From Energy Saving to Plus Energy Settlements
30 Years of Experience towards Sustainable Residential Areas.

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Abstract

Against the background of sustainable urban development, eco-housing schemes have been discussed in Europe and worldwide for many years among professionals, politicians, and residents. While the first attempts made, tried to save energy by using natural building materials and adapting the building better to local climatic conditions, the recent examples have developed to high-tech plus energy buildings and entire settlements.

This paper will critically review the past 30-40 years of ecofriendly settlements in Germany. Out of meanwhile hunderts of different examples which can be found in all parts of the country, 3 are selected to exemplify the changing parameters for a state-of-the art eco-settlement as experienced in Germany. The intention is to give an insight into long-term, systematic steps of sustainable development in the field of housing and urban development in Germany. Standards have been tested and improved continiously and efforts made in Germany have become a model for many other countries worldwide.

The paper is based on literature review and on various site visits of the selected examples where the author had the opportunity to also meeting the urban planners, architects and local residents of the respective settlements.

Key Words: Eco-Settlement, Plus Energy, Sustainability.

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من التجمعات السكنية الموفرة للطاقة إلى التجمعات السكنية الفائضةالطاقة
ثلاثون عاماً من التجارب نحو أنماط سكنية مستدامة

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ملخص

إلى جانب التنمية العمرانية المستدامة، يناقش في أوروبا والعالم منذ سنوات عدّة السكن الايكولوجي (البيئي) من قبل المختصين والسياسيين والسكان. فقد استندت التجارب الأولى إلى مبدأ توفير الطاقة، معتمدةً على المواد الطبيعية في البناء، حيث صممت المباني بما يتناسب والشروط المناخية المحلية.

عرض البحث وحلل مجموعة من التجارب التي تعتمد على تطوير التقنيات العالية للطاقة الفائضة في مجموعة من التجمعات السكنية.

ناقشت هذه الورقة البحثية، بشكل نقدي التطور في الـ 30–40 سنة الماضية للتجمعات السكنية الصديقة للبيئة في ألمانيا، إذْ أجريت في المدة السابقة العديد من التجارب المختلفة، التي توزعت في أنحاء ألمانيا كلها. اختيرت ثلاث تجارب في متن هذا البحث التي تعدُّ مقياساً عبر عن المتغيرات في أنماط التجمعات السكنية المستدامة والبيئية وتطورها في المانيا. الهدف من وراء هذه المنهجية أن نعطي نظرة عن الخطوات المنظمة طويلة الأمد للتنمية المستدامة في مجال السكن والتنمية العمرانية في المانيا. أُخضعت المعايير المحددة في هذا المجال للتجارب إذْ أسهمت هذه التجارب في تحسين أدائها باستمرار. وقد شكلت الجهود والتجارب الألمانية نموذجاً اِحتُذي بها في كثير من دول العالم.

اعتمد هذا البحث على دراسة المراجع المتعلقة بهذا الموضوع وتحليلها من ناحية،

اعتمد البحث من ناحية أخرى على الزيارات الميدانية للأمثلة المختارة. كما تم اللقاء أيضاً مع المشاركين بهذه التجارب ومع بعض المعماريين المصممين والقاطنين في هذه التجمعات.

الكلمات المفتاحية: التجمعات السكنية البيئية، الطاقة الفائضة، الاستدامة.

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Introduction

When in 1970 the Council of Europe declared the first„ *European Conservation Year" it was meant as..."*a campaign to alert Europe of the importance and necessity of protecting and conserving the environment and its natural resources"[1]. An increasing awareness about limited natural resources came up as well in Germany. One may consider 1970 as the starting point for a broader political and social movement, including as well the dicourse on environmentally friendly and resource protecting urban and rural development.

In particular among architects and urbanists this new „green" movements has fundamentally influenced the way of planning and designing new housing estates. And as well among the population more and more urban residents asked for healthy living conditions contributing to a reponsable way of dealing with nature and environment.

These trends focussed in urban areas, where more and more environmental risks performed: increasing consumption of limited resources, such as energy, water and land, encreasing air and noise pollution through traffic, irreversably destroyed landscapes through expanding road networks and sprawling urbanisation, just to mention the main issues. Thus ecological building came up as a new paradigm in the early 1970es, based on principles to minimize the consumption of energy and resources and to safeguard the natural balance. Building in an ecological way is a holistic view of integrating many different aspects into planning and designing and allows buildings to be part of natural circles, which are carefully considered not to affect negatively throughout the whole life-cycle of a building.

The first experiments were made in Germany by smaller communities, kind of pioneers in this field, who started to use mainly natural building materials (clay, wood, stone) and focussed on the individual building and smaller scale housing schemes. Early examples in Germany are *„Alte Windkunst"* in Aachen, which was in 1987 one the first settlements, covering 16 units, comparable to the one in Kassel *„Am Wasserturm"* dating back to 1988 or the residential area of „*Schafbruehl"* in Tuebingen, realized in 1985, covering for the first time 110 rental units, just to mention the most known first settlemnts of ist type. [2]

From energy saving in a *passive* way the next step was an active *low energy* building, leading to a *net zero energy*[3] and finally to *energy-plus*[4] buildings.

The translation into a bigger urban scale came up later in the 1990es, when entire city quarters with up to 2000 dwelling units were provided. Examples in Germany are the „*Franzoesisches Viertel"* in Tuebingen realized around the year 2000 similar to the area „*Hannover Kronsberg"*,which has Germany's first housing estate based consequently on low-energy principles. Integrated into the *EXPO 2000* activities 3,000 homes were built to an exceptionally high ecological standard and above average comfort levels. In Freiburg „*Vauban"* all lessons learnt on eco-housing and eco - friendly settlements have been brought together to establish a comprehensive sustainable city quarter.

What has become clear from the very beginning on is the fact that eco friendly building in cities is instrinctly linked to

[1] Vi Nguyen, in The Ecologist 12/2010, http://www.theecologist.org

[2] See: www.oekosiedlungen.de

[3] „**net zero building"**, is a building with zero net energy consumption. The total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site or in other definitions by renewable energy sources elsewhere. These buildings consequently do not increase the amount of greenhouse gases in the atmosphere. Most zero net energy buildings get half or more of their energy from the grid, and return the same amount at other times. (wikipedia.org)

[4] Buildings that produce a surplus of energy over the year may be called **"energy plus buildings"** Photovoltaic systems generate solar electric power. This is fed into the public electricity grid and paid for according to the German Renewable Energy Act (EEG) (http://www.rolfdisch.de/files/pdf/BROSCHUERE_DAS_SONNENSCHIFF-englisch.pdf)

socially inclusiveness and to economic aspects of sustainability.

This paper will give deeper insights into the development of eco-housing and eco-city movement in Germany, starting in Mid-1980 and has been going on continiously. Standard setting experience not only nation wide- has been made throughout the past 3-4 decades. Three examples dating from 1986, 1998 and 2006 are presented to show the steps towards sustainable urban districts.

Three examples of eco-settlements in Germany – single family housing, apartment blocks, and city quarters

Example 1: Kassel Am Wasserturm

source: Deutsche Bauzeitung 6/2010

source:google earth accessed 2016-01-23

Fig. 1: Site Plan Settlement Am Wasserturm Kassel

The settlement is one of the first 10 pilot projects that have been realized from the late 1980es and onwards in Germany. [5] The scheme is composed out of single family houses, twin-villas and attached row houses for in total 36 families. The urban design aims at minimizing the space for access and car parking and integrates from the very beginning on a vegetation that positively influences the micro-climate in the settlement. Located in the north-west of the city of Kassel, the scheme is integrated into the overall road network and into the landscape of the city's outskirds.

The design is based on the intention to save energy by passive measures, such as the physical arrangement of buildings (orientation towards sunlight), and the provision of winter gardens that would work as a climatic buffer between outdoor and indoor space. They collect solar energy and reduce the loss of indoor temperature. Special focus was laid on using healthy building materials such as clay and wood. Furthermore a variety of measures are taken to explore eco-friendly building techniques hand in hand with water saving and waste reducing and recycling life style patterns. Surfaces in the outdoor space are not sealed to allow rain water infiltration, green roofs and green facades characterize the buildings. Moreover the community of residents wanted to contribute with a holistic approach towards necessary changes in urban societies facing more and more environmental risks. Residents joined from the beginning on during the planning process and during the construction period and experienced as well new social movements on participatory planning and co-housing.

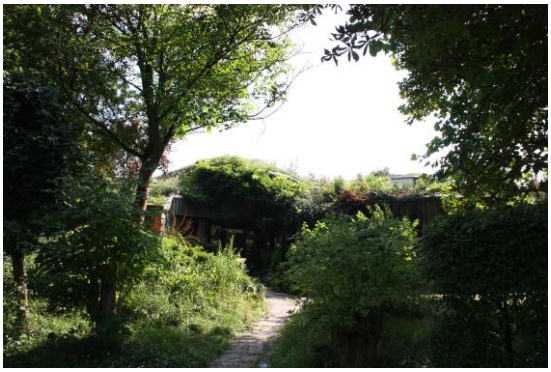
[5] for a brief overview on eco-settlements in Germany see: www.oekosiedlungen.de

Pedestrian area /Eco Settlement

Familyhouse/Eco settlement Kassel

Source: Researcher

Green Roof/Eco Settlement / Kassel

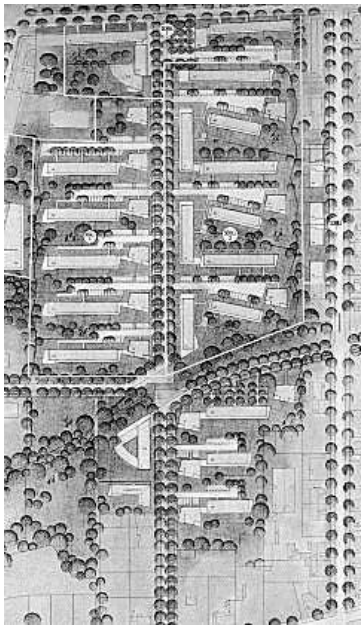


Source: Resaercher

Pedestrian Zone/ Eco Settlement and outdoor Space

Source: Resaercher

Example2: Heinrich Böll Siedlung Berlin Pankow.



Areal View Heinrich Böll Settlement **http://www.stadtgrenze.de**
Foto: GSW W. Brenne - J. Eble source

Location:

Realisation: 1995 – 1999

The scheme is composed out of 17 buildings covering in total 450 residential units on a surface of 45,000 square meters. The project has been realized mainly through a public social housing program and was part of a Berlin Federal State Initiative on *urban ecology* promoting and financially supporting role models for energy-efficient housing schemes. Planners and architects of this settlement put special emphasis on analyzing systematically costs and benefits of eco-friendly building technologies in social housing schemes. This includes besides innovative and cost efficient buildings as well long-lasting and service reduced constructions. Particular interest was given to the selection of construction material, using mainly natural building materials to promote a comfortable and healthy living space. Resource preserving urban design limits land cover and creates a high quality indoor and outdoor space.

The buildings are organized in a lay-out that allows for extensive open space, children play grounds and green neighborhood squares.

The rainwater system collects all water from roofs, streets and other surfaces and guides and cleans it in open gutters towards a reservoir from where it is used for irrigating the settlement's outdoor green space. Remaining rainwater is gathered in a rainwater retention basin. Besides positive impacts on the microclimate and the water is integrated into the public green space design.

On the rooftops of three buildings there have been placed photovoltaic cells covering a surface of 1,200 square meters. They produce it its peak 145 kWp. The electrical energy produced is introduced into the public power net and was compensated with 0,70 DM/kWh. Within a time span of 15 years these facilities allowed an income of 70.000 DM and after a 7 years period of amortization 83 tons of CO_2 are saved annually.

On a display-board installed in the main street of the area people can follow the current capacity of the photovoltaic system, the amount of energy produced and the amount of CO2 saved.

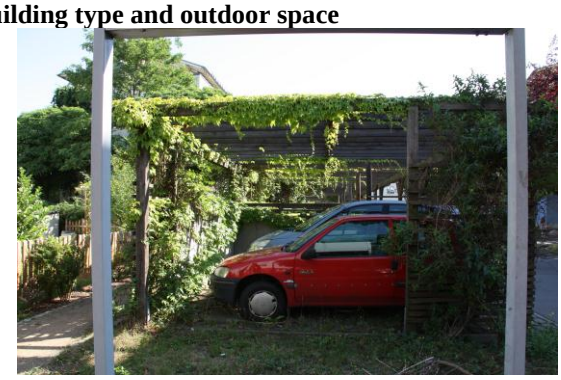
The *Heinrich Böll Residential Area* was the first to test affordability of eco-friendly and energy saving building materials and construction techniques within social housing apartments for rent.

The use of energy efficient material, high standard thermal insulation, plus loam rendering and radiant panel heating allow for comfortable indoor climate and could reduce standard heat requirements.

A systematic review was done to calculate initial investment costs versus cost-saving potential on the long run by comparing conventional building blocks with those done in energy efficient manner.

The example shows that the energy efficient, simple, and innovative construction has produced low maintenance requirement and long lasting structures. Residential space is user friendly, comfortable and healthy. Resources have been carefully treated as consumption of surface and material has been minimized.

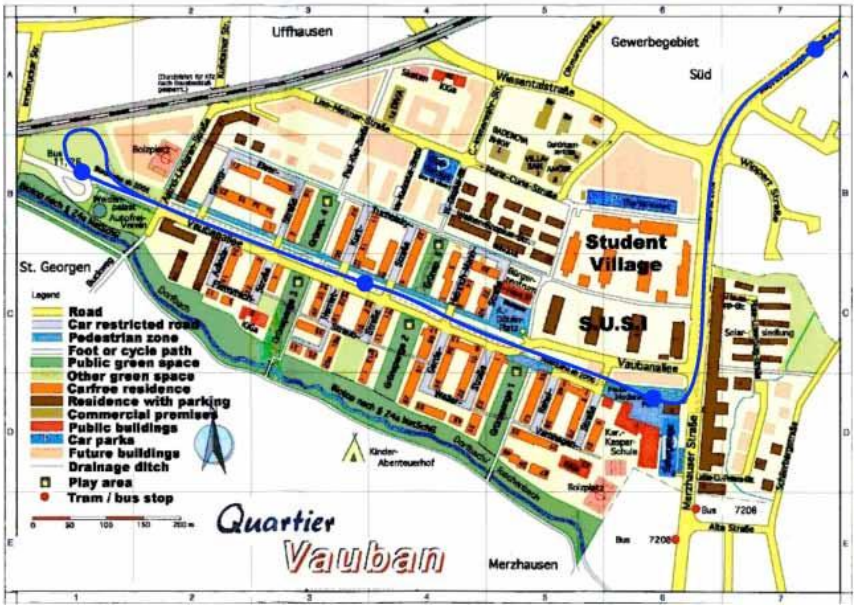
Photos: Characteristics of building type and outdoor space

source: Researcher 2015

Example 3: Freiburg Vauban

http://www.freiburg.de/pb/site/Freiburg/get/documents_E-1834738871/freiburg/daten/bauen/vauban/Luftbilder_Download/Luftbild_2012.jpg



source: S. Field, ITDP Europe

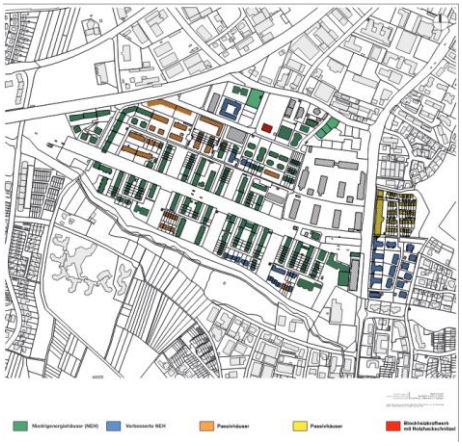
The most comprehensive and sophisticated eco-city that has been realized is probably the district of Vauban in Freiburg, south of Germany. The area has a size of 42 hectars and is located at about 3 kilometers away from the city center. Until 1992 it was occupied by a French military base.

An extensive public dialogue was started in 1995 about a new district to develop in that area initiated by *Forum Vauban*[6] [7] in close cooperation with urban planning institutions of the city of Freiburg.

The district of Vauban has set new standards concerning the energy and transport concept, resource efficient building technologies, and participatory and inclusive planning and implementation processes alike. It has become one of the most known and often awarded eco-settlements in Europe.

The success of Vauban is founded on the holistic concept of a sustainable city, combining new standards in all aspects, the environmental, the social, and the economic one. Environmental standards are met through the *energy concept*, which is based on complementing active use of solar-energy with energy saving building technologies and environmentally friendly heating systems.

About 90 residential units are built as *passive houses* that do not need conventional heating but are using a simple heat recuperation system and passive solar gains. Another 90 units for mixed use, 80% housing and 20 % workspace are integrated into the so called *solar settlement*, which is formed by six buildings integrated in the northwestern corner of the Vauban district. These units are constructed as *plus-energy houses*. By the end of 2000 already 120 kWp are produced by the active use of solar energy through photovoltaic systems. Passive measures are supported by a district heating grid and a co-generation plant operating on wood-chips.



MAP showing location and distribution of different types of solar energy use

„solar village“ with plus energy houses

[6] Forum Vauban e.V. is a non-profit association with about 300 members, active in the Vauban suburb of Freiburg/Germany. In having responsibility for community work, the association has been ultimately responsible for the development of social interaction in the new suburb… During the planning process between 1995 and 1999, Forum Vauban was the legal body of the extended citizen participation and thus co-responsible for the district design by representing wishes and needs of the future inhabitants.

CO2 saving measures are taken as well in the way how mobility and traffic is organized. The overall urban lay-out is designed as a „*district of short distances*“ that provides...„ a school, kindergardens, a farmer's market, businesses, a shopping centre, a food coop, recreation areas, and approximately 600 jobs will all be within walking and cycling distance.

The district is divided into a totally car-free zone and into wider parts of the district organized as parking-free areas. Instead of providing parking space in front of the door, private cars are parked in a community car park. For delivery and pick-up service cars are allowed to enter the residential areas. More than 140 households live without a car and are exempted from paying for the community parking. A car-sharing company „Freiburger Auto Gemeinschaft“ offers private cars when needed.

An efficient public transport (tram and bus lines) connects Vauban with the center of Freiburg.

Space that could have been saved in car-free and car-parking free zones could have been designed as public green space, residents’ streets and children playgrounds.

A system of rainwater infiltration into the ground covers 80% of the residential area and allows for less costs and a better micro-climate.

Strong community and neighborhood structures have been developed while integrating the residents in various workshops and public dialogues.

Further iniatives such as a neigborhood center, a co-operative food store, a farmer’s market, and community gardens have been established and supported a well balanced and inclusive living environment. Local municipal planning institutions adopted a philosophie of 'Learning while Planning' and set new standards for residents’ involvement into decision finding and urban planning processes. Freiburg-Vauban was presented as "German Best Practice" at the UN Habitat II Conference 1996 in Istanbul and played a role as an external site at the 2000 World Expo held in Hannover.

Vauban community parking

Vauban public transport tram line

Vauban solar settlement

Vauban care free living area

Source: Resaercher 2015

Final Remarks/ outlook

What has become evident in looking back on nearly 40 years of eco-settlement movement in Germany is the fact that there has been a continuous development that started with small-scale projects. A few pioneers took the initiative and tried out new ways, in the beginning following mainly their individual goal of 'better living'. It was first a social movement of few what has turned out meanwhile to be an official policy by local municipal and national government in Germany. German National government has launched the expo 2000 the starting point for a nationwide program on supporting eco-settlements becoming part of the expo.

Analysing the eco-settlement movement and its current state of development as well as future trends, it has become obvious that there is no way back in Germany to former "conventional" building techniques, that do not actively reduce the energy consumption or produce their own energy needed or even a surplus. German government has set up new standards for building permits and has introduced quite some incentives for individuals and institutions mainly through tax reduction and special loans.

Overview: Comparative characteristics of the three examples presented

Characteristics	Kassel - Frasenweg	Berlin - Heinrich Böll	Freiburg - Vauban
Construction period	1986 -1988	1995 - 1999	1998-2010
No of residential units	36	640	2000
Building types	Clustered Single family houses, semi-detached/row-housing	4 storey apartment blocks	Apartment blocks
Total area covered		8 ha	41 ha
Energy concept	Passive use of sun energy / greenhouses/wintergarden as buffer zones,	active use of sun energy (photovoltaic) comparison / cost balancing between conventional and eco-building techniques	Active use of sun energy „Solar city" plus energy houses • passive house standard consuming 15 kWh/sqm/year;
Construction material	Clay, wood, green roofs	sand-lime brick, board pile construction method	Bricks, wood
Open space/micro-climate	Surface sealing avoided, minimized space for access, vegetation as windbreaks, greening of facades and roofs, green surfaces support water retension	Carefully designed outdoor space, surface sealing avoided, rain water infiltration	Land saving design (car free) in favour for more open green space, surface sealing avoided, rain water infiltration
Land cover ratio/density	No data	GFZ 1,3	122 p/ha
Jobs on site	-----	-----	600
Car parking	Individual car parking outside the settlement	0,5 /unit	Car free area Parking free area
transport	Private car + public transport Kassel	Connected to public transport network Berlin	Connected to public transport Freiburg 39 % of households membership of Vauban Carsharing company
CO2 balance	No data	Photovoltaic cells 83 t of CO2 anual saving	reduction in CO2- emissions of 40.000 metric tonnes per year.
Social impacts	Strong residential community, families joint for planning, designing and implementation, and maintenance	Social housing scheme, rental housing operated by GSW (Gemeinnützige Siedlungs-und Wohnungsbau Gesellschaft) Berlin	,Learning while planning, collaboration between municipal planning authorities, Forum Vauban and residents, strong involvement of residents, public dialogue, co-operative building process, formation of co-housing initiatives

Resource: Researcher 2015

"In 1994 the Senate of Berlin established principles that made sustainability mandatory for public building projects. These principles were intended to lead the city 'from an ecological experiment to standardized regulations, from the individual eco-house to ecological, environmentally suitable urban planning'. This 'Berlin Standard For Ecological Building' became a

nation-wide model". Berlin Senate of Urban Development: Elements of Sustainability, Ecological Building in Berlin, 2000

The following check-list summarizes a list of questions to evaluate projects of sustainable and ecological building. This list is meant as a general orientation for planners and architects.

The regulations in place for public buildings in Berlin can be summarised in the form of lists of questions that can help private builder-owners to evaluate their projects in terms of sustainability and ecological building. Based on the life cycle approach, these questions are listed according to the respective planning phase. The column on the left indicates the applicable elements. These lists can be used as a preliminary and general orientation for almost any building project. However, they are no substitute for a comprehensive and coordinated ecological concept.

Building and open space planning

- Is the building's geometry optimised, is the structure as compact as possible?
- Are ceiling heights designed economically?
- Does the architecture ensure a measure of natural light and ventilation adequate for the intended use?
- Are room depth and windows designed in an optimal ratio?
- Does the architecture avoid internal (windowless) rooms?
- Does it obey the principle of compact, space and surface-saving construction?
- How has the structure been designed and located in regard to wind effects?
- Does the building's position and design permit passive solar energy use?
- Is overheating in the summer avoided by the structure's positioning and/or through sunblinds?
- Have basement storeys and the utility management, energy efficiency and construction expenses they entail been avoided – to the extent that use, technical demands and sealing requirements permit?
- Have all means of building planning been exhausted in order to render air conditioning and cooling systems powered by external energy supplies superfluous?
- Has thermal insulation been optimised to minimise energy losses? Are structures and materials with low heat conductivity being utilised for the external skin, namely for roofs, walls and glass surfaces?
- Are the storage capabilities of the building components being utilised for targeted heating and cooling management?
- Have heat bridges been avoided as much as possible?
- Does the structure permit a long period of use?
- Does it allow for future reuse?
- Do construction materials derived from renewable raw materials take priority?
- Have you given priority to construction materials that can be used without costly energy-intensive manufacturing and refinement processes?
- Have you given priority to regionally available construction materials?
- Are low-polluting and durable construction materials being used?
- Can the building's surfaces and rooms be cleaned and maintained at low expense?
- Can the construction materials in use be renewed at low expense?
- Are pollutants being removed from existing buildings as they are expanded or converted?
- Will soil pollution in available areas be disposed of during the course of new building?
- Can building components and construction materials be reused later?
- Does the project avoid the use of indissoluble composite materials and processing methods?
- Is a project-specific waste disposal concept in place?
- Are separation systems planned for waste disposable, e.g. appropriate waste bin sites in the courtyard or in special interior rooms?
- Is the property suitable for the on-site composting of biodegradable waste products?
- Is excavation spoil being used for on-site landscaping?
- Are roofs and/or façades being greened?
- Has the necessary care work been optimised?
- Has façade greening been prepared through appropriately designed vertical load capacity, surface conditions and/or scaffolding and trellises?
- Are hedges and bushes (rather than walls) being used to structure outdoor spaces?
- Is existing vegetation being included in green space design?
- Is the selection of plants appropriate to the location?
- Has priority been given to the planting of native shrubs and bushes?
- Are external protection measures for wild animals in place – e.g. nesting opportunities for building nesters?
- Have you given priority to greened or water-permeable coverings for external and road surfaces?
- Are ponds and wetlands planned?
- Is there a project-specific open area and greening concept?
- Will the groundwater and soil remain protected during the construction, operation and later dismantling?
- Have all possibilities been exhausted to increase the share of clean rainwater that can naturally return to the water cycle through seepage or evaporation?
- Is the targeted drainage of rainwater into the separate sewage system guaranteed?
- Is the noise protection, both internal and external, guaranteed?
- Will a favourable gross floor space to usable floor space ratio be achieved?

Planning technical building equipment

- Will high-efficiency energy supply systems be used?
- Is a need-driven heat recovery system planned?
- Can the rooms be freely and naturally ventilated – to the extent that this is not prohibited by regulations or major energy savings?
- Will at least a portion of energy needs be covered by regenerative energies, e.g. by solarthermal or photovoltaic systems?
- Has the cost-effectiveness of such systems been checked?
- Will electricity and heating be at least partially supplied by cogeneration plants?
- Has illumination with sunlight been given priority in the inner rooms?
- Are high-efficiency lamps being used?
- Are daytime and presence-dependent lighting control systems planned?
- Are energy losses being minimised by the use of new and energy-efficient systems and appliances?
- Do the supply lines avoid the root zones of existing trees and bushes?
- Have you chosen water-saving faucets and – if pre-installed – water-saving household appliances?
- Is rainwater being given priority in the irrigation of green and garden areas?
- Can rainwater reach the surfaces to be irrigated via natural inclines, i.e. without pumps or lifting systems?
- Are temporary storage basins planned for rainwater, e.g. in the form of ponds, wetlands or cisterns?
- Where drinking water quality is not essential, has substitution with service water from rainwater or grey water recycling systems been examined?
- Have the size and extent of technical areas been restricted on a need-driven basis and their locations optimised?

Execution

- Have building site logistics been optimised?
- Are construction materials and products being stored on the building site in a protected manner?
- Are construction materials and components being prepared and cut on a need-driven basis and with limited wastage?
- Are reusable and large-scale containers with a low packaging content being used to deliver construction materials?

Project conception and urban planning

- Has a surface-minimising, need-driven spatial programme been prepared?
- Can the planned use and the necessary spatial needs be realised in existing buildings, which can be reused, remodelled or expanded?
- If a new building is necessary, does it utilise developed building space?
- Will the new building project lead to a net unsealing of surfaces?
- Does the choice of location obey the principle of internal development or must previously undeveloped areas be opened to development?
- Does the new building integrate existing building components?
- Does the orientation and arrangement of the structure take account of existing vegetation, natural spaces and habitats?
- Does the building project link existing natural spaces – e.g., by creating stepping stones for plants and animals?
- Does the planning pay heed to characteristic landscape elements at the location?
- Have climate conditions at the location been taken into consideration?
- Does the arrangement of the building take into account issues of lighting, sunlight and shading – depending on the trees and buildings present at the location?
- Does the positioning of buildings take into consideration the emissions situation at the location – e.g., by shielding sensitive areas from heavily travelled traffic routes?
- What impact will the project have on the urban climate? For example, will fresh air corridors be restricted?
- What impact will the future building emissions have on the air?
- Is past pollution present at the location, either in the existing building sections or in the soil, which will be removed in the course of the project?
- Does the location take advantage of existing infrastructure provision? Are connections for the technical infrastructure in place or firmly planned?
- Is the location near connections to the public transportation network so that individual motorised transportation can be minimised?
- Is an ecological master plan being developed for the project?

Elements

- Energy
- Water
- Building materials
- Greenery
- Waste

source:

Publisher Senate Department for Urban Development www.stadtentwicklung.berlin.de

Content and Preparation Senate Department for Urban Development Directorate VI – Ministerial Building Affairs Ecological Building, VI B1, 2009**.**

When thinking of the future situation in Syrian cities, new energy standards should be integrated into the urban planning and design regulations and the after-war reconstructions should include studies on locally adapted solar-settlements, responding to local climate. This article has shown that learning from Germany and translating German experience to a Syrian context could bring tremendous advantage to the country: Solar energy techniques for mass housing estates are ready to implement, eco-cities' urban layout and urban design criteria are ready to be applied in the Syrian context: compact settlements that allow for an adequate physical density and allow short distances between dwellings, workplaces, shopping, religious and cultural facilities, health care and recreation places are ready to be explored as well in the Syrian urban context.

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