Municipal Guidelines for Low-Carbon Urban Planning and Design in Germany – An investigation into Scopes, Strategies and International Transferability.

In the last years climate change and adequate reactions to it takes a renaissance in German urban politics. After cities such as Heidelberg, Bochum, Muenster developed municipal climate protection policies already in the 1990s, today we can recognize a second, much bigger wave of climate-related communal activities. The publication of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) in 2007 and the globally growing number of presumably climate change-related hazards has led to a new wave of political programs and actions, often on the level of cities and regions. This also holds true for Germany: in the last years, a large number of cities (just to name Bielefeld, Hamburg, Muenster, Muenchen or Stuttgart) have developed or updated local climate protection policies. These city policies have been accompanied by several comprehensive activities on fighting climate change on the urban level e.g. by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), the German Institute for Urbanism (DIFU), the German Association of Cities (Deutscher Staedtetag) and other initiatives such as the International Building Exhibition IBA Hamburg.

This paper concentrates on the recent municipal and regional activities of steering climate protection in Augsburg, Bremen, Essen and the states of North Rhine-Westphalia and Bavaria. These cities and states have compiled user-oriented guidelines aiming to advise urban planers on climate protection at the city and neighborhood level. Taking into account the long and successful experiences of German municipalities in sustainable urban planning, these guidelines seem to provide also valuable advices for the development of low-carbon neighborhoods and cities in other parts of the world. Being aware of similar publications on federal level (e.g. Deutscher Staedtetag 2008, DIFU 2011), these municipal and regional guidelines were chosen for this paper since they have not been introduced in a comparative study and respectively critically assessed. In order to explore these guidelines the paper will introduce the handbooks and investigate their character by exploring their:

- Aims,
- Targeted user groups,
- Structure,
- Scales,
- Addressed action fields,
- Proposed strategies and measures of mitigation,
- Their integration into the legal planning framework, and
- Transfer of contents to user.

Taking into account the topic of this year's ISOCARP congress, special attention will be paid to the question if these manuals and their approaches can provide inspirations for other communities aiming for the mitigation of climate change in order to create sustainable and livable cities. Thus legal and institutional and the climatic context of the guidelines as well as the costs of the measures are addressed.

The cities and states in the focus

The guidelines chosen to by analyzed in this paper were published by five municipalities and states respectively: the municipality of Augsburg, a medium sized town in the state of Bavaria with about 260,000 inhabitants, has initiated a guideline on "Climate Protection and Urban Planning in Augsburg" in 2007 (Stadt Augsburg 2007). Two years later the city of Essen, a town with 580,000 inhabitants located in the western state of North Rhine-Westphalia, has developed a "Guideline for Energetically Optimized Urban Planning" (Stadt Essen 2009). In the northern city (and federal state) of Bremen (550,000 inhabitants) a "Guideline for Climate Protection in Urban Design" was developed as a part of a research project (Sustainability Center Bremen 2009). In addition also federal states like Bavaria and North Rhine-Westphalia have published handbooks which are included in the analyses since they have

been laid out for the use in local municipalities: the Ministry for Building and Transport of the federal state of North Rhine-Westphalia has published a guideline for urban planners called "Climate protection in Integrated Urban Development" (Nordrhein-Westfalen 2010) and the Ministry of Interior of the Federal State of Bavaria has edited a handbook on "Energy and Urban Planning" in 2010 (STMI 2010).

Aims and scale of the guidelines

The guidelines of Augsburg, Essen of Bavaria and North Rhine-Westphalia are the operative outcomes of larger political aims of climate protection, either on municipal or federal level. Though the guideline of Bremen is not an official publication of the federal state (it is the outcome of a research project), it was partly funded by the Senate of Bremen and thus presumably follows the political agenda of the Senate. Hence all of the presented guidelines are part of a comprehensive long-term strategy of local climate protection. As the term "climate protection" indicates, the focus of all presented guidelines is the mitigation of climate change. Following the official definition of the concept by UNFCCC, the guidelines generally aim at introducing measures reducing the sources of greenhouse gases in the specific action field of urban design and urban planning (UNFCCC 2011). Rather then focusing on retrofitting of buildings and neighborhoods they should be applied for the design of new neighborhoods, may it be urban expansions or brown field development. The scales addressed in the guidelines range from entire city to building scale, with a main focus on the medium-scale, the neighborhood. Accordingly, the guidelines mainly address potentials and strategies which are efficient on the scale of neighborhoods such as the geometry of a group of buildings or systems of energy supply. The guidelines introduced do not have a formally binding character though they aim at influencing formal plan making (mainly legally binding land use plans on the local level) by providing basic information on climate protection in urban planning. Thus they strive for an integration of climate aspects in the early planning stages in order to tap efficiency potentials. Moreover they can be used for an energetic optimization of already existing formal or informal planning documents and plans (Stadt Augsburg 2007). To conclude, the guidelines mainly aim at disseminating information on climate-protection in urban planning and design and on raising awareness among the plan making bodies, which work on the level of cities and neighborhoods.

Targeted user groups

Since all guidelines (except the Bremen ones) have been published by the municipality respectively the ministries, first and foremost they are for the use in the planning departments of municipalities in the respective city or state. Beyond that they are open and accessible to all parties and institutions related to urban development such as the wider public, architects and private planers or developers. Their public character is supported by the fact that all of the guidelines are publicly available in the internet. Unfortunately they have not been translated into English language and do not include an English summary, thus they mainly will be perceived by German users.

Structure of the guidelines

Though the guidelines differ in detail (e.g. number of pages and chapters), the basic structure of the documents is similar. The handbooks from Augsburg, Essen, Bavaria and North Rhine-Westphalia are structured hierarchically according to spatial levels and chronologically according to planning phases. They:

- First explore the general conditions of the city or region e.g. in regard to climate change and its effects or in regard to local climate policy goals,
- Secondly introduce the possibilities of urban planning and measures for climate protection,
- Thirdly define the translation of these measures into legally binding land use plans and urban development contracts, and

- Fourthly provide a service section with checklists, case studies or funding possibilities.

Analyzing all the five guidelines one has to assume that deviations are made: especially the federal guideline North Rhine-Westphalia stands out since it specifically targets at integrated planning for climate change with a wider spatial and thematic approach. Thus aspects of process organization play a more prominent role in this document. It also explores the local effects of climate change and mitigation aims in more in detail. What connects the structures of all of the analyzed guidelines is the fact that they combine the assessment of local conditions including the local effects of climate change with adequate spatial measures and a translation into legally binding plans.

Addressed field of action

All guidelines address action fields which influence energy consumption on urban level, though the manuals focus on energy consumption for heating, cooling and electricity - except North Rhine-Westphalia. Consequently the guidelines address the physical aspects of spatial planning such as urban design and architecture, mainly focusing on the geometry of buildings and their local topographic and climatic context. Aspects of landscape and vegetation are addressed if they influence energy consumption of buildings. Technical questions are mainly treated in regard to energy supply, a topic that is covered in all guidelines. The topic of transport and mobility is only slightly touched in the Bavarian and Bremen documents; only the North Rhine-Westphalian manual deepens the possibilities of transport policies for CO2-reduction. The topic of land use policies and mixed land uses is only slightly covered in the North Rhine-Westphalian and Bremen guidelines. As all guidelines focus on the mitigation of climate change, the topic of adaptation in only included in the guidelines from North Rhine-Westphalia. This is due to the wider and integrative character of this document. To conclude, the guidelines mainly focus on the design of the physical environment and infrastructure of cities and neighborhoods mostly excluding the topic of land use and transport as well as the integration of adaptation measures.

Proposed strategies and design measures of mitigation

Analyzing the five documents one can roughly group the proposed measures in two groups concerning:

1. Site characteristics, urban geometry and energy consumption,
2. Systems and technologies of energy supply.

Site characteristics, urban geometry and energy consumption

The first advice in the guidelines is to analyze and integrate the natural characteristics of the site, especially considering the location of the project. Since the topography influences the solar gain (respectively the shading of buildings) and the exposure of neighborhood to wind it can have a major impact on energy consumption. The general recommendation of the guidelines is to maximize the solar gain for an optimal passive or active use of solar energy. Thus the site should not be located near shading objects, such as ridges or hills. If the site is located on a slope, south- or southwest-facing slopes are particularly suitable due to the higher solar gain. A location of the site on north-, west-, or east-facing slopes should be avoided. Also a location of the site near valleys and troughs is not recommended because cold air concentrates there which leads to a higher heating demand of up to 20% within the building. But also if the site is located within the existing urban fabric, the urban environment should be considered: The Urban Heat Island effect (describing a heat island which arises from urban materials effectively storing heat) can lead to a reduction of a domestic heating demand of 10% to 15% (Stadt Essen 2009). Thus a location of the new site within the existing urban tissue should be aspired although negative effects such as sealing of soil should be incorporated into decisions on the location of the site. Another aspect elaborated in the guidelines is wind. An exposure of buildings to wind can lead to higher heating demand and hence a higher energy consumption of the building. Consequently the site should not be located on exposed locations. All guidelines (except the North Rhine-Westphalian) deliver in-

formation on the interrelation of site characteristics, microclimate and energy consumption - especially the Essen guidelines offer a profound analysis (Stadt Essen 2009).
A second major advice formulated in the analyzed guidelines is to tap the energetic potential of urban planning and design. By organizing the general spatial structure, the disciplines of urban design and urban planning can have a significant influence on the overall energy balance – it determines not only the energy consumption of a building, but also the energy use of infrastructure systems. Most of the advices given in the guidelines focus on neighborhoods. Only the North Rhine-Westphalian and Bremen documents make statements on form and structure of the entire city respectively its influence on energy consumption. For instance the guidelines formulate the need of incorporating traffic-reducing and resource-saving settlement and land use patterns. Recommendations are given to develop polycentric town models with good public transport options reducing the energy-use on transport and on the building level. Also the creation of a small-meshed network of supply units in the urban fabric reducing the private transport is advised. The location of sites for renewable energies is another recommendation formulated in the guidelines of Bremen and North Rhine-Westphalia (Nordrhein-Westfalen 2010, Sustainability Center Bremen 2009).
Larger parts of the guidelines concentrate on spatial measures for the neighborhood. Two themes of urban geometry are predominantly addressed: First the density and compactness on urban and building level, secondly the position and orientation of the building itself. The compactness of a building is defined as a major point of influence of energy consumption in all guidelines. The more compact the buildings, the smaller is the heat-loss. This requires a minimization of the building surface area which transfers heat to the volume of the building. This is the so-called surface-area-to-volume ratio (SA:V-ratio). The smaller the surface and the higher the volume, the smaller the ratio and the better the efficiency. The SA:V-ratio is influenced by the building type, the number of floors and the length and depth of the building. For a good SA:V-ratio, the guidelines recommend multifamily houses with more then three but less than five floors or terraced housing with two to three floors. The length of the buildings should be between 30 and 50 meter, its depth 12 to 14 meter. Since the form and style of the roof has also a large influence on compactness, flat, double pitch, arched or lean-to roofs are recommended. If combined with a dense urban form, the compactness of the building can be a major factor of influence for energy consumption in urban planning and urban design.
The second dominating theme regarding the urban geometry in the guidelines analyzed is the orientation and position of buildings for optimal solar gain. Building orientation is one of the decisive factors for solar gain. It is mainly achieved by a south-oriented façade of the building - the higher the building's deviance from south, the higher the solar loss. Thus a deviance of more than 30° should be avoided. In order to make use of photovoltaic panels and solar thermal power for power generation and hot water production, the roof type and the slope of the roof should be designed accordingly. Since shading of adjacent buildings can reduce the solar gain, the height and the position of buildings to each other should be considered as well. The ratio of width between the buildings and the height of the buildings (the so-called W/H-ratio) is a decisive factor – the smaller the ratio the higher the shading of the buildings. The Essen guideline proposes a ratio of minimum 2.7, which means that the distance between the buildings should be 2.7-fold higher than the building height (Stadt Essen 2009). Since the shading impact of trees can be is similar to buildings, all guidelines also suggest reducing shading of facades through adequate vegetation or trees. A detailed recommendation depends on the type of vegetation, the height and the distance of trees to main façade.

Systems and technologies of energy supply

The five guidelines strongly suggest integrating concepts of energy supply into the planning and design of a neighborhood. Taking into account that in Germany the highest share of energy in the households is used for heating, generation of warm water and electricity, only the use of climate-friendly energy sources can reduce CO2-emissions; in general renewable energies should be prioritized. Hence the potentials for the use of renewable energies

should be analyzed in the very beginning of the planning process. This requires checking whether wind, water, solar and geothermal sources are available. Also the availability of district heating systems that can be used should be checked. According to the availability of sources, an energy concept should always be developed as an integral part of the neighborhood design. Concerning systems, the energy concept should always prioritize district heating in central, semi-central or de-central system. The recommended solution is power-heat coupling in a cogeneration unit. This helps to shorten networks for supply with electricity and heat and gives the possibility of a stepwise development. Since the influence of the energy concept on the energy consumption is very high, the elaboration of an integrated energy concept is strongly recommended (e.g. Stadt Augsburg 2007, STMI 2010).

Integration into the legal planning frameworks

A major part of all guidelines analyzed is concerned with the transfer of these measures into legally binding plans on local level. Since the main instrument for urban development on the local level in Germany is the binding land use plan (*Bebauungsplan*), the guidelines concentrate on this instrument. The binding land use plan defines "legally binding rules for the development and organization of parts on the municipal territory" (Pahl-Weber, Henckel 2008) and is developed on the basis of the city-wide preparatory land use plan (*Flaechennutzungsplan*). The regulation possibilities and the content of the binding land use plan are defined in the federal building code (*BauGB*), which addresses the topic of climate protection: Article 1 defines that binding land use plans (*Flaechennutzungsplaene* and *Bebauungsplaene*) are responsible for the general protection of the climate. The implementation of these general aims can be fixed with §9 of the *BauGB.* By defining the type and extent of land use, the coverage type, the built-up and non-built-up areas, the orientation, depth, width and size of the building, this paragraph can regulate some of the main factors of urban geometry influencing the energy consumption. However, since the introduction of the general aim of climate protection in the *BauGB* in 2004 there haven been major uncertainties whether the goal of general climate protection authorizes German municipalities to incorporate regulations in binding land use plans on global climate or whether the federal building law only allows regulations reducing air pollutants from site (Wende et al. 2010). Also the compulsory use of renewable energies could not be regulated. Only a recent amendment of the federal building code in June 2011 has brought clarity to this situation (see conclusion). The "urban development contract" (*Staedtebaulicher Vertrag*) offers an additional possibility of safeguarding aspects of climate protection in land use plans. The term urban development contract is applied to a range of agreements between the municipality and the mostly private investor. The idea is to assign private developers with the preparation and implementation of urban design and planning measures (Pahl-Weber, Henckel 2008) – the municipality will allow for faster and more flexible building law in return. Since binding land use plans, which are developed in the framework of urban development contracts are exempted from the catalogue of regulations of §9 in *BauGB*, a wide range of topics can be fixed. Subjects of the contracts can include the set-up of an energy concept, the use of power-heat coupling and renewable energies (Stadt Essen 2009). In order to illustrate these regulative possibilities, all guidelines analyzed include detailed examples of the regulations mainly in form of synopsis. These tables are often amended with examples of regulations from existing binding land use plans as in the Augsburg and Essen guidelines (Stadt Augsburg 2007, Stadt Essen 2009).

Transfer of contents to user

All guidelines analyzed try to present the recommendations in a user-friendly way. Different means are used to illustrate the proposed strategies for the use in every-day planning practice. All guidelines work with illustrations and sketches, mainly to show basic relations between urban form and energy consumption as figure 1 illustrates. In order to deepen the understanding for single topics and give information beyond practical recommendations, some of the guidelines (Bremen, Augsburg and North Rhine-Westphalia) include excursus, e.g. on the influence of compactness on energy consumption of a building (see fig. 2). In some cases such as in Augsburg, Bavaria and North Rhine-Westphalia, also best-practice case stu-

dies from Germany are introduced at the end of the document or in the respective chapter. These cases either illustrate integrative approaches of energy-efficient urban planning or highlight single aspects such as the use of renewable energies (see fig. 3). A fourth extra which is included in three guidelines (Augsburg, Essen and North Rhine-Westphalia) is checklists to be used by the planer. The checklists are meant to be an easy-to-use tool, which enable the planer to integrate energy aspects in the planning process (see fig. 4). Thus they are organized according to the main planning phases: (1) site survey, (2) plan development, (3) land use planning and (4) realization. With the help of these checklists the user should be able to check and asses the design in each planning phase according to the recommendations given in the guidelines. Indicators for each aspect are defined for a fast assessment, which can mostly be checked without any technical help just by plan assessment. The checklist also can be a documentation since the result of the checklist illustrates to which extend aspects of climate-protection were integrated. In addition, most of the guidelines offer a service section containing further reading, internet sources and possibilities for funding of energetic measures in Germany.

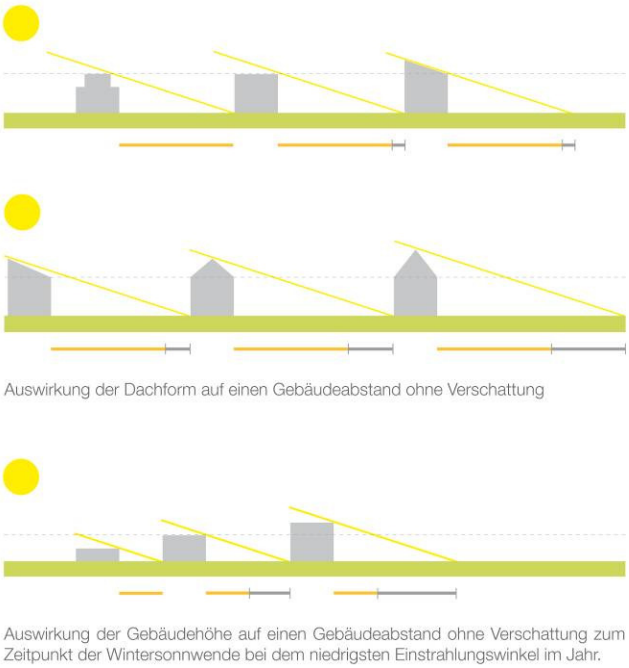
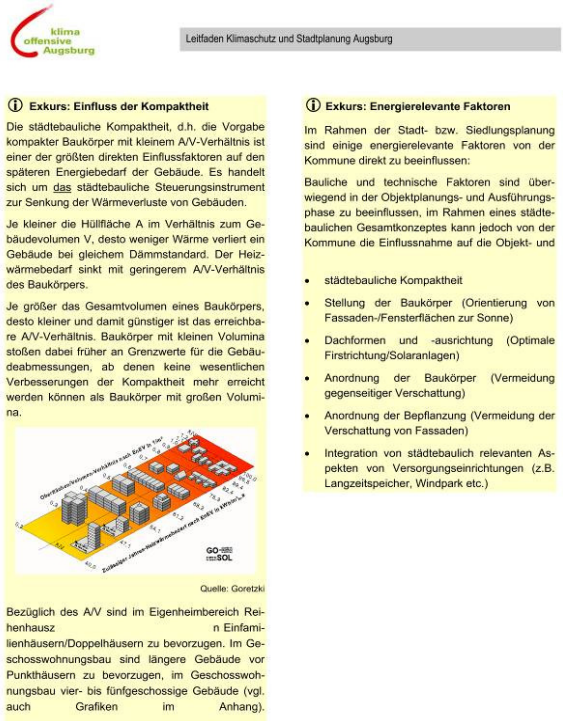


Fig. 1: Illustration of the effect of the roof type and building height on solar gain (STMI 2010).


klima offensive Augsburg

Leitfaden Klimaschutz und Stadtplanung Augsburg

Exkurs: Einfluss der Kompaktheit

Die städtebauliche Kompaktheit, d.h. die Vorgabe kompakter Baukörper mit kleinem A/V-Verhältnis ist einer der größten direkten Einflussfaktoren auf den späteren Energiebedarf der Gebäude. Es handelt sich um das städtebauliche Steuerungsinstrument zur Senkung der Wärmeverluste von Gebäuden.

Je kleiner die Hüllfläche A im Verhältnis zum Gebäudevolumen V, desto weniger Wärme verliert ein Gebäude bei gleichem Dämmstandard. Der Heizwärmebedarf sinkt mit geringerem A/V-Verhältnis des Baukörpers.

Je größer das Gesamtvolumen eines Baukörpers, desto kleiner und damit günstiger ist das erreichbare A/V-Verhältnis. Baukörper mit kleinen Volumina stoßen dabei früher an Grenzwerte für die Gebäudeabmessungen, ab denen keine wesentlichen Verbesserungen der Kompaktheit mehr erreicht werden können als Baukörper mit großen Volumina.

Quelle: Goretzki

Bezüglich des A/V sind im Eigenheimbereich Reihenhausz n Einfamilienhäusern/Doppelhäusern zu bevorzugen. Im Geschosswohnungsbau sind längere Gebäude vor Punkthäusern zu bevorzugen, im Geschosswohnungsbau vier- bis fünfgeschossige Gebäude (vgl. auch Grafiken im Anhang).

Exkurs: Energierelevante Faktoren

Im Rahmen der Stadt- bzw. Siedlungsplanung sind einige energierelevante Faktoren von der Kommune direkt zu beeinflussen:

Bauliche und technische Faktoren sind überwiegend in der Objektplanungs- und Ausführungsphase zu beeinflussen, im Rahmen eines städtebaulichen Gesamtkonzeptes kann jedoch von der Kommune die Einflussnahme auf die Objekt- und

- städtebauliche Kompaktheit
- Stellung der Baukörper (Orientierung von Fassaden-/Fensterflächen zur Sonne)
- Dachformen und -ausrichtung (Optimale Firstrichtung/Solaranlagen)
- Anordnung der Baukörper (Vermeidung gegenseitiger Verschattung)
- Anordnung der Bepflanzung (Vermeidung der Verschattung von Fassaden)
- Integration von städtebaulich relevanten Aspekten von Versorgungseinrichtungen (z.B. Langzeitspeicher, Windpark etc.)

Fig. 2: Example of an excurses on the influence of compactness on the energy consumption of a building (Stadt Augsburg 2007).

Leitfaden Klimaschutz und Stadtplanung Augsburg

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10 Beispielhafte Umsetzungsverfahren

Das Baugebiet SONNENSiedlung Egert, Esslingen am Neckar

Es war von Anfang an Ziel der Stadt, bei der Bebauung ihres Neubaugebiets Egert im Ortsteil Zell besondere Qualitätsmaßstäbe anzulegen, um ein Baugebiet mit Vorbildfunktion entstehen zu lassen. Städtebauliche Qualität, hohe Anforderungen hinsichtlich der ökologischen Verträglichkeit und der Einsatz zeitgemäßer Technologien zur Energieeinsparung bestimmten die Planungsvorgaben.

Da sich das gesamte Gelände in städtischem Eigentum befindet, erlaubt es der Stadt, sich den erforderlichen Einfluss auf die Realisierung zu sichern und die Forderungen vor der endgültigen Übereignung der Grundstücke in Verträgen abzusichern.

Folgende Schritte von der Idee bis zur Realisierung werden durchgeführt:

- Ökologische Zielsetzung durch den Gemeinderat
- Städtebauliches Konzept und Grundlage für die Erfüllung der ökologischen Zielsetzungen durch einen städtebaulichen Ideenwettbewerb
- Vertiefende Planungen, Gestaltrahmenplan zur Präzisierung der Ziele für Städtebau und Architektur, Gutachten zur Vertiefung der Themen Ökologie und Energie.
- Energiekonzept zur Untersuchung von Möglichkeiten der Energieeinsparung und ökologischer Wärmeversorgung: Ergebnis: Erstellung der Häuser zu 80% Passivhäuser, zu 20 % KfW-Energiesparhäuser
- Erstellung des Bebauungsplans
- Vertragliche Bindung der energetischen Ziele mit Sanktionen
- Absicherung der kommunalpolitischen Leitvorstellungen durch die Beratung der Architekten und Bauträger durch einen „Gestaltungsbeirat" (Sachverständigen-Gremium, ergänzt durch Kommunalpolitiker) in Workshops auf der Basis der kommunalen Zielvorgaben.
- Betreuung der Umsetzung der abgestimmten Planung und der Einhaltung des Passivhausstandards durch den Gestaltungsbeirat bis zur Baugenehmigung.

Das Projekt befindet sich in der Bau- und Vermarktungsphase.

Besonders der Gestaltungsbeirat hat sich - zunächst als Störfaktor für den Realisierungsprozess eingeschätzt - als wesentliche und akzeptierte Unterstützungsmöglichkeit für die Investoren zur Realisierung eines hohen Baustandards (u.a. Passivhäuser) bewährt.

Fig. 3: Example of a best-practice case study in a guideline (Stadt Augsburg 2007).

5. Checklisten

1. Checkliste „Planungsgegebenheiten"

Bebauungsplan:.....
Anzahl der WE:.....

günstig / Potenziale gut genutzt
bedingt mit Einschränkungen / Optimierungsbedarf
ungünstig / hoher Optimierungsbedarf

1.1 Nutzung der Steuerungsmöglichkeiten	zutreffendes Feld doppelt anklicken: Ja	Nein
Beratungsleistungen		
Energiekonzept		
Planungsalternativen/Wettbewerb		
Besitzverhältnisse	zutreffendes Feld doppelt anklicken	
- Stadt		
- Großeigentümer		
- Einzeleigentümer		
- Heterogene Besitzverhältnisse		
Vertragliche Regelungen	Ja	Nein
- Durchführungsvertrag §12 (1) BauGB		
- Städtebaulicher Vertrag §11 (4) BauGB		
- Privatrechtlicher Kaufvertrag		

1.2 Prüfung der lokalklimatischen Gegebenheiten	zutreffendes Feld doppelt anklicken
süd-, südwestexponierte Hanglage	
südostexponierte Hanglage	
nord-, ost- und westexponierte Hanglage	
ebenes Gelände	
Keine Verschattung durch umgebende Höhenzüge	
Verschattung durch umgebende Höhenzüge	
innerstädtische Lage	
Arrondierungsflächen	
Geländemulden, Senken, Täler (Kaltluftsammelgebiete und -staubereiche)	
offene Landschaften mit Gewässern u. Feuchtgebieten (Bodeninversionen möglich)	
Lagen ohne bodennahe Kaltluftbereiche	
windschwache u. turbulenzarme Standorte	

Muster

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Fig. 4: Example of a checklist (assessment of local conditions) (Stadt Essen 2009).

International transferability

According to the scope of this year's ISOCARP congress, attention should be paid to the question if the guidelines and their approaches are suitable to be transferred to other urban situations especially in fast developing nations. Thus the legal and institutional as well as the climatic context should be addressed. Also the costs of the measures should be examined:

- *Legal and institutional context*: Since all the analyzed guideline aim at an integration of climate-protection into formal land use planning (though itself informal in nature), the legal and institutional framework is not only a major part of the guidelines but even a pre-condition of their existence. All of the guidelines presented are part of national, regional or local policies and are designed according to the German planning system. Without these institutional and legal frameworks the implementation of these guidelines would not be possible. Thus the legal and institutional context of the local situation is highly influential for the guidelines analyzed. Only the general recommendations on urban form (being independent from the institutional context) seem to transferable.
- *Climatic situation*: However, these general recommendations highly depend on the climatic and topographic situation. The guidelines have been formulated for a moderate climate of Germany, which is characterized by a warm temperate humid mid-latitude climate. This climate brings mild winters and summers, which are not too hot. However, from time to time high-pressure systems block westerly winds which lead to very cold winters and very hot and dry summers (German Weather Service 2011). Due to the local climate and relatively low use of air conditioning, 77% of the energy in German households is related to heating (Initiative Erdgas 2011). Thus most of the measures introduced in the guidelines are targeting the reduction of energy for heating (and electricity). Hence the recommendations are transferable, but only to cities and regions in a comparable moderate climate.
- *Costs of measures:* The costs of the measures recommended are only addressed marginally – only the Bavarian guidelines have a short chapter on the cost and potentials of cost-savings of energy supply. All other guidelines mention the cost effec-

tiveness of the measures at times, but do not offer a more comprehensive cost analyses or a cost-benefit analyses. A rapid estimation of the cost of the proposed measures in the guidelines shows that a certain share of the minimization of energy consumption is achieved only with spatial, non-technical measures, which seems to be cost-efficient. The costs of the proposed energy systems and concepts are difficult to forecast. They have not been detailed, also details about operator models of energy systems or not mentioned.

Conclusion

Generally one has to conclude that developing and implementing guidelines on climate protection on the local level is a very valuable initiative of the German municipalities. None of the guidelines presented stands out since they are all similar in their approach and content, mainly aiming at energy-efficiency through an adequate design of the physical environment and infrastructures. Differences which can be observed are mainly concerning their scope – the North Rhine-Westphalian guidelines are very comprehensive whereas the Bremen document is shorter and focuses more on legally binding land use planning. Nevertheless the guidelines seems to be good tool for integrating information on climate protection in plan making, especially due to their application-oriented character emphasized by illustrations, checklists and case study analysis. Beyond delivering information they also can raise awareness among local municipalities, planers, architects and developers. A weakness in this regard is their informal character: although they aim at influencing formal plan making by providing basic information on climate protection in urban planning, the implementation of these recommendations is voluntary. The first experiences from Augsburg show that the guideline is used within the municipality, but it is questionable if private investors will also refer to it (Schott 2008). Regarding recommendations given the guidelines mainly focus on physical design of the environment and infrastructures. The measures proposed are mostly well-known strategies of climate-sensitive planning on site characteristics, urban geometry and energy consumption (as published e.g. by Givoni 1998) combined with renewable energy options. Though these general concepts and relations are introduced, choosing the right design strategy might be difficult due to the complex interrelations of macroclimate, urban microclimate and energy consumption on building level. Thus finding reliable solutions based on quantitative values might require using software-based simulation tools, which integrate building physics, urban design, climatic parameters and energy supply systems. Despite these challenges, a real innovation of the guidelines is their integrative character since they merge the analysis of local effects of climate change with a comprehensive set of “rules of thumb” on climate-conscious and energy-efficient design. Moreover they demonstrate regulative possibilities of the realization of these rules. In this regard the guidelines combine the demands of different departments of the municipalities as the experience from the municipal administration of Augsburg illustrates: before the guidelines existed, the environmental agency within the municipal administration concerned with climate change wished to integrate climate-related aspects into the early planning stages, whereas the urban planning department expected the input of knowledge on climate-relevant factors from the environmental agency. The guideline now creates an offer for both parties and minimizes the need for the time-consuming coordination efforts in the planning process (Schott 2008).

A potential of further development of the guidelines can be seen in their predominant focus on mitigation measures. For an effective climate protection, mitigation measures must always be combined with measures of adaptation to climate change (Tyndall Centre 2009). Not considering adaptation measures in mitigation policies can lead to negative effects: the idea of a dense and compact urban form can collide with the need to create air exchange corridors for cool and fresh air in Urban Heat Islands. Although it is not the intention of the guidelines to provide an integrated approach of mitigation and adaptation the documents should at least indicate the potential risks of not considering adaptation measures. A second aspect of further elaboration is the fact that most of the guidelines concentrate on energy consumption for heating, cooling and electricity and hence ignore one of the major emitters of CO2-emissions: individual motorized transport. An adequate configuration of land uses,

offering supply units and job opportunities in neighborhoods or reducing traffic areas and parking possibilities urban planning and design offers the possibility to reduce transport. These potentials should be addressed in the guidelines. A third point of further development is related to the latest amendment of the German federal building code, which – due to its actuality – is not included in the guidelines. The nuclear disaster in Fukushima in March 2011 led to a successive change of the German energy policies, the "energy transition". This transition implies the nuclear phase-out in Germany until 2022. The energy transition was linked to a whole range of new laws including a further amendment of the federal building code. In June 2011 the "Law for the promotion of climate-protection in urban development" was passed. The aim of "climate-friendly development" is now a major part of the German planning law. Thereby earlier uncertainties of the municipalities if regulations in favor of global climate can be incorporated in land use plans have been eliminated. The aim of mitigation and adaptation is now clearly integrated in formal land use planning; moreover the realization of renewable energies in land use plans is eased (Krautzberger, Stueer 2011). Though the effects of this new law are not fully foreseeable yet, it seems clear that the guidelines partly need to be updated.

The last part of the paper was concerned with a short assessment of the transferability of the guidelines to other regions or countries. One has to accept that the potentials are limited – the local climate (respectively the climate change effects), the spatial recommendations deduced from it and the steering possibilities of the national building code are highly location-dependent. Nevertheless the design strategies can be transferred at least to regions with a similar climate. Also the holistic approach and the didactics applied seem to transferable. If transferred to other situations the guidelines should be developed further as indicted: the integration of adaptation measures should be included together with comprehensive recommendations on transportation measures.

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