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Climate protection

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Leibniz Association

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Contents

Spatial planning and urban land-use planning can contribute to climate protection by reducing emissions through climate-compatible settlement structures; decreasing the amount of energy used by transport, settlements and buildings; and developing and/or safeguarding land for renewable energies and carbon sinks. Energy strategies and communication strategies can play a supporting role.

1 Introduction: Climate protection and climate change

Climate protection (also frequently called *climate change mitigation*) includes all efforts to protect the global climate as well as the protection and safeguarding of local (bio-)climatic functions in the interest of the climate, which is a protected resource in environmental impact assessments (EIA) and strategic environmental assessments (SEA) (▷ *Environmental assessment*) (Birkmann et al. 2013: 13 et seq.).

All efforts to protect the global climate take place against the backdrop of the consensus among climate researchers that the further increase of greenhouse gases in the atmosphere is causing global climate change (▷ *Climate, climate change*). In addition to adapting to the undesirable effects of climate change (▷ *Climate change adaptation*), climate protection is an important approach to dealing with climate change, as its objective of avoiding greenhouse gas emissions focuses on the causes. Greenhouse gas emissions, especially CO_2 emissions, are mainly caused by energy production, transport, households and industry and, to a lesser extent, by land use or changes in land use.

2 Action areas for climate protection in urban and spatial development

The options for climate protection include informational (soft) measures, financial support measures, legal and regulatory (hard) measures, sectoral planning and investment measures, and comprehensive spatial planning measures (cf. Bergmann et al. 1993). Clearly, spatial planning and urban land-use planning measures are only part of the overall range of measures. Nonetheless, they are important due to their integrated – and in the case of ▷ *Spatial planning (Raumordnung)* supra-local – approach, especially when it comes to the choice of locations for new uses.

To counteract ongoing spatial development trends (land take, settlement sprawl, spatial and functional decentralisation, etc.; *BBSR* [Federal Institute for Building, Urban and Spatial Research] 2012: 91 et seq.) that have negative effects from a climate protection perspective, the use of comprehensive spatial planning instruments that primarily have an impact on new developments and thus influence CO_2-inducing location, mobility and consumption patterns must be given priority at all levels of planning in addition to sectoral planning (▷ *Spatially-relevant sectoral planning*) (Fleischhauer/Bornefeld 2006: 162).

In contrast, the implementation of climate protection measures in developed areas is difficult with the means at the disposal of planning law, as the protection of existing buildings and potential compensation claims stemming from restrictions on use stand in the way of reducing potential damage or implementing measures to reduce CO_2 emissions (Wickel 2011: 420). However, where there are limits with regard to individual buildings, area-specific energy measures such as combined heat and power plants, inner-city photovoltaics or complex plans for the use of geothermal energy and wind power in urban contexts can be effective in existing developments (Krautzberger 2012: 101). Special Urban Development Law takes the objectives of protecting the climate and adapting to climate change into account in the context of urban redevelopment, where they can also be effective in existing developments. However, the success of urban redevelopment measures

implies agreement on their aims and often depends on the availability of funding (Wickel 2011: 421). There is also potential in relation to existing transport and settlement structures at the municipal level through increased access to land owners via information and communication and increased mainstreaming of climate protection in investments of local and supra-local significance (Fleischhauer et al. 2013: 97).

3 Climate protection in urban land-use planning and spatial planning

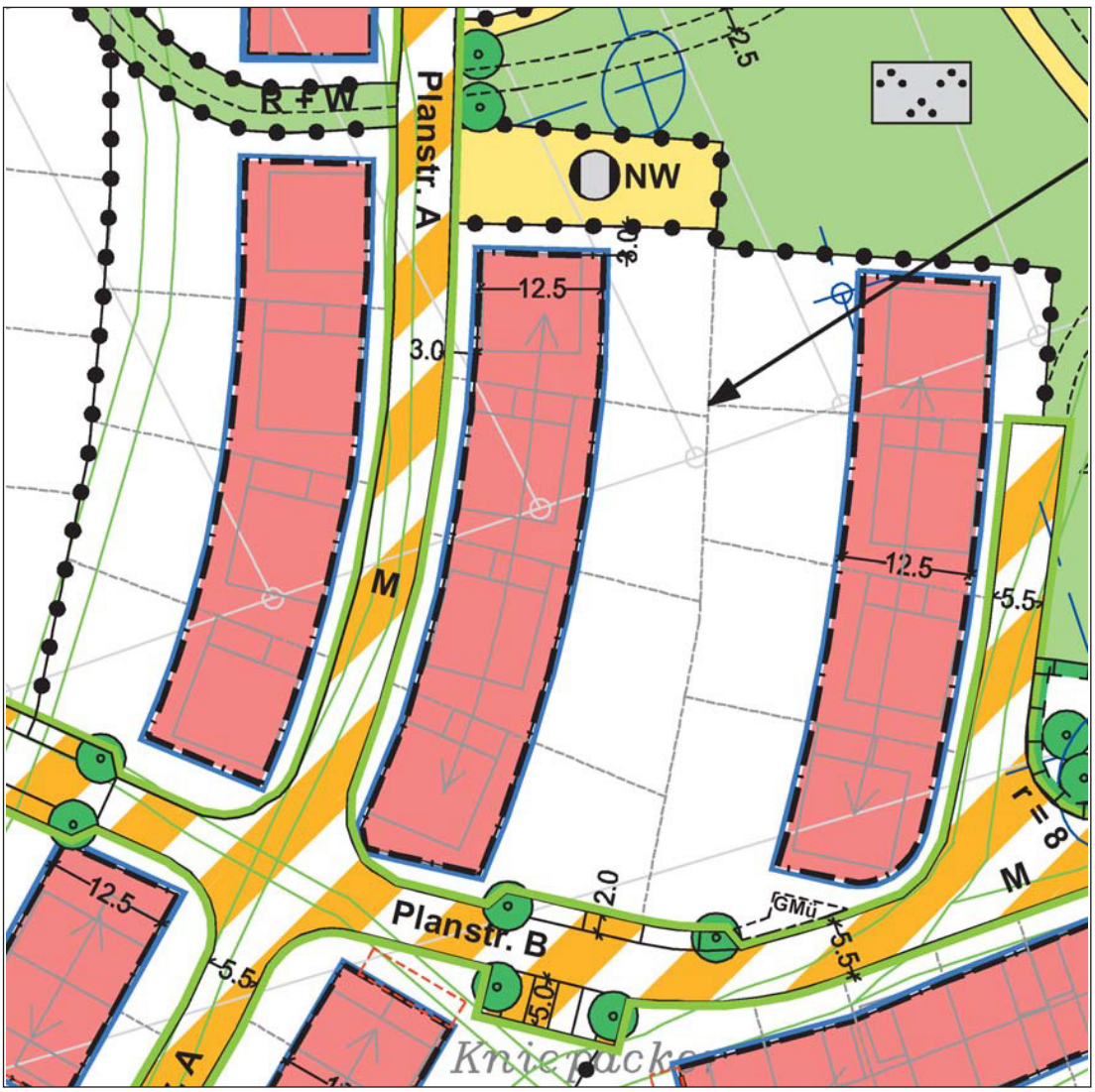
Section 1a(5) of the Federal Building Code *(Bundesbaugesetz, BauGB)* is the current German legal framework for taking climate change in ▷ *Urban land-use planning* into account. It states that 'The needs of climate protection shall be addressed through measures to counter climate change and through measures to adapt to it.' The adoption of this climate protection clause in the Federal Building Code in 2011 provided support for the issue of climate-compatible urban development. Climate-compatible urban development thus comprises urban structural measures that satisfy the requirements of both protecting the climate (see Fig. 1) and adapting to climate change. In particular, the catalogue of stipulations in section 9 of the Federal Building Code, the possible contents of urban development contracts (▷ *Urban development contract*) and the scope of application of ▷ *Urban redevelopment* are since then more specific in this regard.

The amendment to the Federal Building Code makes it clear that urban land-use planning has a responsibility for both protecting the climate and adapting to climate change. However, this also means that protecting the climate and adapting to climate change are not independent urban land-use planning tasks and that they complement urban development requirements and put them into more specific terms. On the other hand, it should also be noted that adapting to climate change has an urban design dimension that needs to be addressed by local authorities when considering their options for local land use. According to the principles of the Federal Building Code, stipulations in ▷ *Binding land-use plans* can thus only be made for urban development reasons with reference to land use (Krautzberger 2011: 263; Wickel 2011: 417; *BMVBS* [Federal Ministry of Transport, Building and Urban Development] 2013: 8 et seq.).

The Conference of Construction Ministers (*Bauministerkonferenz)* views protecting the climate, adapting to climate change and ▷ *Demographic change* as inseparable components of integrated urban development, with the challenge being to recognise synergies and conflicting goals and accommodate them during the weighing of interests process (*Bauministerkonferenz* 2008: 2).

A climate protection clause is explicitly included in the principles in section 2(2) no. 6 sentence 6 of the Federal Spatial Planning Act *(Raumordnungsgesetz, ROG)*, which stipulates that in the interest of sustainable development (▷ *Sustainability*), ▷ *Spatial planning (Raumplanung)* must account for the spatial requirements of climate protection through measures to counteract climate change. This relates to establishing spatial conditions for the expanded use of renewable energies (see Fig. 2), for energy conservation and for the preservation of natural sinks for the storage of substances that are harmful to the climate (Federal Spatial Planning Act, section 2(2) no. 6 sentence 7; *Berlin-Brandenburgische Akademie der Wissenschaften* [Berlin-Brandenburg Academy of Sciences] 2010: 8).

Figure 1: Example of the designation of a local heating supply area in a binding land-use plan in accordance with section 9 of the Federal Building Code



In accordance with section 9(1) no. 23b of the Federal Building Code and in anticipation of the climate protection amendment to the Code, the binding land-use plan Hu 144 'Am Rahmer Wald' designates a supply area for a central heating plant used in the local heating network

Source: Stadt Dortmund [City of Dortmund] 2011

In its action plan for avoidance, mitigation and adaptation strategies, the Conference of Ministers for Spatial Planning *(Ministerkonferenz für Raumordnung, MKRO)* outlines climate change action areas and specific action items at the federal state and regional planning levels and introduces the spatial planning instruments as well as the strategies that can be applied in the federal states in accordance with their applicable regulations and environmental conditions (*MKRO* 2013: 5). These include spatial development plans at federal state and regional levels with

their stipulations (objectives and principles of spatial planning in writing and/or as drawings, e.g. in the form of priority or reserve areas), the environmental assessments to be undertaken for spatial development plans, greater consideration of aspects of climate protection and climate change in spatial impact assessment procedure (*Raumordnungsverfahren*) and the advisory opinions issued by regional planning bodies, the consideration of these issues with regard to informal spatial planning instruments (▷ *Informal planning*) in accordance with section 13 of the Federal Spatial Planning Act (e.g. in regional development strategies, through involvement in integrated transport strategies or regional climate or energy strategies (▷ *Energy strategy*)), and the requirement that aspects of climate protection and climate change be made the object of ongoing ▷ *Spatial observation* and ▷ *Monitoring* in environmental assessments and the audits of spatial development plans (*MKRO* 2013: 5 et seq.).

Figure 2: Example showing wind power areas in a regional plan in accordance with section 2 of the Federal Spatial Planning Act

Priority areas for wind turbines (wind power areas in black cross-hatching) are shown in a draft regional plan for Düsseldorf.

Source: Bezirksregierung Düsseldorf *[Düsseldorf Regional Government]* **2014**

3.1 Energy-saving and traffic-reducing development of settlements and public thoroughfares

Buildings and settlements are significant sources of greenhouse gas emissions due to the energy required for heating, cooling, etc., and also due to the energy consumption involved in passenger and freight transport. Road traffic is named as a key category in the German Environment Agency's *(Umweltbundesamt, UBA)* National Inventory Report (*UBA* 2013: 196). Its share of total emissions rose significantly from 1990 (12%) to 2011 (15%). Successful reductions in such areas are thus very important for achieving climate protection targets. The options for developing energy-efficient settlement structures at local authority and supra-local levels are therefore the focus of the discussions below.

Local authority level

According to section 1(5) sentence 2 of the Federal Building Code, urban land-use plans should do their part 'also out of responsibility for climate protection in general' to keep the environment fit for human habitation. The Federal Building Code and the Federal Land Utilisation Ordinance (*Baunutzungsverordnung, BauNVO*) enable a number of stipulations relevant to climate protection to be made during binding land-use planning. These include the positions and orientations of buildings, technical stipulations enabling the use of renewable energies, efficient energy supply, energy strategies, and also the protection and targeted development of existing vegetation and open spaces, etc. (cf. Fleischhauer/Bornefeld 2006; Janssen/Albrecht 2008: 69). Such requirements, and their implementation, can contribute to reduced energy consumption.

Urban development contracts can also support climate protection, especially agreements on the use of combined heat and power generation and solar power plants in accordance with section 11(1) no. 4 of the Federal Building Code (cf. Krautzberger 2008a, 2008b). At the level of preparatory land-use planning, energy efficiency and climate protection criteria can be considered in choices of location (Janssen/Albrecht 2008: 68).

Supra-local level

When the supra-local level is considered, it becomes clear that there is a close connection between settlement structure and energy efficiency. Per capita fuel consumption is significantly higher in less densely populated areas due to the longer distances travelled and the greater dependence on cars (Bergmann et al. 1993: 499 et seq.). A number of planning and spatial planning concepts and strategies can build on this connection to contribute to a reduction in traffic-related emissions:

- Consistently focusing the development of settlements on the central place system (▷ *Central place*) and the axis system (▷ *Axis*) is a prerequisite for a reduction in traffic and thus of emissions since these systems contribute to the concentration of developed areas and the protection of as yet undeveloped areas (e.g. cf. Bergmann et al. 1993; Janssen/Albrecht 2008: 67).
- Of particular importance in this context is to link settlement planning with the planning or expansion of local public transport since that enables new build areas to be concentrated around public transport stops.
- Implementing the principles of functional mix and densification can help to ensure that basic functions (housing, work, leisure, utilities) are close together, thus reducing traffic (Bergmann et al. 1993: 516). This ultimately reflects the guiding principle of the compact city, but the basic

idea can be applied to higher spatial levels by striving for the spatial integration of functions instead of functional and spatial specialisation (Bergmann et al. 1993: 510).

- Inner development and brownfield revitalisation strategies make important contributions (▷ *Brownfield site, derelict/vacant site*) to the preservation of compact settlement structures, as does the designation of areas for high-traffic businesses, e.g. logistics companies, to suitable locations during spatial planning; the objective is to avoid an increase in overall traffic volume.

At the supra-local level, regional planning (▷ *Regional planning*) is the key spatial planning instrument for managing the development of renewable energies (▷ *Renewable energies*). Its technical foundation includes regional energy strategies, landscape outline plans, and informal landscape-based planning inputs, and it takes environmental assessment results into account.

3.2 Spatial provisions for the spatially compatible expansion of renewable energy

Since investment decisions about power plants and renewable energy or about establishing energy-efficient spatial and traffic structures always have a spatial aspect, spatial planning at all planning levels has an important role to play in successful climate protection. Spatial planners and urban land-use planners are responsible for areas of land and sites and their aim is to optimise the overall spatial structure.

In contrast, the ▷ *Energy industry* has a market-oriented focus. Its few large, private-sector stakeholders pursue profit-oriented aims and operate not only across regions but also internationally. Planning for energy-related investment decisions does not take place in a public setting as it does for comparable sectoral planning in traffic or water management; as a result, the basic tensions between spatial planning and its limiting function on the one hand and designing the energy system through the promotion of climate protection and energy-related projects on the other becomes clear (*BBSR* 2010: 14).

Local authority level

An effective way to increase the scope of urban land-use planning for climate protection measures in the Federal Building Code is seen in the climate protection clause in section 1a of the Federal Building Code, which makes clear that climate protection also has an urban development dimension and must be considered when drawing up urban land-use plans. Promoting the use of renewable energy in a manner consistent with urban planning objectives is an example for general measures that are used within the field of spatial management to expand the use of renewable energies in a space-conserving way (Kunze 2012: 54).

Supra-local level

Regional energy strategies or subsections of regional plans are usually the basis for plans to deal with renewable energy. They aid in integrating renewable energies in energy policy, could provide a basis for the national renewable energy action plans called for by the EU, and help to enable balanced spatial development and to avoid spatially incompatible impacts (*BBSR* 2010: 14).

Specific climate protection measures directly affect planning law where promoting the use of renewable energy depends on the location of a facility, e.g. in the area of a binding land-use plan. In large part, planning law is indirectly affected by the question of location choice, e.g. a combined heat and power generation system (Janssen/Albrecht 2008). The expansion of renewable energy generally requires land that is suitable for the respective source of energy (e.g. wind conditions, insolation, proximity to biomass production areas), hence there is a clear spatial relevance. The effects of energy production are often also spatially relevant. For example, wind power can cause noise emissions and affect scenery and ecosystems such as fauna; ground-mounted solar power plants can spoil scenery and impact the natural balance; and the impact of biomass plants tends to be limited to their immediate surroundings, while the energy crops used in these plants take up extensive areas (*Berlin-Brandenburgische Akademie der Wissenschaften* 2010: 8).

Various sectoral laws provide crucial support for climate protection. In particular, the Renewable Energies Act *(Erneuerbare-Energien-Gesetz, EEG)* and the Combined Heat and Power Act *(Kraft-Wärme-Kopplungsgesetz, KWKG)* have spatial relevance due to their associated financial incentives for the operators of energy production facilities.

In almost all regions, spatial planning has taken on the tasks of identifying suitable areas for renewable energy and of protecting sensitive areas from such use. In addition, infrastructure issues, such as integrating distributed energy production facilities into the grid or the proximity of consumers for heat production, play an important role.

In addition to the space requirements of new facilities, adapting the infrastructure to the requirements of a distributed energy supply is a major challenge. Key actions available to federal state planners and regional planners include expansion targets specified by federal state planners for renewable energy, the designation of ▷ *Territorial categories* (priority, suitability), area-related designations or securing specific individual locations (von Seht 2010: 279).

3.3 Precautionary safeguarding of natural and artificial CO_2 storage systems

The natural storage and sink functions of ecosystems are most important for CO_2 storage; in addition, there are technical means of storing CO_2.

Supra-local level

The climate and ecosystems are tightly coupled. Ecosystems are not only subject to changes caused by climate change, they also affect climate trends themselves through their ability to store or release carbon. Both the soil and vegetation can be important carbon reservoirs.

In most ecosystems, land use has an important influence on whether the storage function is maintained or whether even more carbon can be sequestered, making the ecosystem a carbon sink (▷ *Ecosystem services*). However, the depletion of organic substances is also possible, especially in the case of intensive use, leading to the release of carbon; the ecosystem then becomes a carbon source (intensive exploitation of forests, draining marshland, agricultural uses that increase the loss of organic substances).

Correspondingly, spatial planning and especially landscape planning should include the identification of ecosystem climate protection functions and criteria for the restriction of land use.

Spatial planning can play a supporting role here with appropriate justification of priority areas for nature, landscapes or forests (▷ *Priority area, reserve area and suitable area for development*), with long-term preparation being given a high priority. Because of the necessarily small-scale perspective, consideration at the ▷ *Landscape planning* level is especially important given that the climate protection effect of the various ecosystem types generally depends on their management (cf. Janssens et al. 2005; cf. *SRU* 2008) and thus corresponding nature conservation concepts for ecosystem maintenance and use also need to be developed.

Safeguarding and strengthening carbon sinks can only be done in close coordination between the ministries and the corresponding sectoral planning agencies, primarily nature conservation and agriculture (*SRU* 2008; *BfN* [Federal Agency for Nature Conservation] 2009).

Besides the natural systems, ways of storing greenhouse gases in artificial systems or by technical means have been in discussion recently, particularly the separation and subsequent storage of carbon dioxide at power plants (carbon capture and storage, CCS; ▷ *Spatial planning (Raumordnung) of subsoil*).

In 2012 the Carbon Storage Law *(Kohlendioxid-Speicherungsgesetz, KSpG)* came into force. It implements Directive 2009/31/EC (CCS Directive) and provides the legal framework for CO_2 storage. The law provides for a total maximum storage capacity of four million tonnes of CO_2 per year for Germany and 1.3 million tonnes per storage facility annually. It also includes a clause enabling individual federal states to ban CO_2 storage on their territory. Nevertheless, questions about the availability and technical use of storage facilities remain unresolved from an economic, technical and institutional point of view, hence the technology currently appears not to be feasible from an economic and from a climate or energy policy perspective. Various demonstration projects have since been discontinued; assessments tend towards the view that CCS will not play a role in the German electricity sector through 2030 (von Hirschhausen/Herold/Oei 2012: 3 et seq.).

4 Conclusions

Spatial planning (*Raumplanung*) can contribute to climate protection at the levels of both spatial planning (*Raumordnung*) and urban land-use planning. Contributions to climate protection from spatial planning can come in three areas (Fleischhauer/Overbeck/Janssen et al. 2013: 118 et seq.):

- Reduced greenhouse gas emissions through climate-compatible settlement structures and reduced energy consumption in the transport sector or in settlements and buildings; a large number of starting points and instruments is available here. In actuality, however, spatial planning measures in this area can only gradually prevent large-scale CO_2 emissions. Reasons include the protection of existing buildings, high costs for compensation, spatial planning instruments that cannot be applied in the building sector, etc. There is potential at the local authority level in increased access to land owners through information and communication and increased mainstreaming of climate protection in investments of local and supra-local significance, for example in connection with subsidies or incentives for urban redevelopment or urban regeneration programmes.
- Developing and safeguarding areas for renewable energy: The associated land requirements for the production and distribution of renewable energy have a high degree of spatial relevance,

especially through the resulting conflicts such as competing land use demands, acceptance problems, etc. As a consequence, the greatest need for spatial planning contributions is seen here.

- Safeguarding carbon sinks: The discussions in this matter are still quite open and the role of spatial planning cannot yet be determined exactly. The existing synergies with adaptation measures should be noted and quantitatively compared as appropriate.

The preceding discussions have shown that the legal framework on the one hand and the dynamics of the energy market on the other present significant constraints, especially in connection with the location demands on the part of renewable energy. These constraints can only be controlled to a limited extent with spatial planning instruments. Nevertheless, there are currently potential conflicts with other spatial functions and land uses as well as conflicts between various measures to protect the climate and adapt to climate change (e.g. Wiegand 2010; Fleischhauer et al. 2013). As with adapting to climate change, different interests must be reconciled and sectoral planning coordinated. From this it can be concluded that the coordination function of regional planning is becoming increasingly important.

This leads to the question of the limits of spatial planning and urban land-use planning in climate protection. Cooperation with energy-relevant sectoral planning agencies, the systematic use of funding instruments, and also the role of informal approaches will gain in importance in this context.

Finally, current perceptions of certain problems are also among the issues affecting the power of spatial planning in this regard. For example, collective experiences with heat waves or floods increase the willingness of policymakers and planners to act with regard to protecting the climate and adapting to climate change.

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