LGF allocates funding to three commercially managed urban development funds that, in turn, provide loan and equity finance to waste management, energy efficiency and decentralised energy projects.

  https://www.london.gov.uk/priorities/business-economy/championing-london/london-and-european-structural-funds/european-regional-development-fund/jessica-london-green-fund (accessed 14 October 2015).

- *IMAGINE Low Energy Cities:* This project aims to develop local energy roadmaps for 2050 in eight European pilot cities, based on a shared vision of the energy future of each. The project is focused on dialogue and engagement processes, as well as on communication between local stakeholders and local authorities. Various forums and events have been organised to foster sharing of experience and best practice for sustainable cities. The project also produced a publication targeted at local authorities, the Low-Energy City Policy Handbook.

  http://www.imaginelowenergycities.eu (accessed 14 October 2015).
  http://www.imaginelowenergycities.eu/-Publications-.html (accessed 14 October 2015).

- *Torrent dels Maduixers:* This project has provided the city of Barcelona with a municipal infrastructure for the management of urban solid waste collected from the streets. The underground building includes areas for compacting waste, storing containers, parking electric vehicles, housing geothermal equipment, office space, etc. Its green roof has been designed as an urban park. It integrates resource-efficient components, such as saving energy through geothermal air conditioning and hot water and saving water by using groundwater.

  http://www.dgfc.sgpg.meh.es/sitios/dgfc/es-ES/ipr/fcp0713/c/bp/ac/ac2012/Documents/BPAC2012FCH_5.pdf (accessed 14 October 2015).

- *Implement:* This project aims to increase the production and use of biogas for transport and heating. It has contributed to increased growth and new businesses and has created jobs in an emerging sector. Many uses of biogas have been developed and extended, such as biogas for transport (Skive municipality), a biogas ferry (Samsoe municipality), increased biogas production (Lemvig municipality), 100 new buses running on biogas (Østfold municipality), and biogas filling station.

  http://www.energibyenskive.dk/en/projects/implement (accessed 14 October 2015).

([11]) http://ec.europa.eu/regional_policy/en/regio-stars-awards/#5 (accessed 25 June 2015).

Box 3.5 LIFE and water efficiency

The publication *LIFE and Resource Efficiency: decoupling growth from resource use* (EC, 2011e) provides 'real-life solutions to real-world problems'. It presents over 120 projects gathered by LIFE since its launch in 1992. Many projects show how companies, organisations and cities can achieve simple gains in efficiency without making large investments in different domains, mainly water saving and energy efficiency in transport and buildings.

Some examples of LIFE projects on saving water

The *RAKWANET* project in Rakvere, Estonia, showed that significant water savings could be achieved in ageing infrastructure with a moderate investment, simply by reducing the time taken to detect leaks from around 6 days to 3.

The *PALM* project in Italy has introduced the latest acoustic technology to detect leaks and uses a calibrated hydraulic model to optimise water flow and close valves to control leaks.

The city of Zaragoza in Spain has demonstrated, particularly for other countries in southern Europe, that it is possible to become a 'water-saving city'. The city applied for LIFE funding to run an extensive public awareness campaign using the full range of media and promotional tools to encourage households, businesses and public authorities to reduce their water consumption. The project gave practical guidance on how to save water and persuaded many companies to market and/or give discounts on water-saving products.

The *Dropawater* project in Ceuta, Spain, reduced demand by 10 % through the introduction of state-of-the-art water meters. Efficiencies in water supply were achieved by checking pipes metre by metre for leaks, a process that saved more than double the money it cost, through saved water. The project also introduced systems for using non-drinking water in appropriate applications, such as street cleaning and watering gardens.

the development of technological solutions for the production and distribution of renewable energy and for improving energy efficiency, as well as initiatives that favour sustainable and resource-efficient growth in the blue economy.

3.2.4 Sharing knowledge and learning by example

Cities, especially small and medium-sized ones, often suffer from a lack of knowledge and the financial resources to identify and implement integrated sustainable policy — and this problem is exacerbated during periods of austerity. Decision-makers and policy-makers must always be striving to improve the knowledge and skills that will enable cities to develop and implement smart integrated sustainable strategies and action plans. For example, dialogue between cities is a way of ensuring that practitioners and decision-makers can access collective knowledge and share their ideas.

Urbact

The 'Urbact III' programme (2014–2020) promotes the exchange of ideas and learning on sustainable urban development among cities. The programme includes not only exchanges and learning activities but also capacity-building measures, pilot projects and knowledge transfer. The programme's resources for exchange and learning will be concentrated on several priorities including 'supporting the shift towards a low-carbon economy in all sectors' and 'protecting the environment and promoting resource efficiency' (Urbact, 2014). The issue of resource and energy efficiency has also been addressed in previous Urbact programmes ([12]), mainly in the areas of mobility, public space, and energy efficiency (Lewis et al., 2013).

Partnerships

The aim of the European Innovation Partnership on Smart Cities and Communities is to accelerate the deployment of innovative technologies to find organisational and economic solutions to increasing urban sustainability. The operational programme focuses mainly on smart solutions in the domains of urban mobility, sustainable buildings and districts, integrated infrastructure, integrated urban planning and management, dialogue with citizens, and monitoring. Resource efficiency is clearly identified as a target. The main objective is to increase collaboration between local decision-makers, industry suppliers and representatives of civil society and to develop new business models and public–private partnerships. Projects can be funded by a range of instruments, such as the ERDF, the European Social

([12]) URBACT I (2002–2006) and URBACT II (2007–2013), http://urbact.eu (accessed 19 November 2015).

Fund and the European Energy Efficiency Fund, or innovative instruments such as risk-sharing financial facilities. The initiative is dedicated to learning through the demonstration of commercial-scale solutions ('lighthouse projects').

Action Clusters, assemblies of partners committing to working on specific issues related to smart cities, are central to the success of partnerships: they are tools for sharing knowledge and expertise with peers ([13]). The European Water Partnership ([14]) aims to stimulate citizens and stakeholders to change their mindset, to promote technological and management innovations, and to raise the awareness of policy-makers of water challenges.

Encouraging cities

The European Green Capital Award ([15]) (for cities with more 100 000 inhabitants) and the European Green Leaf initiative (for cities between 20 000 and 100 000 inhabitants) reward cities that are making

Box 3.6 The main platforms, portals and initiatives facilitating the exchange of information, knowledge and experience

- *The Urban Portal of Regional Policy — InfoRegio* ([16]) provides an inventory of programmes and initiatives that have an urban dimension and information for the Urban Development Network.
- *The European Online Resource Efficiency Platform (OREP)* ([17]) provides information on transition to a more resource-efficient economy, such as European policies, and notifications of funding opportunities and calls. It also provides publications and a calendar of events.
- *Build Up*, the European Portal for Energy Efficiency in Buildings ([18]), presents information on energy efficiency, including practical examples of good practice in saving energy in buildings.
- *ManagEnergy* ([19]) assists public sector practitioners working on energy efficiency and renewable energy at the local and regional level. Support includes training, workshops, networking events, case studies and examples of best practice, and an online tool to search for partner practitioners.
- *The SmartCities* ([20]) Stakeholders Platform is part of the Smart Cities and Communities initiative to foster innovation, to reduce cities' environmental impact and to enhance citizens' quality of life. The main objective of the platform is to encourage stakeholders to contribute to the design of better policy support for smart cities and to identify innovative solutions and disseminate information.
- *Civitas* aims to tackle pollution caused by transport in European cities. Its objective is to help cities redefine their transport policies to create cleaner and better transport systems. It provides funding for the dissemination of smart measures. The initiative manages several networks and working groups and shares best practice examples.
- *Eltis* is Europe's main portal on urban mobility ([21]). It targets individuals working in the field of transport, as well as in related disciplines, including urban and regional development, health, energy and environmental sciences.
- *The Climate-Adapt* ([22]) platform focuses on adapting to climate change and includes relevant information for cities.
- *URBACT* ([23]) is a European exchange and learning programme promoting sustainable urban development.

([13]) http://eu-smartcities.eu/content/action-clusters-will-be-central-eip-smart-cities-and-communities (accessed 5 December 2014).
([14]) http://www.ewp.eu (accessed 2 December 2014).
([15]) http://ec.europa.eu/environment/europeangreencapital/about-the-award/index.html (accessed 5 December 2014).
([16]) http://ec.europa.eu/regional_policy/urban/portal/index_en.cfm?smenu_mapping_id=1#12 (accessed 6 December 2014).
([17]) http://ec.europa.eu/environment/resource_efficiency/re_platform/index_en.htm (accessed 6 December 2014).
([18]) http://www.buildup.eu (accessed 6 December 2014).
([19]) http://www.managenergy.net (accessed 6 December 2014).
([20]) http://eu-smartcities.eu (accessed 6 December 2014).
([21]) http://www.eltis.org (accessed 6 December 2014).
([22]) http://climate-adapt.eea.europa.eu (accessed 6 December 2014).
([23]) http://urbact.eu (accessed 6 December 2014).

efforts to improve the urban environment and move towards healthier and more sustainable living areas. These can also be an important source of information on solutions for improving urban sustainability and quality of life. Some sectoral initiatives are supported by EU regional policy. Civitas ([24]) is a programme that supports cities introducing ambitious transport measures and policies promoting sustainable urban mobility. The Green Digital Charter ([25]) was launched at the end of 2009 to encourage cities to reduce their carbon footprint through ICT (information and communications technology) solutions that improve energy efficiency in areas such as buildings, transport and energy ([26]). Some completed programmes can be also sources of information on good practice, such as Concerto ([27]) on energy solutions or the GreenBuilding Programme, now completed, on the energy efficiency of non-residential buildings.

Box 3.7 The Covenant of Mayors ([28]): a bridge between cities and the EU's institutions

Local governments face many challenges in their efforts to mitigate and adapt to climate change. There is the dual challenge of achieving economic competitiveness and sustainable urban development. They have to deal with the trade-off between current priorities and long-term risks and with jurisdictional, financial and policy-making constraints. Despite these difficulties, cities are committing to action on climate change.

Following the adoption of the EU Climate and Energy Package, the European Commission decided to involve municipalities directly in reaching the 2020 objectives by launching the Covenant of Mayors. Created in 2008, it is a network of local and regional authorities that have committed to a voluntary programme to meet and exceed the EU target to reduce carbon dioxide emissions by 20 % by 2020.

The Covenant of Mayors is an emblematic example of multilevel governance and bottom-up action in Europe to help local and regional governments to meet their objectives. The private sector's contribution is also a crucial dimension of the Covenant of Mayors through the formal involvement of federations of companies as partners in the initiative. National and European financial institutions constitute another category of stakeholders that brings funding and technical assistance to support the initiative.

By joining the Covenant, signatories commit to preparing a baseline emission inventory and adopting a sustainable energy action plan (to be submitted within 12 months of signing the Covenant). The network provides guidance and support to signatories to help them meet their commitments.

The Covenant initiative fosters cooperation among local, provincial, regional, national and European administrations. Platforms bringing together signatories from the same country are emerging to help local authorities to deliver the EU's climate and energy objectives and to share best practice. The signatories are supported in their countries by energy agencies, regional government and associations of local authorities.

The Covenant of Mayors plays an important bridging role. It has a sound knowledge of its members' needs and priorities and can ensure that European objectives are understood and promoted in practice. Similarly, aspirations expressed at local level feedback to EU institutions.

According to a preliminary assessment, after 6 years, 3 421 action plans determining the long-term vision of local authorities have been signed. Signatory cities are home to 126 million people, representing one-quarter of the EU population. Forty-four per cent of the overall reduction in carbon dioxide emissions will come from improving the energy efficiency of buildings ([29]).

Source: Covenant of Mayors, 2013.

([24]) Civitas: http://www.civitas.eu/mobility-solutions-page (accessed 5 December 2014).
([25]) Green Digital Charter: http://ec.europa.eu/information_society/activities/sustainable_growth/green_digital_charter/index_en.htm (accessed 5 December 2014).
([26]) See the EEA Technical report 'Resource efficient cities: good practices': http://www.eea.europa.eu/publications/resource-efficient-cities-good-practice.
([27]) http://concerto.eu/concerto (accessed 6 December 2014).
([28]) http://www.covenantofmayors.eu/index_en.html (accessed 5 December 2014).
([29]) Summary of the preliminary assessment report on the first 6 years given at the IUME (Towards an Integrated Urban Monitoring in Europe) initiative's meeting on 20 November 2014.

3.2.5 Research

The need for research is considerable. The Seventh Framework Programme ([30]) offers opportunities to develop research into resource and energy efficiency. Several projects are already focused on all aspects of this issue (e.g. Trust, Sume, InContext, Clicq, Urban-Nexus). The European Observation Network for Territorial Development (ESPON ([31])) aims to support policy development while fostering territorial cohesion. The Joint Programming Initiative Urban Europe ([32]), which coordinates research on urban planning in 14 European countries, addresses these issues, including governance and participation. The European Green Cars Initiative ([33]) provides financial support for research into green technologies. The European Energy Research Alliance ([34]) (EERA) is a pan-European programme focusing on research into new forms of energy, including the Joint Programme for Wind Energy.

3.2 The national level

National regulations and specific actions are a key element in balancing the top-down requirements of the EU level (e.g. directives) and the bottom-up needs and expectations of the local level. The legal framework set by the national level has to be flexible enough to be adapted to the diverse needs of all levels below the national level. To stimulate the active involvement of all levels and cooperation between levels, cross-cutting instruments to achieve goals that can be shared by even the lowest levels of governance (local communities, cities, neighbourhoods) are needed. Long-term visions, plans and programmes are key to directing and guiding actions.

3.2.1 Long-term visions and targets

Long-term visions and strategies with clear objectives and targets help to facilitate cooperation and collaboration among the national, regional and local authorities. A strategic framework is crucial to mobilising local government and stakeholders to achieve specific goals. However, it has to be combined with other measures, such as regulations, incentives, operational programmes, participation of local and subnational governments, information to raise awareness and monitoring to analyse the effectiveness of policies. To achieve their goals, national and subnational governments develop, in cooperation with each other and local governments, guidance material and administrative capacity-building.

National governments provide the framework through a strategy on resource efficiency, often through a sustainable development strategy and most commonly through sectoral policies (EEA, 2011a) that give long-term direction and often set targets. Resource efficiency is integrated differently in national policies. In 2011, a survey conducted by the EEA (EEA, 2011a) showed that, even if Member States were aware of the resource efficiency issue, few countries ([35]) declared that they had dedicated strategic policy documents or action plans targeting resource efficiency as their main goal. This issue is often integrated into national sustainable development strategies or sustainable consumption and production action plans.

For example, the Austrian Resource Efficiency Action Plan, adopted in 2011, is required by the Austrian National Strategy on Sustainable Development (EEA, 2011b). Some countries have developed a holistic approach, focusing on greening the whole economy. An example of this is Switzerland's Green Economy Action Plan, approved in March 2013, which relies on voluntary initiatives and the commitment of industry (Federal Council, 2013).

Some of the issues crucial to urban planning, such as land take, are rarely addressed. However, some countries have set out clear targets in this area. For example, in 2002, the German National Sustainable Development Strategy set the goal of reducing land consumption to 30 hectares a day by 2020 (EEA, 2011a). From 2008 to 2012 the daily loss of soil fell from 74 hectares to 69 hectares; it is still far from the 2020 objective of 30 hectares, but there is at least a noticeable downturn (Bachmann, 2014). In Switzerland, the federal Sustainable Development Strategy for 2012–2015 proposes that the total built-up area should be stabilised at 400 m^2 per capita (Confederation Suisse, 2012). By revising the Spatial Planning Act, it aims to bring about compact, space-saving urban development and to increase population density in cities.

([30]) http://ec.europa.eu/research/fp7.
([31]) http://www.espon.eu.
([32]) http://jpi-urbaneurope.eu.
([33]) http://ec.europa.eu/research/transport/road/green_cars/index_en.htm.
([34]) http://setis.ec.europa.eu/implementation/technology-roadmap/european-energy-research-alliance-eera.
([35]) Austria, Germany and the Flanders region.

Box 3.8 German resource efficiency programme

The German federal government adopted its resource efficiency programme in 2012. Its aim is to progressively decouple resource use from economic growth and to take a major step towards a sustainable society. The federal government wants to minimise negative environmental impacts while securing economic growth and increases in productivity. It takes responsibility for the global environmental and the social costs arising from Germany's use of natural resources.

The programme considers the entire resource value chain: it is about securing a sustainable supply of raw materials, increasing resource efficiency in production and building a resource-efficient recycling economy.

The Centre for Resource Efficiency offers consultations and technical expertise to help companies, in particular small and medium-sized enterprises (SMEs), to become more resource efficient. The average company can achieve at least a 20 % saving.

The implementation of the programme is at an early stage. Every 4 years, a progress report is to be provided to the Bundestag. The first is planned for 2016.

These measures need to be added to the German laws currently in force that already specify rules for resource conservation such as the Closed-Cycle and Waste Management Act (Kreislaufwirt-schafts-und Abfallgesetz), the Federal Emission Control Act (Bundes-Immissionsschutzgesetz), the Environmental Assessment Act (Gesetz über die Umweltverträglichkeitsprüfung), the Environmental Audit Act (Umweltauditgesetz), the Federal Mining Act (Bundesberggesetz), the Federal Regional Planning Act (Raumordnungsgesetz), the Federal Building Code (Baugesetzbuch), and the legislation on awarding contracts in the public sector.

Source: Federal Ministry of the Environment, Nature Conservation and Nuclear Safety, 2012 and http://ec.europa.eu/environment/ecoap/about-eco-innovation/policies-matters/germany/20140422-progress_en.htm (accessed 8 December 2014).

Energy (supply, efficiency, use of renewable energy sources) and waste (management, recycling and recovery), followed by green public procurement, building and construction and water management, are the areas that most frequently have sectoral policies (often with targets) (EEA, 2011a). Many countries have targets for energy efficiency related to the 20-20-20 European objectives and the Energy Efficiency Directive (2012/27/EU).

Box 3.9 National or regional targets for municipal waste

- The review of waste prevention programmes in the EU-28 developed under the Waste Framework Directive, Article 29, shows that municipal waste is targeted by waste prevention programmes in five countries/regions:
- *Italy*: a 5 % reduction in waste generated per unit of GDP (gross domestic product) between 2010 and 2020 (corresponding to 0.5 % annually).
- *England*: a 5 % reduction in household food and drink waste by 2015 from a 2012 baseline (equivalent to 1.7 % annually).
- *Finland*: stabilising annual waste generation at 2.3–2.5 million tonnes and further reducing that trend by 2016.
- *Latvia*: no reduction target set but has set an upper limit of 400 kg on the amount of municipal waste generated per person by 2020.
- *Portugal*: by 2016, a reduction of 10 % per person compared with 2007 (equivalent to 1.2 % per year).
- *Wales*: an annual reduction of 1.2 % until 2050 compared with 2006/2007.

Source: EEA, 2014.

3.2.2 From national to subnational level

The national level has to provide a framework that establishes coherent mandates, roles and responsibilities across all governmental levels. A national strategy can be applied from national to local level through a range of systematic formal hierarchical plans or programmes involving the subnational level, public institutions using powers and funds at their disposal (e.g. the French Environment and Energy Management Agency ([36]) or non-profit organisations (e.g. the Waste and Resources Action Programme — WRAP — in the United Kingdom, which works at all levels on waste and resource management, sustainable products and behaviour change). A national strategy can also launch information campaigns and raise awareness among specific sectors of the public.

3.3 The regional level

Generally, the region offers an appropriate spatial dimension in which to develop relevant resource efficiency policies and to bring together the key actors who should be involved. Decentralisation has made regional and local governments more powerful in formulating and delivering policy, and they play an increasing role in improving the competitiveness of the regional economy.

City authorities can spearhead strategies and set ambitious goals for their own territory, but the implementation of policies is limited by the boundaries of the municipality. To overcome the resource challenges, cities need to build strong and permanent links with their hinterland, often far from

Box 3.10 England's plan to reduce waste food

The Waste Management Plan for England (Department for Environment, Food & Rural Affairs, 2013) is a high-level document that is not site specific. It provides an analysis of the current waste management situation in England.

The Plan — like the Government Review of Waste Policy in England (DEFRA, 2011) — recognises that the objectives of the directive cannot be delivered by government alone. It requires action by businesses, consumers, householders and local authorities. The policies summarised in the Plan provide a framework for action by such groups.

At the local authority level, waste planning authorities (county and unitary authorities in England) are responsible for producing local waste management plans that cover the land use planning aspect of waste management for their areas. Waste planning authorities have regard to this Plan — alongside detailed national planning policy ([37]) on waste.

The Government Review of Waste Policy in England identified food waste as a priority for action. Preventing food waste was seen as not only good for the environment but also a way for businesses and households to save money. Several plans provide a framework for action concerning food waste.

The Waste Management Plan for England identifies anaerobic digestion as the best technology currently available for treating food waste. Anaerobic digestion is promoted through renewable energy subsidies, and the government has adopted the Anaerobic Digestion Strategy and Action Plan ([38]) to overcome barriers to the uptake of the technology.

Other initiatives include work by WRAP ([39]) to reduce food and packaging waste. WRAP works in particular with businesses on voluntary agreements. For example, agreements with the hospitality and food services sector include targets on waste prevention and reduction of packaging and on sending unavoidable food waste to anaerobic digestion or composting. An agreement with the grocery retail sector includes finding ways to reduce household waste from groceries.

The 'Fresher for Longer' campaign was developed in 2013 to reduce food waste through better public understanding of the functional roles of packaging. It builds on the message of the 'Love Food Hate Waste' programme.

Source: DEFRA, 2011, 2013 and http://www.wrap.org.uk/ (accessed 20 January 2015).

([36]) http://www.ademe.fr (accessed 14 October 2015).
([37]) Planning Policy Statement 10.
([38]) https://www.gov.uk/government/policies/reducing-and-managing-waste/supporting-pages/anaerobic-digestion-and-energy-recovery-from-waste (accessed 20 January 2015).
([39]) http://www.wrap.org.uk/ (accessed 12 October 2015).

the municipality boundaries. In addition, implementing the circular economy implies developing new markets for recycling products and working closely with the industrial sector (and in some cases certain specific branches) to stimulate research and development (R&D). The city scale is rarely big enough to develop markets and involve all the relevant actors in the process.

3.3.1 Potential for action

The opportunities for action at the regional level depends on the country's institutional and constitutional set-up. Generally, in federal states, the regions are large and powerful, with significant budgets. In this case, they play a role in implementing EU and national policies and also in developing their own policies. When the regions are weak, the potential for action is limited.

From the perspective of the circular economy, regional governments can act in different ways:

- *Long-term commitment*: The regional government collaborates with relevant regional stakeholders to draw up an integrated long-term vision with clear targets and concrete action plans (including research). Its role is not only to facilitate dialogue between stakeholders but also to create good conditions for innovation, in particular by supporting R&D and the dissemination of its main outcomes.
- *The demand-pull*: Developing a market becomes possible when the demand represents a sufficient critical mass (e.g. for recycling materials). The demand-pull from the public sector is an important instrument that can encourage new players to enter in the market (e.g. the development of the cradle-to-cradle approach in the Venlo region of the Netherlands).

Box 3.11 The role of regions in the renovation of buildings

The BPIE's ([40]) report *Boosting Building Renovation — an overview of good practices* gives some examples of regional practices (Atanasiu and Kouloumpi, 2013). It also gives a wide-ranging overview of potential ideas for the elaboration of long-term renovation plans. The report is based on a compilation of renovation requirements, as well as financial instruments, support programmes and market mechanisms for building renovation in a number of countries and regions.

To support programmes for building renovation, many grants and subsidy schemes, preferential loans and tax-related instruments (e.g. reduced VAT, tax reductions, tax credits) have been identified at the national level. However, in some countries, programmes for renovation are developed, implemented and supported at the regional level (e.g. Belgium, Italy and the United Kingdom) through specific instruments. The role of the regions is particularly strong in federal countries.

For example, in the Brussels-Capital Region (Belgium), the Brussels Housing Code has been amended to include a minimum performance threshold for rented homes; this will protect tenants in homes with excessive energy consumption. The organisation Bruxelles Environnement ([41]) provides information on and assistance with all financial subsidies available to citizens of Brussels who want to renovate their buildings. It also offers subsidy for energy studies and audits, passive house or low-energy renovations, and improving insulation and ventilation. In addition, the Brussels-Capital Region has introduced other support programmes and initiatives, for instance the Local Energy Management Action Programme (Programme d'Action Locale pour la Gestion de l'Energie — PLAGE ([42])), which is an energy reduction action plan for public buildings that consume large amounts of energy. The Exemplary Buildings (Bâtiments Exemplaires ([43])) programme is a competition that has been held several times since 2007 with the aim of constructing or renovating buildings that are at the cutting edge in terms of energy consumption and environmental performance.

Source: Atanasiu and Kouloumpi, 2013.

([40]) BPIE — Buildings Performance Institute Europe: http://www.bpie.eu (accessed 14 October 2015).
([41]) http://www.environnement.brussels (accessed 14 October 2015).
([42]) http://www.ukkel.be/fr/services-communaux/environnement/energie/plage#plage (accessed 20 January 2015).
([43]) http://www.environnement.brussels/thematiques/batiments/sinspirer-des-batiments-exemplaires (accessed 20 January 2015).

- *Incentives and regulation*: Regional governments can use taxes, subsidies and regulation (depending on the role of the regions in the national institutional setting) and accelerate the changes by stimulating cooperation between economic partners.

- *Raising awareness*: Keeping all actors informed (industry, users, citizens, researchers, the public sector and public authorities, in particular small municipalities) is crucial to achieving a resource-efficient society. All forms of communication should be explored to achieve the widest reach: guides, websites, social networks, working groups, training, education and the media.

- *Learning by doing*: Regional governments can use the resource efficiency approach in highly visible flagship projects to demonstrate that innovative but practical approaches are possible. Through public procurement ([44]), regional authorities can target the development of innovative resource efficiency solutions and R&D (Semple, 2014).

- *Monitoring and evaluating*: Tools and indicators for measuring the progress of action plans need to be developed and used to communicate with all stakeholders and citizens.

Resource efficiency policies at the regional level also provide multiple economic benefits. Their scale is sufficiently large to have a real leverage effect. For example, in the past the Venlo region had experienced a decline in its population and economy. However, the development of the cradle-to-cradle approach has proved to be a tool not only for improving urban sustainability but also for achieving growth through the development of a circular economy. Today, the cradle-to-cradle approach is a driver for economic development in the region, and the city of Venlo is famous for its innovation in this domain.

Box 3.12 Promoting a regional circular economy in Flanders, Belgium ([45])

Flanders has committed itself to establishing a basis for a green circular economy with the lowest possible use of raw materials, energy, materials and space and the smallest possible impact on the environment, both in Flanders and in the rest of the world. The goal is for Flanders to become one of the top five EU regions in the field of sustainable materials management. By 2020, Flanders should be a pioneer in that field and be able to share its know-how on an international level. This commitment was part of the Flanders in Action (ViA) ([46]) programme and its new transition approach, adopted by the Flemish Government in 2011.

- *Sustainable Materials Management* ([47]): The main challenge is to reduce the need for raw materials by developing closed material and nutrient cycles, thanks to more efficient, cleaner technologies and innovative services. To achieve this objective, the Flemish Government has developed targeted investment policies and regulation. The approach calls for a systemic change bringing together technological progress with shifts in mindsets and behaviour. The government has identified, along with its partners, so-called 'grand societal challenges', cross-cutting themes that address issues of crucial importance for the long term.

- *The Flanders Materials Programme* ([48]): This involves the government, industry, research organisations and civil society at all stages of the programme, from design to implementation on the ground, in accordance with the principles of co-ownership and co-production that are at the heart of the programme. The Public Waste Agency of Flanders acts as the coordinator and catalyst for the Flanders' Materials Programme. The programme is based on three pillars:

  – *Vision*: Plan C ([49]), the Flemish transition network on sustainable materials management, is responsible for advancing the vision to 2050 and beyond. It brings together representatives of the public and private sector, as well as research and civil society organisations. Its mission ([50]) is to accelerate breakthroughs in sustainable materials management through three core activities: shaping a vision, activating a self-learning network around sustainable materials management, and supporting transition experiments.

([44]) https://www.innovation-procurement.org (accessed 14 October 2015).
([45]) http://en.wikipedia.org/wiki/Flanders (accessed 2 July 2014).
([46]) http://www.vlaandereninactie.be/en (accessed 3 July 2014).
([47]) All information about the project, unless otherwise noted, based on http://www.vlaamsmaterialenprogramma.be (accessed 24 June 2014).
([48]) http://www.vlaamsmaterialenprogramma.be (accessed 2 July 2014).
([49]) http://www.plan-c.eu (accessed 28 June 2014). In legal terms Plan C is an association.
([50]) The name 'plan C' represents a need for a radical alternative, as opposed to 'plan B', which focuses merely on symptoms.

Box 3.12 Promoting a regional circular economy in Flanders, Belgium (cont.)

- *Research*: The Policy Research Center for Sustainable Materials Management provides a solid basis for the Flanders Materials Programme. The research centre explores how material flows move through the economy, how sustainable materials management can be measured and how taxes, subsidies and legislation can be used to accelerate the transformation.
- *Action plan*: Agenda 2020 is the action plan drafted by a multi-stakeholder group (30 organisations representing all relevant sectors) that sets out actions to be achieved by 2020.

- *Communication and networking*: The partnership approach is not limited to Flanders. Considerable effort has been made to provide well-designed communications (e.g. the website, brochures and videos are available in English and other languages) and joint projects. For instance, the Public Waste Agency of Flanders is a founding member of the European Network of Eco-Design Centres (ENEC) ([51]), which brings together partners from France, Germany Spain and the United Kingdom.
- *Monitoring and evaluation*: Within the framework of the Flanders Materials Programme the partners are currently working on identifying a set of indicators to measure its transition towards sustainable materials management.

Enabling factors

- It is a unique governance model, based on the transition approach, promoting an integrated approach and co-ownership.
- It is a long-term commitment, shared by the Government of Flanders and all relevant regional stakeholders.
- It is a comprehensive approach, bringing together a long-term vision, policy-relevant research and practical action.
- The Public Waste Agency of Flanders, one of the leading EU agencies in the field of sustainable materials management, has an important coordinating role.
- The programme is highly visible at the EU level and participates in international networks.

Box 3.13 Green innovation vouchers to support SMEs in Navarra and Valencia

As part of the European public–private partnership REMake ('Recycling and resource efficiency in manufacturing') ([52]), two Spanish regions, Valencia and Navarra, have tested green vouchers as a tool to accelerate eco-innovation. The process was divided into two stages: the first voucher was used to conduct a resource efficiency audit identifying the most promising areas for saving resources ([53]), and the second voucher was used to implement specific measures ([54]).

Innovation vouchers proved to be a user-friendly way of financing external expertise to solve small innovation issues. They were non-bureaucratic and specially designed for SMEs. The voucher schemes were financed through regional, national or European funds, including the EFRD. In the both regions, implementation was handled by a technical organisation offering research, innovation and market expertise. Green innovation vouchers focused on areas with positive environmental impacts — water consumption and energy efficiency (Valencia) — and potential resource savings — product lifecycle assessment, eco-design and eco-innovation management, and eco-innovation financing (Navarra).

Reaching SMEs proved to be a challenge. Companies were reluctant to apply for a voucher scheme that includes auditing; they were afraid of being punished later for not meeting environmental standards. The success of such initiatives depends on making the effort to raise awareness and demonstrate the advantages of participating in terms of improvements in business performance.

Source: Greenovate, 2012.

([51]) http://www.ecodesign-centres.org (accessed 4 July 2014). The network, launched in 2012, has already produced two studies presenting exceptional examples of eco-design, and it has coordinated the development of an eco-design toolbox.
([52]) http://www.greenovate-europe.eu/completed-projects/remake (accessed 1 July 2014).
([53]) All information about the project, unless otherwise noted, is based on Greenovate (2012). *Guide to resource-efficiency in manufacturing. Experiences from improving resource-efficiency in manufacturing companies.*
([54]) The vouchers covered 100 % of external service costs up to EUR 10 000 (Valencia) or EUR 20 000 (Navarra).

3.3.2 Working with enterprises

The regional level has an important role to play in accelerating eco-innovation in enterprises, in particular in guiding SMEs (see Table 3.2). Beyond regulation and compulsory requirements, regional policies can help leading players to move beyond the 'usual' ambitions of national and regional programmes. They can develop soft measures such as voluntary agreements and one-stop shops offering advice and professional support. They can also create the conditions necessary to achieve market transformation through a clear and predictable policy and regulatory framework. For that, they need to avoid overlaps in support mechanisms, to create a simple administrative framework, to involve all relevant stakeholders in the decision-making process, to raise awareness on resource efficiency among relevant stakeholders and the public, to increase knowledge and skills (e.g. in R&D, designers and the workforce in certain sectors such as construction), and to monitor the impact of the measures implemented and communicate the results in a transparent way.

Table 3.2 Local governance and available instruments

Local governance	Explanation	Instruments	Actions	Examples
Self-governing	The capacity of local governments to oversee their own activities	Institutional innovation Strategic innovation Incremental improvements in actions and strategies (e.g. loop learning) Establishing new norms and routines to support actions Monitoring Participating in learning networks (e.g. communities of practice)	Developing, planning and integrating resources and energy efficiency needs Upgrading, refurbishing and renovating infrastructure and buildings Regular assessment of policies Development of tools	Eco-budget tool in Bologna (Italy) Circular economy achieved through the cradle-to-cradle approach in Venlo (Netherlands) Green innovation vouchers in Valencia and Navarra (Spain)
Enabling	Coordinating and facilitating partnerships with private actors and promoting community engagement	Positive incentives Enabling multi-actor cooperation (e.g. industrial clusters for recycling and reusing) Participatory mechanisms Information and raising awareness Encouraging social learning Experimentation Market-based instruments	Engaging interest groups Encouraging private sector, in particular industry, to recycle and reuse Information and raising awareness of citizens and businesses Promoting research	Public–private partnership for transforming Bottrop (Germany) A regional circular economy in Flanders (Belgium) Building the foundations for a sharing economy in Seoul (South Korea)
Provision	Delivering particular forms of services and resources	Territorial and multi-actor cooperation to facilitate the implementation of resource and energy efficiency Financial policy	Upgrading and developing resource- and energy-efficient infrastructure and buildings	Turning vacant spaces into community spaces in Budapest (Hungary) Turning Güssing from a 'dying town' to the renewable energy capital of Austria
Regulation	Use of traditional forms of authority	Legislation control and sanctions	Urban planning, regulations, local building codes, regulations on watering gardens, etc.	Building code regulations of Copenhagen (Denmark)

Source: Adapted from EEA, 2012.

4 Transition management in cities

Municipalities' level of authority and jurisdiction and their budgets are limited. Depending on the country and the domain, they rely, more or less, on policy decisions (including funding) taken at EU, national or regional levels. However, despite these constraints, some cities find a way of developing innovative place-based policies and cooperating with neighbouring cities rather than competing (e.g. to attract economic investment).

City authorities are also faced with the limitations of policy instruments that are not adequate to deal with the complexity of the challenges. Nevertheless, some city authorities have adopted ambitious policy agendas with targets and manage the city to achieve these goals. There are many individuals acting at different levels and in different sectors that can contribute to achieving resource efficiency through their daily decisions and practices. They represent a huge potential that can be mobilised by city authorities to transform resource use. The transition management approach can also be used to facilitate societal changes and guide all these different actors towards making sustainable choices (ICLEI, 2014).

To accelerate transformation, city authorities can develop a range of binding measures such as regulations (e.g. the building code in Copenhagen, urban congestion charging schemes in London and Stockholm) and guidelines (e.g. for construction or rehabilitation), urban planning and other types of planning, zoning, and fiscal measures (taxes, fees, etc.). By engaging civil society and a variety of stakeholders cutting across sectors, functional specialisations and jurisdictions, they can also create fertile ground for reaching their strategic and operational objectives.

4.1 Facing a 'wicked' problem

Shifting to a resource-efficient society is not just a question of technological change but also one of systemic change. These kinds of change are often referred to as transitions and defined as societal processes of fundamental change in the structure, culture and practices of a societal system (Frantzeskaki and de Haan, 2009). To achieve this transition, it is necessary to critically examine institutions' settings, markets, values and norms, and practices (Frantzeskaki et al., 2012).

'Transition is a radical, structural change of societal (sub) systems' (Rotmans and Loorbach, 2009). It can be described as ' a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems' (Rotmans et al., 2001).

Complex social–environmental issues are persistent problems (e.g. climate change, loss of biodiversity, land degradation) that cannot be solved by narrow ways of thinking and the traditional modes of decision-making. They are known as 'wicked' problems: 'a complex issue that defies complete definition, for which there can be no final solution, since any resolution generates further

Box 4.1 Strict energy standards in Copenhagen's building code

Cities that have drawn up a low-carbon strategy with targets have generally defined very strict energy standards to improve the energy efficiency of new and existing buildings. For example, in Copenhagen, on an annual basis the energy consumption required for heating, ventilation, air conditioning and hot water is not permitted to exceed 30 kWh/m² plus 1 000 kWh divided by the floor area in square metres ([55]). There is great potential to make existing buildings more energy efficient, as 70 % of the buildings in Copenhagen were built before Denmark's energy efficiency standards were introduced.

Source: City of Copenhagen, 2012.

([55]) The standard requirement in the Danish building code is 52.5 kWh/m² plus 1 650 kWh divided by the floor area.

Box 4.2 Transition management

Urban authorities face problems that are highly complex and do not have pre-defined solutions. Some cities have already used transition management to explore potential solutions through a cooperative learning process (Urban-Nexus, 2014). To achieve a change in society requires searching, experimenting, testing and learning.

The study on transition management in five European cities (Roorda and Wittmayer, 2014) identifies factors that can influence transition:

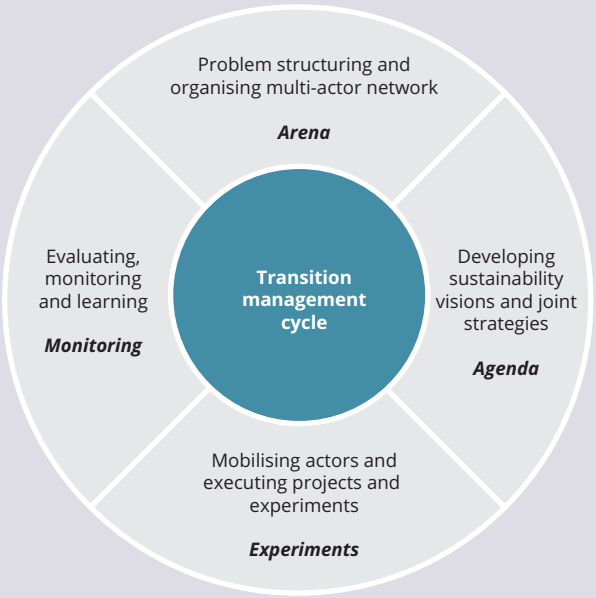
- *Insight into the system:* The complexity of the challenges must be fully acknowledged (e.g. inter-linkages between domains, actors and scales) in order to identify opportunities to address challenges.
- *Incremental steps:* Innovation is achieved incrementally by taking small but radical steps guided by the long-term perspective.
- *Diversity and flexibility:* As the future cannot be predicted, strategies have to keep options open by exploring different pathways.
- *Co-creation:* The process involves many different stakeholders cutting across sectors, functional specialisations and jurisdictions.
- *Creating opportunities for change agents:* Individuals who are already adopting new ways of thinking and doing (change agents) should be actively empowered and engaged in the process.
- *Social and institutional learning:* Learning is essential in societal change. Involving individuals with different backgrounds in the decision-making process makes it possible to imagine new and alternative practices.

Social learning is a key factor in transition management. It is 'a process of social change in which people learn from each other in ways that can benefit wider social-ecological systems' (Reed et al., 2010). It is a way of changing the understanding of urban stakeholders and therefore their behaviour. Social interactions help to stimulate new ways of thinking: 'Learning is a way of discovering how to change existing patterns in pursuit of a new goal' (Rydin, 2010). Behavioural change occurs if stakeholders understand the values that underpin their actions and those of others and if learning applies not just to individuals but also to institutions, organisations and communities. The collective dimension is more significant than the aggregation of individual learning outcomes (Urban-Nexus, 2014).

Transition management to achieve resource-efficient cities needs to develop an overarching policy integrating various sectoral policies and setting up collaborative networks of many individuals. Transition management addresses different components (Laes et al., 2014):

- *the strategic level,* which deals with the 'culture' of the place (e.g. collective goals and norms, foresight, development of a long-term vision);
- *the tactical level*, which is how the vision is translated into transition pathways (e.g. technical, regulation, cultural);
- *the operational level*, which is how to put transition into practice (e.g. the project);
- *the reflexive level*, which is the monitoring and evaluating part of the transition process itself (e.g. using a transition management tool).

Figure 4.1 Transition management cycle



Source: Loorbach, 2010.

The transition management cycle (Loorbach, 2010) includes four steps (see Figure 4.1). The transition arena is central. It provides an informal and well-structured space for a small group of change agents with different perspectives (businesses, government, research institutes and civil society).

issues, and where solutions are not true or false or good or bad, but the best that can be done at the time.' (Brown et al., 2010; Donovan et al., 2014).

Transition management is 'an intentional governance design aimed to steer important societal subsystems (e.g. transport, water, energy) in a more sustainable direction' (Laes et al., 2014). It is 'an explorative process addressing "wicked problems" and searching for long-term solutions' (Rotmans et al., 2001). Transition management implies changing traditional ways of thinking (principles, business models, end-user practices, decision-making processes, etc.). It is a long-term process that requires many changes at the micro-level (e.g. new technologies, new practices) and in the institutional set. It implies defining goal-oriented policies based on far-sighted visions.

4.2 A co-creative and participatory process

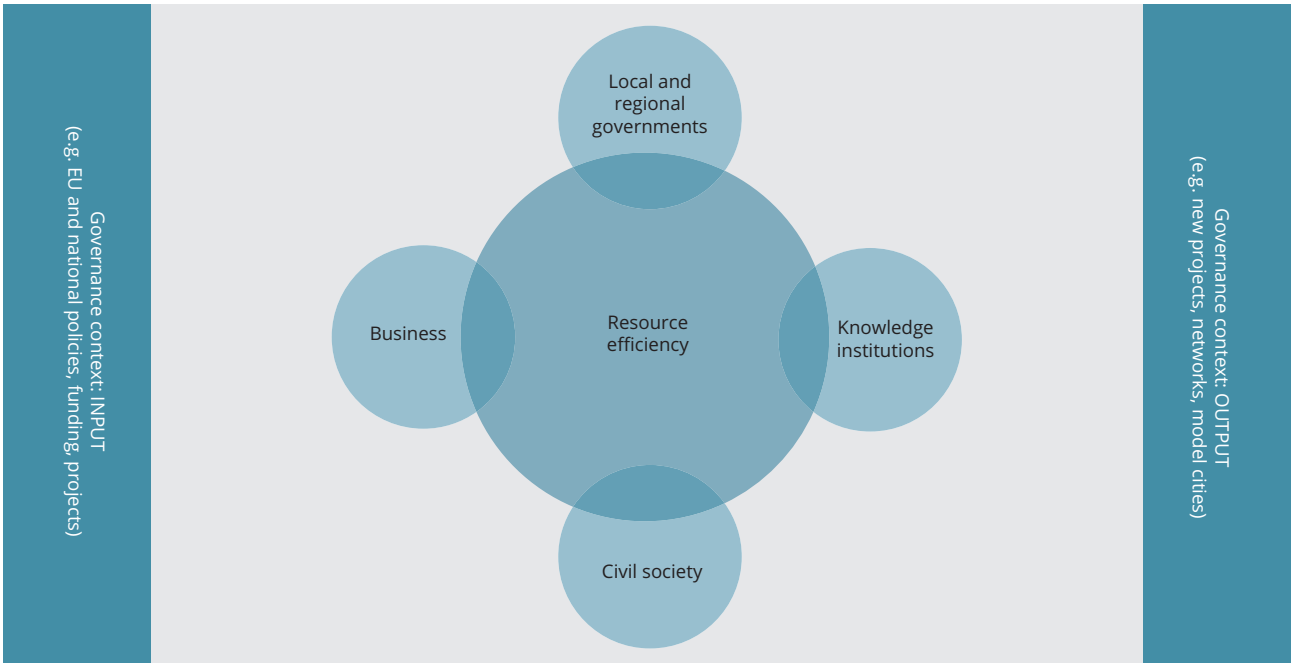
Natural resources are not managed centrally by any level of government. Their management depends on product design, production methods, consumption patterns, scientific knowledge, management procedures and the political and legal framework. That is why efforts to shape or accelerate change towards a resource-efficient society can happen only as a co-creative, participatory process, involving all relevant actors.

Some authors promote the quadruple helix model (see Figure 4.2). This is 'an innovation cooperation model or an innovation environment in which users, firms, universities and public authorities cooperate in order to produce innovations. These innovations can be anything considered useful for partners in innovation cooperation; they can be, for example, technological, social, product, service, commercial, and non-commercial innovations.'(Arnkil et al., 2010).

The model emphasises broad cooperation in innovation. It is a challenge for public authorities and the provision of public services. It 'represents a shift towards systemic, open and user-centric innovation policy. An era of linear, top-down, expert driven development, production and services is giving way to different forms and levels of coproduction with consumers, customers and citizens.' (Arnkil et al., 2010).

In the quadruple helix model, four groups of actors — users, firms, public research organisations and public authorities — participate in the arena (Arnkil et al., 2010). The arena is 'a tool for working on understanding of the current challenges, envisioning a common future, identifying pathways and starting the

Figure 4.2 Governing resource efficiency



Source: ICLEI, 2014.

first experiments to put these into practice, this tool supports a multi-actor learning process in the transition towards sustainability' (InContext, 2013). By engaging in the participatory process, city authorities build trust and strong links with local stakeholders.

The focus of the arena can be different depending on the objectives. For example, the arena can be public sector centred in order to develop public organisations that function better and offer better services to clients, users or citizens. It can also be citizen centred, focusing on the development of innovations relevant for citizens; in this case users are the drivers of change and transformations are based on their knowledge (Arnkil et al., 2010).

The CLiQ research project ([56]) (Interreg IVC) has produced an overview of the multiple roles that local and regional authorities can play in supporting innovation (see Table 4.1).

Table 4.1 Summary of the different roles of city and regional authorities in promoting innovation based on the quadruple helix model

1. Enabler
• Funder (e.g. through project funding, ownership, investments)
• Provider of infrastructure and buildings (including upgrading, refurbishing and renovating)
• Provider of public services (utilities)
• Planner
2. Decision-maker
• Member of the innovation arena
• Designer of innovation policies (e.g. dissemination of technical information, guidelines, financial incentives, R&D programmes, user-oriented programmes)
3. Supporter
• Supporting the identification of stakeholders and the establishment of stakeholder communities (e.g. communities of users or residents)
• Supporting the development of the innovation arena's partners (e.g. firms, universities, users, public organisations)
• Supporting the networking and interactive learning of different groups and stakeholders (including public sector data)
• Supporting the systematic collection and utilisation of user information and the establishment of databases
• Supporting the development of knowledge and capability to the innovation arena (e.g. research, education, methods and tools)
• Promoting the empowerment of citizens and helping them to innovate
4. Utiliser
• Utilising the quadruple helix model and user-oriented development methods in the internal development work of the public sector
• Utilising the user-oriented development services provided by the quadruple helix model for themselves (as part of the development of public services)
5. Developer
• Developing public organisations so that they can function and offer new and better products and services to their clients and citizens
• Redeveloping institutional frameworks to make them more suitable for user-oriented innovation
6. Marketer
• Raising awareness of user-oriented innovation among citizens, businesses and the public sector
• Marketing user-oriented innovation models and practices to businesses, users and other financiers
7. Quality controller
• Supporting the development of 'quality checks' or standards for 'quadruple helix-type' activities and for a co-creative environment
• Assessing the quality of 'quadruple helix-type' activities by means of these standards

Source: Adapted from Arnkil et al., 2010.

([56]) http://www.cliqproject.eu (accessed 4 July 2014).

Box 4.3 Seoul: an arena for building a sharing economy

In 2012, the Seoul Metropolitan Government announced the Sharing City Seoul project. This was seen as a way of simultaneously resolving a number of social, economic and environmental issues faced by the city. The Seoul Metropolitan Government Act for Promoting Sharing ([57]) sets out a framework for further action to 'ensure the maximum utilization of resources, restore communities, and revive the regional economy by promoting sharing'. Public participation is a priority of the project and is embedded in all the administration's activities through participatory budgeting and online platforms for participation and information sharing.

Any organisation or business that wishes to resolve social problems through sharing can apply for sharing organisation/business status and benefit from administrative and financial support. Different categories are defined on the basis of the resources shared: information, space, objects, experience and skills.

The Sharing City Seoul programme also includes support measures designed to encourage the creation of sharing start-ups, such as the Youth Business Start-up Incubation ([58]).

Enabling factors

- State-of-the-art technological infrastructure
- High-level political commitment (initiative led by the mayor)
- Strong legal and institutional framework (dedicated legislation, new bodies and platforms, such as the Sharing Promotion Committee and the Share Hub)
- High local and international visibility (engendering a sense of pride in citizens).

Source: ICLEI, 2014

Box 4.4 Public–private partnership for transforming the city of Bottrop

In 2010, Bottrop was selected as a pilot city for climate-friendly urban redevelopment of some districts in a competition organised by the Ruhr Initiative Group (a consortium of 70 leading companies). Five years later, the city of Bottrop has been transformed through an active public–private partnership and an innovation arena initiating projects focused on climate-friendly urban redevelopment.

InnovationCity Management, a private company established to coordinate the process, together with its local consortium and strategic partners, worked on the creation of a blueprint. The basis of the blueprint was established in a bottom-up process, involving citizens in the pilot districts in a series of forums and workshops held to allow them to express their ideas and share their visions regarding the future of the district and the city. In 2014, this strategy was translated into a master plan, accepted by Bottrop City Council as a guiding document for the redevelopment of the pilot area.

The strategy is based on the concept of a bottom-up energy transition, with the objective of transforming the energy system from the micro to the macro level. Through capacity-building and involving citizens in energy production, the goal is to change the role of the city's inhabitants from that of energy consumers to prosumers.

Enabling factors

- Strong public–private partnership, including local, regional and national partners
- Political commitment from the local administration
- Bottom-up approach to the development and implementation of the redevelopment concept
- Active engagement of the research community
- Well-developed funding model, including private sector and state/federal government contributions

Sources: www.icruhr.de; ICLEI Case Study 169 'InnovationCity Ruhr – Model City Bottrop: revitalizing an industrial region through low-carbon redevelopment and active public-private partnerships' (accessed 12 October 2015).
http://www.iclei.org/fileadmin/PUBLICATIONS/Case_Studies/ICLEI_cs_169_Bottrop_2014.pdf (accessed 20 January 2015).
http://www.eneff-stadt.info/en/pilot-projects/project/details/bottrop-welheimer-mark-energy-optimisation-of-a-mixed-area-comprising-residential-industrial-an (accessed 30 June 2014).
ICLEI, 2014.

([57]) http://legal.seoul.go.kr/legal/english/front/page/law.html?pAct=lawView&pPromNo=1191 (accessed 26 June 2014).
([58]) http://sharehub.kr/english (accessed 25 June 2014).

4.3 The perception issue

In times of economic, environmental and social crises, resource efficiency is no longer perceived to be a distant problem. Investing in resource efficiency is increasingly understood to be a smart economic development strategy. Local, decentralised production and closed loops are seen as risk management strategies that favour economic development and resilience. This way of thinking is gaining in importance, although it remains far from mainstream ideas on urban development.

However, for this shift to take place in practice, a number of conditions need to be fulfilled:

- *Measuring, monitoring, assessing:* In order to design resource-efficient systems, it is necessary to be able to easily measure, visualise and analyse the use of resources at both the household level (e.g. smart meters) and the city level (e.g. urban metabolism calculations, indicators for urban monitoring, inventories of empty buildings).
- *Monetisation:* It is important to estimate the real price of the resources we use. Natural resources, as common goods, cannot be reduced to market commodities; their price should take into account not only market logic but also environmental and social costs. In addition, some market distortions (e.g. subsidies) make it difficult to establish a business market for the most sustainable products and materials. For this reason, the idea of putting a monetary value on natural resources is still under debate.
- *Public control:* Local and/or regional governments need to be able to control the delivery of basic services linked to resources, including, at a minimum, water and sanitation, energy distribution and waste management. This is a way of making it easier to consider social and environmental criteria linked to service delivery and to adopt an integrated sustainable perspective on local development.

4.4 The lessons learnt from success stories

In examining how cities are delivering effective action on climate change adaptation and mitigation, the first assessment report from the Urban Climate Change Research Network, *Climate Change and Cities* (Rosenzweig et al., 2011), mentioned four key factors that can be equally applied to the resource efficiency issue:

- effective leadership to overcome fragmentation across neighbourhoods and sectors in order to build consensus;

Box 4.5 Cataloguing vacant spaces in Budapest

The problem of vacant buildings and spaces was particularly serious in Budapest. The recession, combined with many obsolete buildings and the mismanagement of real estate, has left a significant proportion of the city's buildings empty. In 2012, the vacancy rate in the office stock in Budapest ([59]) was the highest among the central eastern European capitals, reaching 26 %.

To address this situation, in 2012 the Hungarian Contemporary Architecture Centre (KÉK ([60])) launched a research and advocacy project called Vacant City (Lakatlan ([61])). This has succeeded in drawing the attention of both citizens and the local administration to the problem of vacant spaces in the city. KÉK has launched an online mapping tool, inviting citizens to create a map of vacant properties and spaces around the city. This crowd-sourced database acts as a tool to support citizens' participation and to stimulate discussion.

In 2013, KÉK started the Vacant City_Reload (Lakatlan_Reload ([62])) project ([63]), which aims to identify community, social and cultural initiatives in need of space and pair them with the owners of vacant properties.

([59]) Cushman & Wakefield (2014). *MarketBeat Office Snapshot: Hungary*. http://www.cushmanwakefield.com/~/media/marketbeat/2014/02/hungary_off_4q13.pdf (accessed 30 January 2015).
([60]) KÉK: Founded in 2005, KÉK is a cultural institute that promotes architectural education, awareness and innovation among professionals and the general public. KÉK's objectives are to initiate dialogue about architecture, the city and its culture and about the built environment.
([61]) Based on http://lakatlan.kek.org.hu (accessed 3 July 2014).
([62]) http://toltsdujra.hu (accessed 3 July 2014).
([63]) In partnership with the Kreater Social Innovation Agency, Habitat for Humanity Hungary and the Oslo School of Architecture and Design. The project was funded by Norway Grants.

- efficient financing to allow empowered governance in cities;
- jurisdictional coordination across city, state and national governments;
- participation of citizens in order to develop inclusive local government decision-making.

The World Future Council (Woo et al., 2014), in *Regenerative Urban Development: a roadmap to the city we need*, identifies short-term vision, silo approaches, a lack of policy mandate and finance, and corruption as the main obstacles to creating regenerative cities. To overcome those obstacles, the following elements are needed: vision and leadership, the participation of citizens and many different stakeholders, decentralisation and multilevel dialogue, cross-sectoral coordination, communication, and education. Whereas some of these aspects (e.g. corruption or decentralisation) may apply predominantly to cities in developing countries, it is clear that this list also reflects problems and solutions that apply to many European cities.

The United Nations Environment Programme (UNEP) has identified six issues that need to be addressed if the transition to sustainable, resource-efficient cities is to be successful (UNEP, 2012). These are:

- integration (looking at environmental, social and economic factors);
- the urban divide (social and political sustainability);
- governance (coordinated multi-sector change, with the participation of all relevant stakeholders);
- smart urban design, logistics and spatial planning (compact and multi-use urban development);
- finance (funding streams and financial incentives, e.g. tariffs, subsidies, taxes);
- technology and skills transfer and development (particularly relevant for cities in the developing world);
- innovation (focus on diversity and going beyond technology).

The European Parliament report *Mapping Smart Cities in the EU* (EP, 2014a) identifies good practice and the factors that have led to the success of the most highly performing European cities ([64]), taking into account their country's national priorities and political and socio-economic circumstances. This cross-analysis has highlighted a number of good practices, each related to three factors that are important for successful 'Smart City' solutions:

- inclusion and participation are important targets to be included in programmes in order to avoid the polarisation of urban elite and low-income areas;
- citizens should be empowered through active participation to create a sense of ownership and commitment;
- efficient processes need to be developed to ensure the integration of solutions and the coordination of ideas, projects, stakeholders, beneficiaries (e.g. the information can be provided as 'open data').

Defining goals and long-term objectives in a 'vision' seems to be the key factor for unifying diverse groups and actors with different interests. It is the most important step in the management of transition cities. Working towards a common vision of a 'desirable future' (InContext, 2013) will contribute to the transformation of individuals, groups and communities.

The vision needs to be presented as a series of small practical steps to motivate all participants to become and remain active (InContext, 2013). Urban areas are constantly changing, and city authorities, developers, housing corporations, providers of utilities and house owners have to integrate resource efficiency goals into their daily investments and practices. Sharing the same vision (i.e. having a common understanding) helps (Wittmayers et al., 2014) everyone to take appropriate action.

In addition, some cities have demonstrated that innovation to achieve resource efficiency is not an obstacle to a flourishing economy (e.g. the range of stakeholders' benefits arising from the innovative environment generated by projects focused on achieving resource efficiency). Some projects that are today considered flagships of sustainable urban management were initiated to simultaneously address environmental issues and transform a poorly performing economy (e.g. Venlo and Güssing) or a city with a negative image.

([64]) The six most successful cities: Amsterdam (the Netherlands), Barcelona (Spain), Copenhagen (Denmark), Helsinki (Finland), Manchester (United Kingdom) and Vienna (Austria).

Box 4.6 Urban sustainability and the city's image

'Being green' can be seen as an image statement that generates international visibility, even for medium-sized cities (e.g. Växjö, Sweden, and Nantes, France), small rural towns, districts (e.g. Quartier Vauban in Freiburg, Germany, and BedZED in Sutton, United Kingdom) or iconic buildings. In a globalised environment with strong competition between cities, urban sustainability is not only a way of planning, designing and managing the urban environment to achieve a better quality of life for citizens but also a way of building the city's identity and promoting it. It is recognised as a strong driver for attracting businesses, investment, research centres, tourism, cultural festivals and other entertainment events.

Urban sustainability is the result of the transformation of the physical characteristics of the city (e.g. renovation of buildings, modernisation of infrastructure, creation of green areas, increasing overall density) and the non-physical elements such as culture and capacity to innovate (Rehan, 2014). All these factors contribute to forging the image of the city and at the same time change how the city's residents think about their city and how the city is perceived from the outside.

Successful sustainable cities shape a collective sustainable urban image both within the city and outside. For example, European green capitals such as Copenhagen or Ljubljana (Slovenia) are recognised as models for urban sustainability all over Europe. The small rural town of Güssing in Austria is known throughout Europe and is seen as a replicable model. For the city's residents, their quality of life influences the perception they have of their city (TNS Political and Social et al., 2013). Policies with clear goals that are easy to understand and defined through a participatory process can create a territorial dynamic and change residents' image of their city.

4.5 Key factors in the management of transition cities

From the transition perspective, there has to be fundamental changes in — rather than simply optimisation of — institutional frameworks, mindsets and practices. They cannot just be planned by policy-makers and city administrations. To achieve ambitious goals leading to resource efficiency, the decision-making process has to change and engage all of society.

'Transition management is about the participation of all in a societal learning process' (Wittmayers et al., 2014). It can be understood as the 'co-production of societal knowledge'. It is not only a participatory process but also transformation from the inside.

In transition management, policy-makers and city administrations do not have complete control of the process, as it is driven by stakeholders and citizens. At the start of the process, the vision determined by participants cannot be predicted, and the results may not be fully in line with the initial goals and plans of the municipality (Roorda and Wittmayer, 2014). Policy-makers have to rethink their roles in driving decision-making in their communities. They have to keep in mind that lasting changes will depend on citizens (InContext, 2013). Rather than focusing on predictable project deliverables, the target of the process is the empowerment and engagement of a community around a shared vision and agenda.

Several factors are crucial to addressing the challenges of achieving resource efficiency (ICLEI, 2014).

Finding the appropriate scale

There is no 'right' level of governance at which resource efficiency should be addressed. It can be done at all levels, ranging from the neighbourhood to the city, from the metropolitan area to the entire region, or on an even larger scale. To a certain extent, it depends on the resource in question: for instance, vacant spaces can more easily be addressed at the neighbourhood level, whereas water efficiency can be addressed more effectively on the river basin scale. Other important factors influencing the choice of scale are the prerogatives of different levels of government when it comes to managing the various types of resources.

On the other hand, local initiatives may shape the context of national, European and even global governance, expanding the realm of what is considered possible. This is particularly the case in the field of renewable energy, in which many successful local experiments with decentralised renewable energy provision have paved the way for similar initiatives to be replicated on a broader scale (REN21 et al., 2011).

The potential for action depends on the characteristics of the city and the context: size, function (national or regional capital, for example), presence of high-tech companies and universities, wealth and funding potential, territorial capital. However, even for the largest cities, the municipal scale is not appropriate to address

current challenges such as climate change, demographic change, changes in production patterns, urban sprawl and, more generally, environmental problems. To successfully address these problems, urban municipalities need to cooperate across borders and find common solutions with surrounding municipalities. The scale needs to be sufficiently small to be tangible and sufficiently large to be relevant.

Urban planning, which is crucial to addressing the challenges of achieving resource efficiency, can no longer be coordinated only on the municipal scale. Increasing mobility has rendered the borders of individual municipalities more porous and less important in daily life. People live, work and move in a wider functional area. The transformation of major cities into complex metropolises, characterised by large polycentric urban areas, and the extension of commuting areas raises the question of cross-border planning perspectives. In addition, the uncertainty and risks caused by climate change means adopting preventive measures in planning frameworks and new environmental regulations.

To be more resource efficient and minimise costs, urban authorities need:

- to increase efficiency in all aspects of urban planning, development and management;
- to emphasise an integrated way of thinking (inter-sectorial) on an appropriate scale (cross-border);
- to develop innovative approaches (not only technological but also organisational, financial, knowledge inputs, etc.) in order to reduce costs;
- to develop synergies between policies (e.g. combining different objectives in one project, such as adapting to climate change, improving quality of life, reducing emissions).

During the planning process, all solutions (including those that are 'out of the box' or unconventional) have to be explored, fully discussed and approved by stakeholders. This is a way of interlinking policies and activities. For example, if the goal is to develop walkable neighbourhoods, other policies have to be considered in parallel, for example transport policies: integrated transit systems, when and how much to charge for car traffic, liveable streetscapes, noise and pollution.

The main benefits of cross-border cooperation are:

- *Developing smart approaches on the appropriate scale*, in particular spatial planning, risk management (e.g. flood protection), mobility, renewables (e.g. energy production by windmills). For example, urban sprawl is an issue that cannot be addressed only at the municipality level.
- *Generating economies of scale* in order to develop cost-effective utilities to provide better services for users at better prices (e.g. waste and water management, public transport). For example, given the cost of construction and maintenance of public transport lines (tram, light railway and metro), their cost-effectiveness depends on the number and density of potential users in the areas served. To be economically viable, their catchment area generally covers several municipalities (EEA, 2013).
- *To speed up the transmission of new ideas*: working together can stimulate the development of early-stage initiatives and experiments. Co-creating new solutions helps to share risk, to share costs and to enlarge the number of potential users and customers.

Taking stock

Each city is unique, and there is no 'one size fits all' solution. Local specifics have to be considered when defining appropriate solutions. It is important to

Box 4.7 Functional regions in Sweden

The report by the Ministry of Regional Development of Poland *Place-based Territorially Sensitive and Integrated Approach* (Zaucha and Świątek, 2013) highlights Sweden's long tradition of promoting the concept of functional regions in an informal way without changing the existing administrative system or the boundaries of municipalities or regions.

In Sweden labour markets were identified as important areas of public intervention more than 20 years ago. The intensity and direction of commuting influenced decisions made by local and regional politicians on public investment in transport or on the location of public services of general interest.

The authors found that the most important factor was the emergence of the conviction among local leaders that only by cooperating with other municipalities to create a critical mass could they remain competitive in the long term (Zaucha and Świątek, 2013).

understand the particular assets of a given territory and make the best use of them. The place-based approach is seen as a way of making better use of territorial capital — as described in depth in the EU Territorial Agenda of 2007 (Informal Ministerial Meeting on Urban Development and Territorial Cohesion, 2007) — in order to develop more efficient policies (Zaucha and Świątek, 2013) and to stimulate cooperation between participants.

It is crucial to play to local dynamics and strengths. Experience in different cities show that it is important to learn from local participants and initiatives (Roorda and Wittmayer, 2014). What already works can be a foundation for future action. For example, the transformation of the district of Hammarby Sjöstad (Stockholm) by circular metabolism has been largely based on past initiatives from the 1970s (Suzuki et al., 2010). In the case of Seoul it was, among other things, its state-of-the-art technological infrastructure that proved to be an excellent foundation for building a sharing economy. In the case of Güssing it was its rural setting, with abundant wood from forests that could be used as biomass to produce energy.

The baseline analysis should also take into account other elements of the local context that may represent opportunities or obstacles to designing resource-efficient systems. For instance, cities that receive large numbers of tourists may struggle to ensure adequate service provision during the peak tourist season but have unused resources at other times of year. This poses further questions related to the costs of tourism that are not accounted for, in that local communities may be disproportionately affected.

Learning from others means not applying exactly the same solutions from one city to another as 'copy and paste' solutions. To ensure the best results, the measures chosen should reflect the local situation. For instance, in the case of Bottrop, where most buildings in need of refurbishment were privately owned, it was essential to establish the Centre for Information and Advice ([65]) to customise retrofitting solutions in accordance with the needs of home owners.

Creating networks and institutions

Resource use is too complex an issue to be handled by public administration alone. A successful strategy

Box 4.8 Güssing: a small town that achieved self-sufficiency in renewable energy

Güssing, a town of about 4 000 inhabitants in Austria, achieved self-sufficiency in renewable energy in 2001. This was the final step in a process of planning and development that took Güssing from a poor rural town to a role model for the supply of municipal renewable energy.

In 1990, experts developed a revolutionary model that aimed to abandon the use of energy from fossil fuels. Its objective was to supply the town of Güssing (and subsequently the whole district) with renewable energy from locally available sources. It projected that this could bring new kinds of added value to the whole region. The model comprised heat generation and production of fuel and electric power.

The first step was targeted energy-saving measures: optimising the energy consumption of all buildings in the town centre alone cut energy costs in half. In the next step the focus shifted to energy production, with the installation of a plant producing biodiesel from rapeseed oil, biomass-powered district heating systems and, finally, a new biomass power plant. As a result, Güssing has become a net energy producer — generating more energy from renewables than it uses. Altogether, there are more than 30 power plants using renewable energy technologies within 10 km of the town, as well as a research institute focusing on thermal and biological gasification and the production of second-generation fuels. As of 2013, the town has 60 new companies, 1 500 new jobs and an annual revenue of EUR 12.5 million from energy sales, all resulting from the growth in the renewable energy sector.

Sources: ICLEI, 2014 and http://cleantechnica.com/2013/10/16/renewable-energy-powered-austrian-town-gussing/ (accessed 2 July 2014). http://www.go100percent.org/cms/index.php?id=19&id=69&tx_ttnews%5Btt_news%5D=37&tx_locator_pi1%5BstartLat%5D=45.93583305&tx_locator_pi1%5BstartLon%5D=-4.86260045&cHash=c97c427939de97ca926c53a132d6bdc3 (accessed 12 October 2015).

([65]) To achieve the goal of a significant reduction in carbon dioxide emissions, large-scale retrofitting of existing buildings was necessary. Around 60% of buildings (2010) in Bottrop's pilot area were highly or moderately in need of refurbishment. Approximately two-thirds of the buildings were privately owned, meaning that any changes were dependent on the successful involvement of the residents. Therefore, the Centre for Information and Advice (ZIB) was established, which offers free energy efficiency studies to owners, including data consumption analysis and individualised retrofitting proposals.

Box 4.9 Managing natural resources with the ecoBUDGET tool: the case of Bologna

The city of Bologna introduced ecoBUDGET ([66]) in 2001 as one of the local administration's programming tools, following its formal adoption by the city council and the executive committee.

Used by a number of cities around the world, *ecoBUDGET* is designed to support local governments to manage their resources in a sustainable and efficient way. The basic idea is to manage natural resources following the procedures used for the management of financial resources, although no monetary value as such is attributed to these resources. It takes stock of local resources and helps municipalities to draw up a budget for their annual use.

As of 2013, 13 environmental budgets had been adopted, and *ecoBUDGET* had developed into an integral part of the municipality, despite the political changes that had taken place over the years. Thanks to *ecoBUDGET*, the city has been able to improve and streamline data collection, supporting the creation of a basic dataset that was lacking and is now updated annually, as well as establishing a system for monitoring the results. It has also helped to raise awareness within the local administration of the major environmental issues at stake and increase the municipality's transparency to the population on its priorities and activities ([67]).

To execute *ecoBUDGET* properly, some institutional changes were necessary. A cross-sectoral working group was created within the administration and approved by the council.

Before *ecoBUDGET* was introduced, the only monitoring tool used by the administration was its 'Report on the state of the environment', which collected data in a very static way, without indicating targets or measures taken to reach those targets.

The environmental budget turned out to be a useful tool not only for technicians but also for politicians and the city's managers. It enabled them to improve their administration and management of the urban area, as well as improving their understanding of the links among environmental, social and economic aspects.

In conclusion, *ecoBUDGET* provides a comprehensive overview of the environmental management of the urban area and raises awareness. The quantitative indicators allow solid planning of measures and help with reaching targets and monitoring the effects of measures taken. In addition, *ecoBUDGET* supports more effective internal and external communication.

The main lessons learned through implementing *ecoBUDGET* were the importance of political commitment, of setting up a cross-sectoral team and of setting up a database and continually updating environmental data.

Source: ICLEI, 2014.

needs to take into account the needs and capabilities of all participants — and not only in the implementation stage but also much earlier, ideally starting at the design stage (e.g. the Flanders Materials Programme). This will ensure not only a solid knowledge base but also co-ownership of the strategy thus developed, making it less vulnerable to short-term political changes. Considering the close link between resource efficiency and the local economy, special attention should be paid to engaging businesses in dialogue without reducing the discussions solely to the question of economic efficiency.

However, building networks should not be confined to the local or regional level. Rather than reinventing the wheel, it is important to reach out to others dealing with similar problems in order to share experiences and learn from each other.

To ensure long-term commitment, shared responsibility should go hand in hand with institutionalisation. The adoption of strategic frameworks that set out targets for the future or the establishment of new institutional participants (e.g. InnovationCity Management GmbH in Bottrop) can act as a driving force for resource

([66]) Initially, environmental budgeting was introduced with the support of the European ecoBUDGET project, funded by the EU LIFE programme (2001–2003). Since then, the activities have been funded by the municipality itself.

([67]) All information about the project is based on: ICLEI (2013). *Managing Environment and Poverty in Asian Cities. ecoBUDGET guidance*, pp. 132–140.

Box 4.10 The success story of tramway T2 in Île-de-France

Tramway line T2 (Trans Val-de-Seine) in Île-de-France, linking the south-western suburbs of Paris with La Défense (the business area), opened in 1997 and has since been extended twice. The first extension, in 2009, took the line into Paris. The second one, opened in 2012, was a north-west extension.

The main aims of the two extensions were to offer an alternative route into Paris and to improve connections to the localities along the western city limit of Paris. The new extension crosses or borders six municipalities. The length of the line is 17.9 km, which is covered in 45 minutes.

Tramway line T2 is a heavily used route, carrying, on a daily basis, a number of passengers that exceeded the authorities' initial estimate, making it a real success story.

The tramway is also part of the 'Grande Tram' project that plans a ring of tramways around Paris to increase the connectivity between central Paris and the suburbs. The objective is to replace daily commuting trips by car with sustainable means of transport.

Source: http://www.eltis.org/discover/case-studies/paris-region-connectivity-improved-extension-t2-tramway-line-france (accessed 25 January 2015).

efficiency, as well as an insurance policy in the event of short-term changes in political commitment. The case of Bologna in Italy shows how adopting ecoBUDGET, an environmental management system, as an annual routine since 2001 has made it easier to strengthen the position of environmental and resource efficiency issues on the local agenda.

Striving for excellence

Choosing an ambitious goal, one that all stakeholders can get behind, has the power to put the entire city or region on a completely new path, setting off a transformative dynamic and inspiring new, even more ambitious, goals. This was the case in Güssing, which in 1990 pledged to go 'fossil fuel-free' and now aspires to extend the concept to the whole region. Ambitious goals have turned Bottrop into a model for the development of cities. They are also what pushed Flanders into pledging to become one of the top five EU regions in the field of sustainable materials management.

≠This strategic dimension seems to be an important factor in the success of initiatives. The ability to define a vision for the future with clear priorities and targets eases the decision-making process (e.g. the fossil fuel-free objectives of Växjö) and dialogue with stakeholders, who can in turn make their own decisions.

The approval process is also crucial, as it should enhance, or at least not jeopardise, the likelihood of achieving the final goals. However, the selection of a project is often based upon immediate costs, without taking a broader sustainable view of all the indirect effects and costs. For example, a lack of flexibility in land use zoning might prevent cites from creating efficient mixed-use buildings and neighbourhoods.

Developing social learning

Learning processes play an important role in the transition process, and the arena is the key tool for supporting multi-actor learning process. Transition management can be seen as the co-production of societal knowledge alongside long-term new structures, cultures and practices. It is a process that needs time, and it is based on trust between all the participants. Facilitation methods are very important to foster debate and discussion within the arena. If the process of developing a vision is carefully moderated, it can become a powerful tool for unifying even extremely diverse groups, because the objective of the discussions is to discover a shared purpose in the long term.

Different arguments emphasise the importance of the local level in this process, and thereby the city level (Jäger and von Raggamby, 2013). Firstly, local circumstances have practical consequences for societal challenges, in particular for quality of life and everyday life. Secondly, addressing local concerns stimulates citizens' and stakeholders' engagement and motivation to take action; it also provides strong arguments for local funding of the initiatives. Thirdly, local initiatives provide a strong basis for an 'open knowledge society', recognising that scientists are not the only 'holders of knowledge'.

Change is happening anyway. Policy-makers can foster it by using the diverse grassroots initiatives that emerge at the local level (InContext, 2013). Developing alternative ways of solving complex challenges can be used to stimulate innovation in the city. The 'frontrunners', the

groups of citizens or individuals exploring innovative solutions (e.g. 'organically grown' communities, collective gardening, sharing communities), can be empowered and supported to boost social learning and to allow innovative ideas to become mainstream practices (Raushmayer et al., 2013).

Strategic investment in innovative projects (private, public and the municipality itself) is a way of demonstrating that new approaches are possible and of stimulating local initiatives. Experimentation and demonstration are ways of showing different stakeholders what works; they can then share the vision and track its progress if there is a monitoring system to measure it.

Operationalising transition management

The research project MUSIC (Roorda and Wittmayer, 2014) has translated transition management's principles into a process and step-by-step guidance. It has identified different key phases: preparation and exploration, problem structuring and envisaging, backcasting, pathway and agenda building, experimenting and implementing, and monitoring and evaluation.

According to this project, starting with something that is concrete and relevant seems a good way of engaging people and the best entry point for mobilising people. When people define concrete small steps based on a vision of greater change, it can encourage them to become and remain active.

Encouraging monitoring and evaluation

The question of monitoring and evaluation is a key issue. It is necessary to develop adequate indicators for resource-efficient cities that will be able to account for the spatial and temporal dimension of resource flows, going beyond simple resource use indicators.

One of the challenges when looking at examples of pioneering initiatives is to find a reference point against which to judge their efforts. Considering the diversity of European cities, any set of quantitative indicators will offer only limited information, and, while having EU-wide data can certainly be useful, more attention should be given to qualitative and process-oriented indicators, as well as peer exchange and benchmarking. The EU Directorate-General for Environment is developing a benchmarking tool to help cities to determine their sustainability.

Developing a user-centric approach

Municipal authorities play a key role not only in supporting technical transition (e.g. infrastructure development, technology, management, maintenance, innovation), but also in changing demand. Supplying better services can support citizens to change their behaviour. For example, offering affordable, frequent, user-friendly public transport can dramatically change the behaviour of city residents, and the demand can exceed the expectations of public authorities.

City authorities can help citizens to change their everyday behaviour as consumers, users and residents. They can encourage changes in behaviour by better urban planning and urban design, by enabling sustainable behaviour (e.g. an interconnected network of cycle lanes, a building code allowing solar panels), by empowering citizens to take part in the decision-making process, and by encouraging innovative initiatives (e.g. collective urban gardening, crowd funding in the local community for sustainable initiatives).

They also have an important role to play in the event of ecological crises. For example, during the water crisis in 2007–2008, the Regional Government of Catalonia, as well as the city of Barcelona, took drastic measures to

Box 4.11 The 'Bicycle Account' of the city of Copenhagen

The cycle policy of the city of Copenhagen is mainly focused on increasing the proportion of commuters travelling by bicycle and on reducing the risk to cyclists and increasing their speed and comfort.

Evaluation and public accountability are essential components of an effective cycle strategy. The Bicycle Account is a biannual evaluative tool used by the City of Copenhagen's Roads and Parks Department since 1995. The Account incorporates two main elements: a survey of over 400 frequent cyclists, and important statistics that affect cycling conditions.

The Bicycle Account is used to measure how successfully the goals set forth in the cycle policy are met. Cyclists are actively involved in defining areas of improvement. This creates widespread support for smart cycling programmes because investments in the cycling infrastructure are based on the needs of citizens, and that creates a sense of ownership.

Source: EP, 2014b.

control the demand for water and raise the awareness of citizens (Martin-Ortega et and Markandya, 2009; Domènech et al., 2013).

Encouraging technical innovation

City authorities can implement measures such as support for innovative business models, public procurement (pre-competitive procurement, recommendations and preferences in municipal procurement for services), incorporation of standards and norms in tender requirements, improvement of regulations (e.g. the building code of Copenhagen, the cradle-to-cradle initiative in the city of Venlo), developments in local experimentation, etc.

Box 4.12 PRO-LITE — public procurement for innovative lighting solutions

The EU actively supports public procurement for innovation through a number of policies linked to the Europe 2020 strategy and in particular the flagship Innovation Union Initiative ([68]), adopted in 2011. Public procurement aims to stimulate partnerships, to facilitate access to finance and to develop research. It is seen as a way of triggering the purchase of innovative solutions on a large scale. Achieving a critical mass can help to shift public and private sector demand towards new technologies and processes. It is a powerful way of delivering innovation on all scales and across the main territorial domains.

Procurement of Lighting Innovation and Technology in Europe (PRO-LITE) is a partnership project co-funded by the European Commission to support the development of guidance for public sector authorities. Its objective is to exemplify how public sector organisations can overcome organisational and procurement barriers to deliver innovative and cost-effective products and technologies for their organisations, and at the same time support economic growth.

This example demonstrates that diverse public and private participants, including municipalities and public authorities at different levels of different Member States, can work together to develop innovative solutions. The partners involved in the project are:

- *Transport for London*, one of the functional bodies of the Greater London Authority (the coordinator of the project);
- *The Free Hanseatic City of Bremen*, a German commercial public authority managing and implementing construction projects;
- *The municipality of Turin* in Italy;
- *Consip*, a delivery body of the Italian Ministry of Economy and Finance that operates as a national 'central purchasing body' for the whole Italian public sector;
- *EVE*, a Spanish energy-saving company that specialises in devising energy strategies through government directives in relation to security of supply, cost competitiveness and sustainability;
- *PIANOo*, the Dutch 'Public Procurement Expertise Centre' that works with a network of over 3 000 public procurement and tendering bodies across the Netherlands.

Sources: Semple, 2014; https://www.innovation-procurement.org/ (accessed 20 August 2015); https://procurement-forum.eu/ (accessed 20 August 2015) and http://www.innovation-procurement.org/resources (accessed 20 August 2015).

([68]) http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=action-points (accessed 20 January 2015).

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