

Hessian Agency
For Nature Conservation, Environment and Geology
Centre for Climate Change and Adaptation



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Business parks - climate-adapted and fit for the future!

Real-life examples from local authorities and companies



Climate change in Hesse - focus topic



Imprint

Climate change in Hesse - key topic

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Foreword



*Prof Thomas Schmid
President of the Hessian
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Climate change and its consequences affect all of us. Whilst it is still essential to pursue ambitious climate protection goals, we in Hesse must also give attention to ways of adapting in all areas of everyday life. This also relates to commercial enterprises and business parks.

Heat and heavy rain are just two effects of climate change that can be felt with increasing force. Both have very different – sometimes devastating – consequences for entrepreneurs, production chains and working conditions. In this brochure, we will use real-life examples to show the concepts and measures that can deal with heat and water in the future, whilst also creating added value for the location, the enterprise, the local authority, nature, and last but not least the people who work there every day.

No business park needs to be grey, tarmacked and treeless anymore – everyone ultimately benefits. Be inspired and join in!



*Ulrich Caspar, President of
the Frankfurt am Main
Chamber of Industry and
Commerce and Chairman
of the PERFORM initiative*

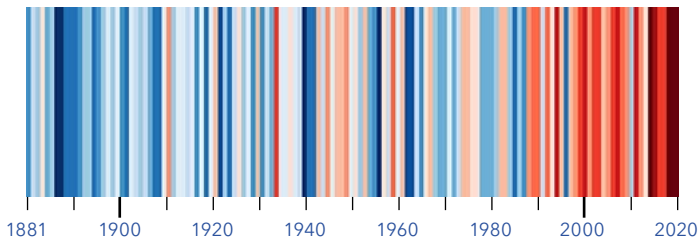
When industrial parks are flooded, logistics chains are disrupted and the performance of the employees is impaired, this has an impact on companies. Even though Germany is complying with the goals agreed in the Paris Agreement, the development in many other – especially larger – economies can hardly be avoided. However, companies and cities can work together to adapt to the changed climate. Even though many companies have already taken the appropriate measures, this can be underpinned by more information. Therefore, the brochure “Business parks – climate-adapted and fit for the future!” has come at just the right time. Business parks should not become forgotten urban spaces, either with regard to the quality of the urban environment or when it comes to the protection of the climate.

Climate change – the major challenge for trade and industry

Extreme weather has a negative impact on operating conditions

Throughout Germany and thus also in Hesse, periods of extreme heat have increased significantly in the recent past. Regional climate predictions for the 21st century show a continuation of the rise in temperatures. In industrial and business parks with their high degree of surface sealing, the heat stress is particularly high. An excessive heat increase in the buildings and on the business premises makes employees' working conditions worse, triggers higher costs for air conditioning and leads to damage to the buildings and to production cutbacks.

Warming stripes for Hesse – 1881–2020



© Ed Hawkins, www.showyourstripes.info
Data source: German Weather Service

The warming stripes for Hesse show an increasing rise in temperatures for the period 1881–2020. Representation of how the average temperature of a calendar year deviates from the longtime average – shades of red for upward deviations, shades of blue for downward deviations.

Other extreme weather situations are also expected to become more frequent or to last longer in the future. This can not only lead to a disruption of logistical processes and production chains, but can also put life and limb at risk. In the event of a flood, stored harmful substances can enter the environment. Slower-moving storm cells and violent storms can cause significant damage to property.

Climate change in figures

- In Hesse, the average annual temperature increased by 1.6 °C in the period between 1881 and 2020.
- Periods of extreme heat are increasing significantly: in 2018, the longest and, along with 2003, the most intense heat wave since 1870 was registered. In Hesse, the temperature was above 30 °C on 24 days in 2018.
- Without climate protection measures, the average annual temperature in Hesse will increase by up to 3.9 °C by the end of the century.
- Rainfall is consequently becoming heavier and more intense: warmer air can absorb more water vapour than colder air, on average 7 % per 1 °C temperature increase. A rain cloud in warmer air contains more water than one in colder air and can thus produce more rain.

Business parks: harnessing potential!

Climate adaptation - an asset for local authorities and companies!

For companies, the existing buildings, outdoor areas and infrastructure provide good opportunities for a climate-adapted design, e.g. with greening measures. These improve the quality of the working conditions and the time spent in the company for the employees. In this way, companies secure their economic well-being and reinforce their positive image. Planned modernisations open up good opportunities for a climate-adapted remodelling!

Business parks amplify the overheating of neighbouring urban areas, and heat islands emerge. Together with the municipal land and the public infrastructure, these result in a large potential area for the integrated realisation of climate adaptation measures. Climate-adapted business parks provide an additional incentive for companies to settle. Therefore, the climate-resilient design of business parks provides local authorities with the opportunity to also enhance the quality of life in neighbouring districts and offer attractive future-proof urban districts.

Real-life examples

On the following pages, you can discover how this can work. However, the potential is far from being exhausted. Be inspired and identify the adjustments that you can make in your local authority, your business park and your company!

Business parks often have a degree of surface sealing of 80-90 % and are particularly affected by heat stress



Basic geodata:
© Stadtvermessungsamt Frankfurt am Main, last updated 08.2021,
© Hessian State Office for Soil Management and Geological Information

Commercial buildings

How can the consequences of climate change be tackled?

Increased temperatures and extreme weather events have consequences for buildings:

- Heat buildup with consequences for air-conditioning requirements, working and production conditions
- Faster ageing of materials due to heat
- Damages to the building fabric and to the roof and facade as a result of flooding, hail or gusts of wind
- Impairment of the stability up to the collapse of buildings due to subsurface erosion or the action of the wind
- Increased difficulty in storing heat-sensitive products and increased air-conditioning costs
- Damages to means of production and machinery as a result of heat or heavy rain and floods
- Additional costs for companies due to increased cooling of buildings, coolant, maintenance of green areas or drinking water consumption



Tried-and-tested solutions for healthy conditions for work, production and time spent in the company:

- Choosing light outdoor surfaces reduces the heat buildup in buildings.
- Shading elements, such as external sun protection, canopies or photovoltaic systems regulated by the sun level, keep the heat out of the buildings.
- Insulation of the building envelope helps against heat and cold. Climate protection and adaptation go hand in hand here!
- An optimised building orientation allows an exchange of air for nighttime cooling thanks to a natural fresh air supply.
- Roof and facade greening contribute towards the heat insulation, the protection of the building envelope and the water retention and reduce the heat buildup through evaporative cooling.
- An elevated building arrangement protects against flooding.

Integrating the consequences of climate change into operational concepts

- Adjustment of risk management concepts or incorporation of climate risks
- Organisational protective measures, e.g. the proper storage of water-polluting substances
- Raising the workforce's awareness, e.g. through behavioural measures such as correct ventilation
- Natural hazard insurance

Real-life examples commercial buildings – heat-adapted

Minimising the need for air conditioning: cool supply air, a selection of appropriate materials and wall incline



© Alnaturo, Lars Gruber

Good heat insulation with approximately 70-centimetre-thick walls made of rammed earth and lava gravel from the Eifel make it possible to achieve a stable and balanced temperature level in the building in hot and cold weather. Fresh air is

conducted from the edge of the forest by a subterranean channel and fed into the building. The ground stores the stable average temperature of a site. In this way, the outside air is heated in the winter and cooled at the height of summer.

Alnaturo, office building, Darmstadt, new build, completed 2019



© INFRASTRUKTUR & UMWELT

Due to the funnel-shaped roof structure on the science and congress centre in Darmstadt, rainwater flows into the subterranean channel under the underground car park and is then stored in a rainwater cistern, treated and used

for sanitary facilities and green areas. The incline of the building's large glass facades (double glazing) also ensures that the rooms heat up less in the summer.

Congress centre, Darmstadt, new build, completed 2007

Good heat insulation replaces air conditioning

Good insulation, lowering the building 2.5 m into the ground and the associated groundwater cooling make it possible to dispense with an energy-intensive air conditioning and heating of the logistics centre.

Alnaturo distribution centre, Lorsch, new build, put into operation 2010



© Alnaturo, Alexander Heimann

Greening of commercial and industrial buildings

Roofs and facades of commercial and industrial buildings provide a lot of potential space for greening measures and thus for a versatile protection against the impacts of climate change. Solutions also exist for building structures that are typical for the commercial sector such as lightweight constructions.

How roof and facade greening works

- The evaporation activity of the plants has a cooling effect. The leaves of the plants cast shadows and reflect sunlight. Therefore, greening activities lower the building temperatures and perform a microclimatic function. Energy costs for heating and cooling can be saved.
- Any roof greening causes a drainage delay. Rainwater is retained and thus relieves the burden on the sewage system.
- The vegetation on the buildings reduces severe temperature fluctuations, protects the building fabric from storm damage (e.g. hail) and weather conditions and thus extends the renovation cycles of roofs and facades.
- In addition, the greening of buildings makes a positive contribution towards biodiversity and increases the quality of the time spent in the building. It can be realised without using any additional land.

Well suited: greening of flat roofs on administrative and office buildings



In the example, roof greening was planned in the new administrative building. It is low-maintenance; larger roots need to be removed just twice a year so as not to put the sealing or load-bearing capacity of the roof at risk.

Walter Lerch Bau- und Industriebedarf GmbH & Co. KG, Hattersheim, new build 2010

Facade greening as a contribution towards biodiversity



Greening was retrospectively realised on the western facade of an existing production hall for heat protection and protection against the sun. Various varieties of vine were chosen that provide a green feast for the eyes.

Carl Friederichs GmbH, Frankfurt, existing building, remodelling 2019

Roof and facade greening on lightweight buildings



Climbing aids on a 30 m long and 5.50 m high lightweight facade allow plants to be grown. The climbing aids were installed when the wall was manufactured. Roof greening, e.g. with species of sedum, is also not a problem in the case of lightweight construction.

Achilles Group, production hall, Düsseldorf, new build 2011



Dual effect - special forms of roof greening with procedural benefit



Roof greening can also be used for procedural purposes. This kind of roof greening is not an ordinary green roof, but a retention roof that is integrated into the cooling circuit to cool the

cider cellar. This climate-adapted solution can save € 6,000 cooling costs per year.

Kelterei Possmann GmbH & Co. KG, Frankfurt, existing warehouse with wide-ranging use, subsequent construction of the green roof 1991

Roof greening can also be combined with the treatment of production-related wastewater. This constructed rooftop wetland consists of reeds and sedges with their roots in water. Dispensing with the usual soil ensures that the permissible roof load is observed.

John Deere GmbH & Co. KG, Mannheim, existing warehouse building, constructed wetland put into operation 2005



Climate adaptation in traffic and outdoor areas

The consequences are manifold:

- Rupture, sagging or softening of the road surface and tarmacked operational areas due to heat, as well as consequential damages to technical infrastructure
- In conjunction with a high degree of sealing, heavy rain leads to an overloading of the sewer system and to floods
- Impairment and disruption of transport routes and supply chains as a result of road closures in the event of floods, disruption of access routes due to trees having been uprooted in a storm or waterways not being navigable in the event of a low water level
- Impact on the water balance and an increased need for irrigation of the green areas in the event of a drought and a shortage of water

Possible measures for water retention with a cooling effect:

- De-sealing / removal of sealed surfaces
- Creation of emergency waterways / adaptation of ground inclinations and flow paths
- Technical flood protection measures
- Establishment of infiltration systems / option for retention in open spaces
- Creation of green spaces, flower meadows and bodies of water
- Tree planting (climate resilient)
- Keeping cold air areas clear

Natural water retention - real-life solutions

The risk of flooding can be reduced by de-sealing. Other options for retaining unpolluted rainwater and feeding it back into the natural water cycle through infiltration or evaporation are retention on roofs, in open spaces or infiltration swales, as shown in the following examples.



Outside area as a recreation and rainwater retention area



© Mitsubishi Electric

A stream crossing the premises has been remodelled into a semi-natural meandering waterway. This provides various options for the storage and infiltration of rainwater. At the same time, a recreation area for employees was created.

Mitsubishi Electric Europe B.V., Ratingen, remodelling of the outside area 2018

De-sealing on the company premises



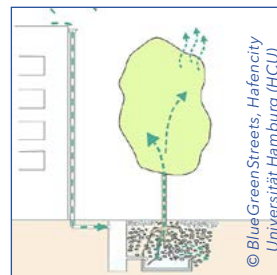
© Fa. Carl Friederichs GmbH

The de-sealing of traffic / storage areas on the company premises that are not required for operational purposes made it possible to create meadows and plant fruit trees. The layer of vegetation has a cooling effect, the outside area is

enhanced and precipitation fees are saved because the area is disconnected from the sewer system.

Carl Friederichs GmbH, Frankfurt, existing building, remodelling 2019

There is no space for planting trees?



© BlueGreenStreets, Hafencity Universität Hamburg (HCU)

The tree infiltration ditch with a storage element for vital tree sites provides a solution.

Rainwater from the roof drainage system is conducted into a shaft as a buffer tank with an emergency overflow. This buffer tank forms a water reservoir, from which the tree is watered.

Thus, water is not diverted into

the sewer system, but used as a resource. Thanks to the shadows cast and the evaporation activity, the planted tree makes a contribution towards heat precautions.

BlueGreenStreets project, running from 2019-2022

Good to know: why is it sensible to plant trees?

Evaporation produces cooling: according to researchers from Wageningen University in the Netherlands, the cooling performance of a large deciduous tree is equivalent to 20 to 30 kilowatts. Therefore, a single tree is as effective as ten standard air-conditioning systems. (Botanik Guide 2018)

Green business parks: proximity to nature as a “flowering calling card”

Biodiversity in business and industrial parks – (how) does that work?

Green spaces within business parks provide a huge potential for protecting and promoting biodiversity through a climate-adapted, semi-natural (re)design. Hitherto they have often exhibited a monochrome and species-poor appearance.

“Companies are blooming” initiative

Since 2019, the Main-Kinzig District has supported companies with the “*Unternehmen blühen auf*” (Companies are blooming) initiative as part of the “*Main-Kinzig blüht*” (Main-Kinzig is blooming) programme. With this support, flower meadows were created in the open spaces around the building, for example in the case of a newly built production hall, combining the useful with the beautiful: low-maintenance, a “wildflower calling card” for the business and an attractive outdoor area for the employees.

Main-Kinzig District, Landschaftspflegeverband Main-Kinzig-Kreis e.V. and regional nature conservation authority, initiative since 2019

Climate-adapted – less maintenance required!

Flower meadows are tolerant of drought and are characterised by low maintenance and irrigation requirements: to create a beautiful carpet of flowers, the area should only be mown twice a year. By contrast, ornamental lawns, non-native ground cover plants and shrubs on business premises, or roadside greenery are not only species-poor, but also require intensive maintenance.

Public green spaces in the business park – climate-adapted and species-rich

In the West Business Park in Weiterstadt, an approximately 1,800 m² green strip and a roundabout have been redesigned. Native wild plant species have transformed the species-poor lawns into a colourful, long-lasting and species-rich flower meadow. A good heat tolerance leads to low irrigation and maintenance requirements.

City of Weiterstadt, West Business Park, redesign 2016



Climate change alters working conditions

Increasing heat has an impact on the working conditions and limits the ability to concentrate and work effectively. This can lead to serious health risks, increased levels of sick leave and even deaths.

In addition to behavioural measures, heat adaptation in buildings and the climate-adapted (re)design of outdoor areas is indispensable.

In the North Industrial Park in Freiburg, apprentices have been made familiar with the most important criteria of a sustainable and semi-natural environment through excursions and workshops. They developed concrete projects, presented these to the company management and put them into practice immediately when they were given the green light. A "Greencity Wall" was created with flowering shrubs, climbing plants and kitchen herbs. The joint campaigns strengthened the team and the sense of community and had a positive effect on the well-being of the workforce

Blooming Industrial Areas project, running 2018-2020

Such a redesign provides a significant added value for employees: green break areas, meeting places amidst greenery, opportunities for meetings outdoors, as well as urban gardening and snack gardens, increase the quality of the time spent on the premises. Through campaign days, collective workshops or apprentice competitions, employees can get involved themselves and help to create a climate-adapted workplace.



What can local authorities do?

The requirement for and promotion of a climate-adapted design in public and private areas provides local authorities with a good opportunity to address the aspects of climate adaptation, biodiversity and the quality of time spent on the premises in business parks and put corresponding solutions into practice. Climate and heavy rain hazard analyses provide a good foundation for this - to provide owners with information and raise their awareness, and to plan adaptation measures in a targeted manner.



Climate adaptation measures REQUIREMENT

- Specifications in the development plan, e.g. regarding roof and facade greening or infiltration systems, unsealed open spaces / clearance areas
- Contractual provisions in urban development contracts, e.g. agreements regarding the design of open spaces
- Keeping areas clear of development in the town planning through a land-use plan and a development plan to secure cold-air production areas and cold airstreams for the long term
- Conditions and criteria for the allocation of land

Climate adaptation measures PROMOTION

- Financial incentives with respect to the allocation of land
- Specialist advice for companies and support for the realisation
- Provision of information
- Promotion of the exchange of experiences between the enterprises and formation of networks
- Climate-adapted design of public open spaces, e.g. as example measures

Financial incentives with respect to the allocation of land

The city of Bocholt (North Rhine-Westphalia) has set minimum requirements for the sale of urban commercial property. The environmental prerequisites for construction projects are assessed with scores in five categories (water and soil, urban climate, renewable energy and energy efficiency, biodiversity and mobility). A performance exceeding the minimum requirements leads to a discount of up to € 10/m². Possible measures: leaving less frequented areas open by using water-permeable surfaces on verges or parking spaces – on at least 10 % of the site area for a maximum score – or roof greening in the case of lightweight construction (e.g. production halls), using native or location-appropriate species – on at least 95 % of the total roof area for a maximum score.

City of Bocholt, Department of Urban Planning and Building Regulation, in collaboration with Wirtschaftsförderungs- und Stadtmarketing Gesellschaft Bocholt mbH & Co. KG, 1st update of the guidelines 2021



© Viesturs Kalvans, Adobe Stock

Examples of specification options

With the planned amendment of existing development plans, the town of Mörfelden-Walldorf is making the most of the opportunity to provide for specifications and guidance regarding climate-adapted design (preliminary draft, 16 February 2021).

“Zoning-law specifications in accordance with Section 9 (1) German Building Code (BauGB) in conjunction with the German Land Utilisation Ordinance (BauNVO)”

4. Measures for the protection, maintenance and development of soil, nature and the landscape (Section 9 (1) No. 20 in conjunction with No. 14, 25a and b BauGB)

4.2 Infiltration and collection of rainwater

Accumulating rainwater must be collected and infiltrated on the sites, unless this is opposed by water-management or health concerns.

4.3 Facade greening

External walls of buildings with an area of 50 m² or more must be planted with climbing, rambling or twining plants in accordance with the species recommendations [...] and looked after or maintained. [...]

4.4 Roof greening

Flat roofs and roofs with a shallow incline of up to 15 degrees and a continuous area of at least 25 m² must be extensively planted in accordance with the species recommendations [...] and looked after or maintained. The vegetation layer must be at least 10 cm thick. Gaps in the roof greening for necessary roof structures and technical systems such as heating, purification and ventilation systems or for photovoltaic systems are permitted.

5. Planting and preservation of trees, shrubs and other plants (Section 9 (1) No. 25 BauGB)

5.1 Front garden area

Facing the adjoining access roads, a strip at least 5 metres wide must be laid out as a front garden, and at least 50 % of this area must be intensively planted and maintained. The extensive laying of gravel, chippings and crushed stones is not permitted for the garden design. Parking spaces, driveways, access paths and ancillary systems are permitted on a maximum of 50 % of the area of the specified front garden area. [...]

The combination of roof greening and photovoltaic systems is explicitly provided for:

“3. Technical systems for the use of renewable energy (Section 9 (1) No. 23b BauGB)

In a business park (GE) or an industrial park (GI 1 to 3), photovoltaic systems must be installed on at least 70 % of the roof area of buildings with roof greening. [...] On flat roofs, the systems are only permitted in an elevated installation, i.e. in conjunction with the specified roof greening (see No. 4.4). [...]

Town of Mörfelden-Walldorf, Bebauungsplan Nr. 46.1 Teil A, “Gewerbe- und Industriegebiet Mörfelden-Ost”, 1st revision, Teil A, Textliche Festsetzungen zum Vorentwurf, as at: 16 February 2021. The amendments are currently (September 2021) at an early stage and do not yet have any legal force. They arise from the policy decision to revise the development plan in accordance with environmental protection aspects.



Any roof greening contributes towards the water retention

A look at the big picture



© Wirtschaftsförderung Bocholt

Business parks are part of the municipalities

At around 20 % of the settlement area, commercial premises greatly influence the settlement structure and the urban climatic conditions.

There are good arguments for a climate-adapted and green development in business parks with a view to the entire municipality:

- Improvement of the urban climate in the neighbouring residential districts
- Business parks are often located on the outskirts of settlements. Green corridors between the outer areas and the residential districts can be established here.

A shortage of land and a competition for land present challenges for municipal and private business park developers and make alternative space-saving solutions necessary. Innovative concepts pursue ideas relating to a vertical arrangement of commercial space, such as the leasing of plot levels to different enterprises or the organisation of operational processes across multiple floors. A space-saving arrangement is associated with a reduction in the degree of sealing.



© INFRASTRUKTUR & UMWELT

Greenery on the roofs and facades of multi-storey car parks in business parks can combine saving space, improving the microclimate and biodiversity

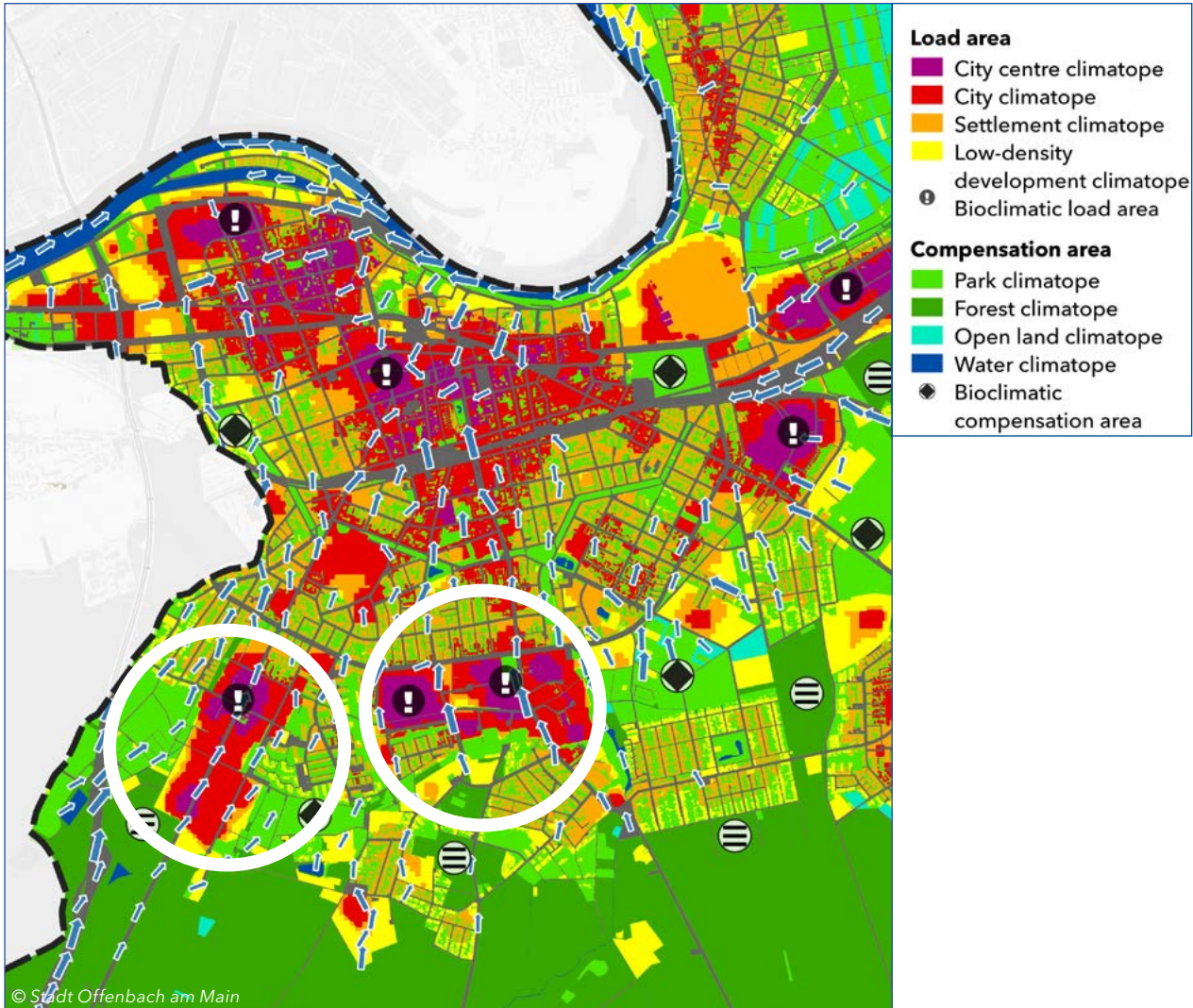
Going deeper – analysis and assessment of climate risks in business parks

Under what condition are business parks particularly affected by climate change? Information on stress caused by heat or heavy rain is provided by municipal climate analyses or regional and national risk maps. A look at past extreme weather events and their consequences for the area in question, especially deployment data from the fire brigade, is very useful.

The Federal Ministry for Economic Affairs and Climate Action provides a detailed climate check for medium-sized manufacturing companies: <https://www.bmwi.de/Redaktion/DE/Artikel/Industrie/klimaschutz-klimacheck-klimarisiken.html>

Assessment of climate risks for commercial space – guidelines of StädteRegion Aachen (2012)

Location	<ul style="list-style-type: none">• Location in the terrain (slope, sink, high plateau, etc.)• Location in the water system (river location, coast, etc.)• Connection to the transport infrastructure (rail, road, etc.)• Accessibility (alternative access routes)• Location in the urban area (city centre, outskirts of the city)• Characteristics of the surrounding area (green space, dense development, etc.)
Structural and spatial characteristics	<ul style="list-style-type: none">• Development density• Degree of sealing• Type of use (developed land, open space, useful space, etc.)• Orientation of the buildings• Building design (building types, heights, roof shapes, etc.)
Operational characteristics	<ul style="list-style-type: none">• Type of commercial activity (production, logistics, trade, etc.)• Type of workplace (offices, production facilities, warehouse, etc.)• Product-specific characteristics (storage, sensitivities, etc.)• Flexibility and buffer capacities (water and energy supply, supply bottlenecks, etc.)• Density of people in the space (employees, customers, suppliers)



The climate function map of the city of Offenbach am Main shows that business parks act as heat islands

Funding programmes and advice

Funding programmes for local authorities

- The Hessian Climate Directive provides funding opportunities for preparing urban climatic analyses and heavy rain risk maps.
- With the programme “Measures for adapting to the consequences of climate change”, the Federal Ministry for the Environment is funding municipal adaptation concepts, staff for the realisation of these, and selected measures.
- The KfW Programme 432 is funding adaptation to climate change in the context of integrated energy district concepts for existing business parks.

Funding options for companies

- In Hesse, a number of towns and cities are providing support for greening measures for companies.
- The KfW environmental programme is funding measures for adapting to climate change, for example for protection against heavy rain or heat stress, and a semi-natural design of company premises.

You can find further information and advice here (in German):

- You will find further information on the website of the Hessian Agency for Nature Conservation, Environment and Geology (HLNUG), e.g. checklists for climate adaptation or a heavy rain reference map for Hesse that identifies particularly at-risk local authorities.
- The HLNUG Centre for Climate Change and Adaptation provides local authorities with advice about the consequences of climate change and possible measures.
- A checklist and fact sheets containing practical tips for realising measures in business parks were published at the beginning of 2022.

Examples of municipal funding programmes

- The programme “*Frankfurt frisch auf!*” (Frankfurt refreshes) supports companies with free on-site advice and financial support of up to 50 % (max. € 50,000) of the costs for the realisation of roof and facade greening, the de-sealing and the greening of courtyards, or shading measures with an impact in public spaces. With the campaign “*Der geschenkte Baum*” (The donated tree), the city of Frankfurt is also providing companies, after on-site advice regarding the location and species of the tree by the environment agency / nature conservation authority, with € 500 to finance a deciduous tree.
- The green roof cadastre of the city of Marburg shows the suitability of roofs for greening in a digital model. The potential CO₂ storage, dust suppression and water retention are also calculated. Owners can make an application for a subsidy for roof greening in the case of new builds and for the retrofitting of roofs on residential and commercial buildings as well as garages and carports. The subsidy covers 50 % of the costs (max. € 5,000).
- The city of Hanau offers a combined green roof and de-sealing cadastre. A digital model is used to calculate the suitability for a green roof and the potential areas for de-sealing along with the thermal impact of these measures. In addition, free on-site advice is offered.
- The Energy and Climate Protection Funding Directive of Alsfeld subsidises the realisation of roof and facade greening as well as the de-sealing and greening of parking spaces.

Literature and sources

- Botanik Guide (2018): Bäume kühlen Städte wie natürliche Klimaanlage. <https://botanik-guide.de/baeume-kuehlen-staedte-wie-natuerliche-klimaanlagen/>. Abgerufen am 14.9.21.
- BMU (2021) – Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit: Förderrichtlinie Maßnahmen zur Anpassung an die Folgen des Klimawandels, Stand: 19.7.21, Berlin.
- HafenCity Universität Hamburg: BlueGreenStreets. Gefördert vom Bundesministerium für Bildung und Forschung. <https://www.hcu-hamburg.de/research/forschungsgruppen/reap/reap-projekte/bluegreenstreets/>. Abgerufen am 21.9.21.
- HAWKINS, ED (2021): ShowYourStripes, University of Reading, Datenquelle: Deutscher Wetterdienst. <https://showyourstripes.info/>. Abgerufen am 17.9.21.
- HLNUG (2020) – Hessisches Landesamt für Naturschutz, Umwelt und Geologie: Checkliste Klimawandelangepasste Quartiere in Hessen, Wiesbaden.
- HMUKLV (2018) – Hessisches Ministerium für Umwelt, Klimaschutz, Landwirtschaft und Verbraucherschutz: Hessische Städte – Natürlich Vielfältig, Wiesbaden.
- Innovation Academy e.V. (2020): Abschlussbericht „Blühende Industriegebiete“, Freiburg.
- StädteRegion Aachen (2012): Gewerbeflächen im Klimawandel, Leitfaden zum Umgang mit Klimatrends und Extremwettern, Aachen.
- Stadt Mörfelden-Walldorf (2021): Bebauungsplan Nr. 46.1 Teil A, „Gewerbe- und Industriegebiet Mörfelden-Ost“, 1. Änderung, Teil A, Textliche Festsetzungen zum Vorwurf, Stand: 16. Februar 2021.
- Stadt Offenbach a.M. (2021): Stadtklimaanalyse mit integrierter Planungshinweiskarte, Klimafunktionskarte – IST, August 2021.
- Stadtverwaltung Bocholt (2021): Teil B Leitlinie für eine nachhaltige Gewerbeflächenentwicklung, 1. Fortschreibung.
- WILA (2019) – Wissenschaftsladen Bonn e.V.: Gewerbegebiete im Klimawandel, Leitfaden für Kommunen zur Klimavorsorge, Bonn.
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Hessisches Landesamt für
Naturschutz, Umwelt und Geologie
Für eine lebenswerte Zukunft

