



THE FUTURE CITIES ADAPTATION COMPASS

A guidance tool for developing climate-proof city regions



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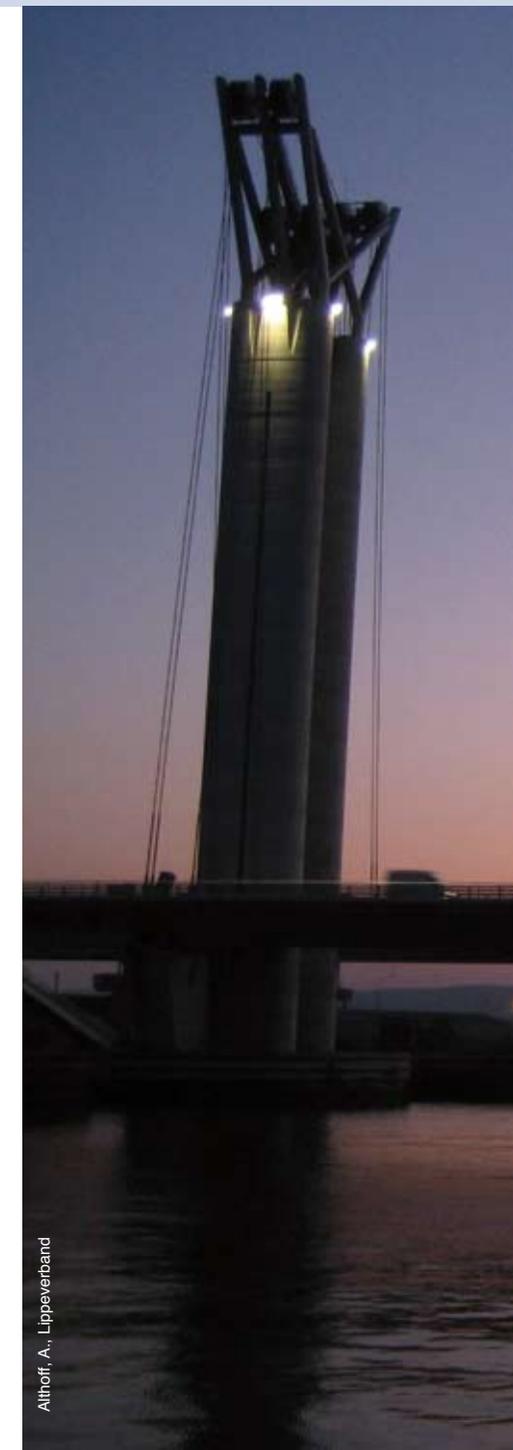
“Future Cities – urban networks to face climate change” is a project in the framework of the INTERREG IV B NWE programme, led by the German water board Lippeverband. The project aims at making city regions in Northwest Europe fit to cope with the predicted climate change impacts. The Future Cities strategy combines selected strategic key components – green structures, water systems and energy efficiency – for a pro-active transformation of urban structures.

The Future Cities partners are: Lippeverband/D (Lead Partner), City of Arnhem/NL, Emschergerossenschaft/D, City of Bottrop/D, Hastings Borough Council/UK, South East England Partnership Board/UK, Sea Space (Hastings and Bexhill Renaissance)/UK, City of Nijmegen/NL, Rouen Seine Aménagement/F, City of Rouen/F, City of Tiel/NL and West-Vlaamse Intercommunale/BE.

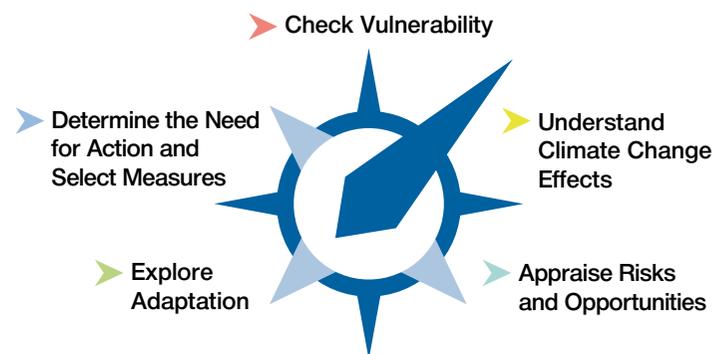
From 2008 to 2012, together the project partners strive for

- Common evaluation methods for climate-proof city regions – the “Future Cities Adaptation Compass”
- Action plans for existing structures to enable the participating regions to adapt their strategies in a concrete manner
- Implementation of combined measures: selected construction solutions in pilot projects
- Awareness raising of decision-makers and disseminators for pro-active ways of tackling adaptation to climate change impacts.

This brochure focuses on the development of the Adaptation Compass and the status of the network’s projects in 2010.



THE FUTURE CITIES ADAPTATION COMPASS – WHAT IS IT ABOUT?



In a city, almost all departments are facing the impacts of climate change. They must adapt their policies and ways to act in one way or another. The urban water systems have to cope with more rain water, and on the other hand plants and trees suffer from drought during summer. Measures taken by one department might also facilitate the adaptation needs of another. On the other hand an adaptation action of one department may conflict with the adaptation aim of another urban structure; Planting more vegetation like trees to keep public spaces cool will mean more falling leaves into the discharge system to be cleaned up and might increase the possibility of blocked gullies and storm water flooding. Using green structures and the water system for cooling the city instead of energy-consuming air-conditioning supports also mitigation aims: reducing or omitting greenhouse gas emissions.

This is where the Adaptation Compass starts from: It is a guide to interlink different stakes and to check the vulnerability and adaptation options across the sectors.

The Future Cities Adaptation Compass is meant to help planners and experts at cities and water boards structure the working steps, give examples for best-practice and experiences of Future Cities partners

and highlight possible barriers. The focus is on “guiding through the process”. Based on a pre-structured assessment and documentation layout, this Compass shall facilitate a well-structured and substantiated preparation of the stages to create climate proof cities.

The Adaptation Compass can be applied for a region, a city, a project area or only for a department. However, the main intention is to interlink the different stakes.

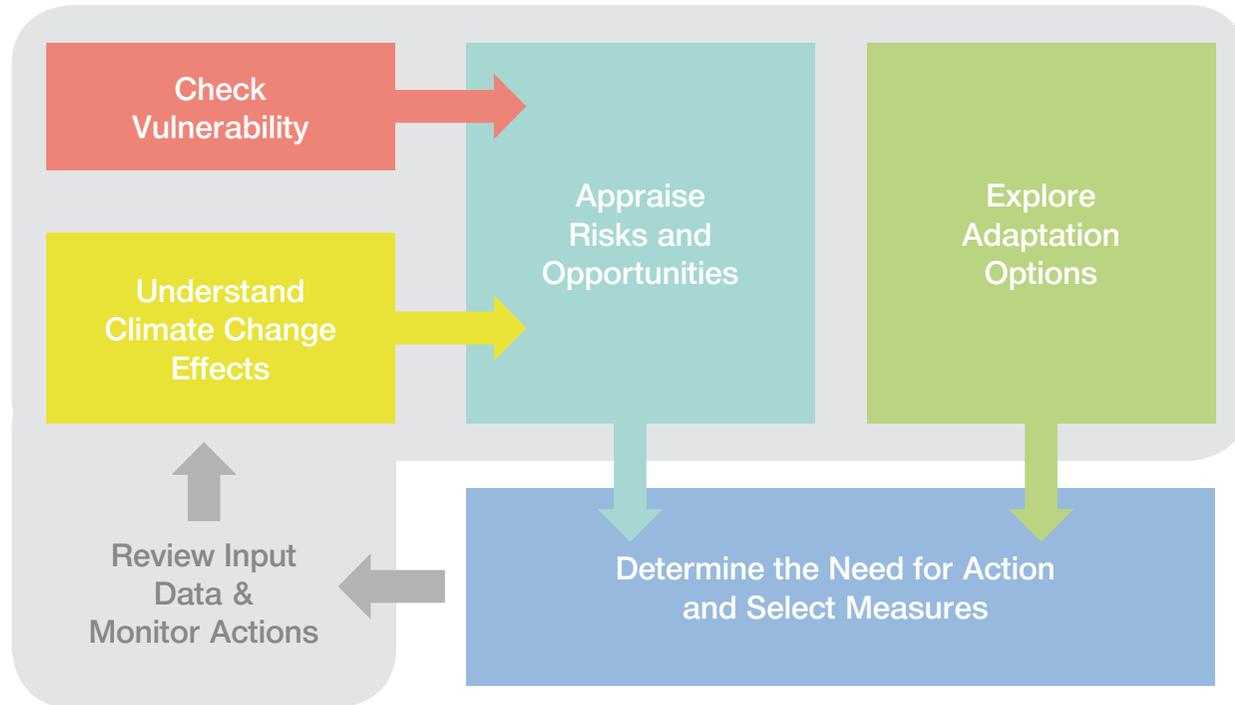
The Future Cities Adaptation Compass is a computer-aided guide built up of five modules to be used as a whole or part. The procedure as a whole is based on the risk management approach.

The tool provides general information and automated answers and also gives the user the opportunity to submit local information. E.g., the guidance explains why automated answers are given and how they can be altered to adapt the Compass to the individual needs. The results of each step and of the complete cycle are documented and can be stored and printed for further use.

“Check Vulnerability” and “Explore Adaptation Options” are the main focus based on the practical experiences and evaluation of measures from the Future Cities partnership. For the other modules, instructions for action and background information will be provided.

The first version of the Compass was tested by the Future Cities project partners who come from cities, water boards and regional associations in Belgium, Germany, France, the Netherlands and the UK. In this way it is ensured that the tool will be a practical help and easy to use. It will be further developed and will be available by the end of 2012.

The Future Cities Adaptation Compass is structured in five modules:



- CHECK VULNERABILITY for a city region or parts of a city provides the basis to determine the current vulnerability.
- UNDERSTAND CLIMATE CHANGE EFFECTS – here the Compass informs how to get the necessary information. Advice is given on how to cope with the uncertainties involved in climate projections and related effects.
- For the APPRAISAL OF RISKS AND OPPORTUNITIES a method is proposed which uses the results from the vulnerability check and the projected climate change trends.

- The module EXPLORE ADAPTATION OPTIONS facilitates exploring the various adaptation options: especially the combination of different measures for improved efficiency and effectiveness. Possible links to mitigation measures are given.
- Last but not least, the NEED FOR ACTION can be determined. The core problems and problem areas are identified and suitable adaptation measures can be found.

The user can save the results and can REVIEW later whether parameters and collected information are still correct. Additionally, examples for MONITORING the results of measures are provided.





CHECK VULNERABILITY

The development of a city or region is subject to many uncertainties, e.g. changes in the demographic situation. The climate projections add more uncertainties. Therefore, the Future Cities vulnerability check starts by determining the current vulnerability.

With the Adaptation Compass, the local physical features and socio-economic conditions – called receptors – can be checked for their vulnerability related to weather events. The list of receptors is based on the experiences of the Future Cities organisations and provides a comprehensive check list for the urban environment. For customised use, the user can select the receptors of individual interest and describe the spatial relevance of the receptors for the area in question. For this, practical indicators are proposed.

Furthermore, the user can submit individual information regarding former events, e.g. heavy precipitation or heat waves, what impacts they imposed on the different receptors and which actions were taken, e.g. in the infrastructure system or in organisational procedures.

As the overall result for the different receptors, the current vulnerability is summarised as – low, medium, high – as a basis for the module “Appraise Risks and Opportunities”.

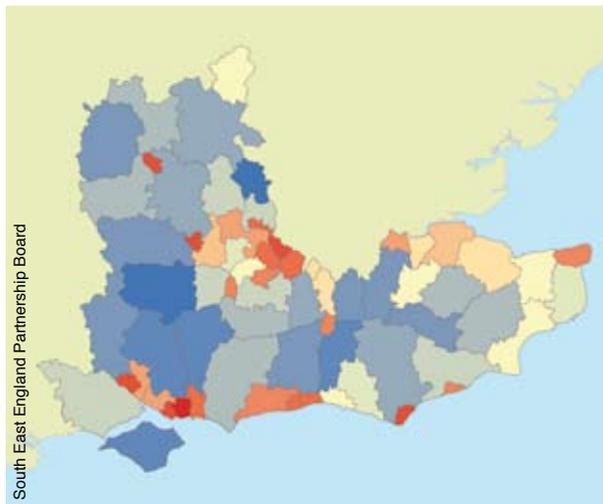
List of topics and urban receptors

- Population e.g. public health, vulnerable groups
- Built environment e.g. existing building stock, construction material, urban (green) spaces
- Infrastructure e.g. transport, water and sanitation services, electricity and heating services, communication services, waste water management
- Economy e.g. industry, retail, tourism
- Natural resources e.g. water resources and water quality, air quality, agriculture, forestry, biodiversity
- Administration e.g. preparedness, public budget

Spotlight: The Regional Vulnerability Assessment in South East England

In the South East of England, the Partnership Board, a partnership between the South East's local authorities and the regional economic development agency, undertook a regional vulnerability assessment. Different sectors were explored, e.g. population and health, water resources and the economic development. The Board decided to first look at the current vulnerability: What consequences are currently experienced as a result of flooding and erosion?

The regional vulnerability assessment has focussed on identifying areas at greatest risk or "vulnerability hot spots". These were identified by overlaying maps with the geographical information available at the regional planning association. Starting from the current vulnerability, the experiences made with the receptors were integrated into the Future Cities Adaptation Compass.



Analysis map of density of households in the South East of England (Red zones: high density; Blue zones: lower density)

Spotlight: The Local Vulnerability Check in Hastings

The Future Cities partner, Hastings Borough Council, explored its local vulnerability by conducting a Local Climate Impacts Profile. This is a procedure introduced in the UK by the UK Climate Impacts Programme to explore the consequences of extreme weather events.

In Hastings, a town on the South East England coast, weather events reported in the news during the past 10 years were connected to the impacts they caused on the municipal services and communities. For the past 10 years, 20 events of flooding, 14 events of drought and each 7 events of heat waves and high winds were noted.

Heat waves had positive and negative consequences. More tourists came to visit Hastings because the sea and wind lowers the temperatures. Negative was the increase of complaints due to more noise in the streets during warmer nights. The process also raised awareness among the various departments of the administration as they were requested to gather the necessary information.



Heat waves also create opportunities: Hastings beach tourists



DU Holubowicz Fuga Ltd

The Future Cities Adaptation Compass provides a similar approach to explore the current vulnerability by checking former events. Following the vulnerability check Hastings Borough Council will be developing a town-wide climate change adaptation 'plus' plan, drawing on regional and local climate impacts data of the UK Climate Projections 2009 with actions spread across a range of partners.

Spotlight: Assessing the urban climate of the city of Arnhem

The Dutch city of Arnhem focuses on the urban vulnerability due to heat and the urban heat island effect: The average temperature in a city is higher than in the surrounding area.

Different types of instruments are used. The Urban Climate Analysis Map, also called Heat Map, shows areas at most risk for heat storage and possibilities to ventilate and cool the city based on five factors: topography, land use, urban morphology, material use and colour, and wind paths. Additionally, in August 2009 after a series of hot days the temperature on the ground was measured with special bicycles. Late in the evening a maximum temperature difference of 7 °C was measured between stony and green areas in the city. These results validate the theoretical results of the Heat Map. In the same period, an aeroplane at 4000 metre altitude took pictures with a heat sensitive camera for a so-called heat scan. Analysing the Heat Map and the heat scan leads to interesting conclusions: E.g. the heat scan shows that the football stadium "Gelredome", a stony area, radiates in the evening a lot of heat which was absorbed during the day. The Heat Map concludes that the open area around the stadium prevents the area as a whole from heating up because it is well ventilated.



The Arnhem Heat Map: Existing geographical and meteorological data were combined with knowledge and experience from Germany (University of Kassel) and China (Chinese University of Hong Kong). Green zones: fresh and cool air producing areas; Red zones: sensitive areas for heat accumulation of a part of the Arnhem Nijmegen City Region.



Analysing the city climate with special bicycles and the heat scan in parts of the City Region Arnhem Nijmegen.

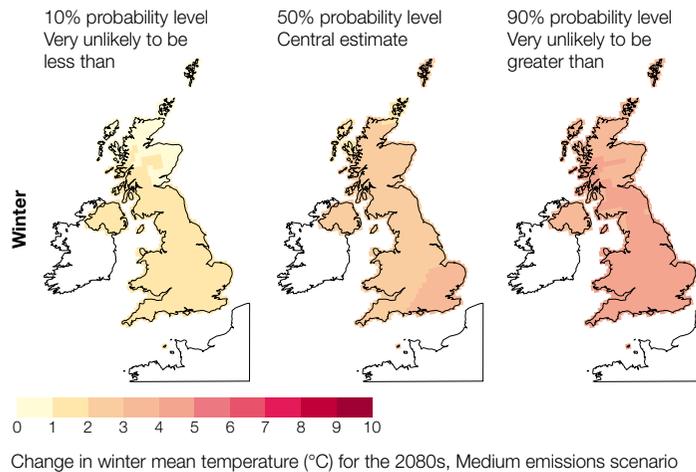
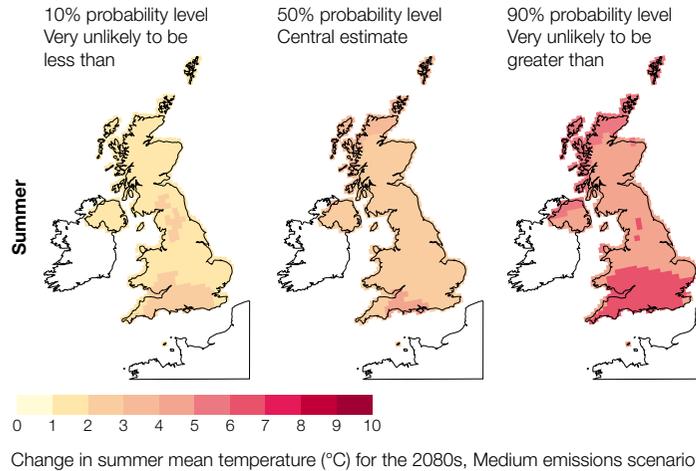
UNDERSTAND CLIMATE CHANGE EFFECTS

Detailed research is being undertaken to determine the impacts of climate change. Nevertheless, models involve many assumptions about how the parameters will develop and interact. Almost every country is working on its own regional climate projection model derived from different global climate models. For some regions, various regional climate models are being used providing varying results. For a planner in the city the Adaptation Compass will supply practical information to guide the user through questions such as:

What do I need to know? What kind of information do I need? Where can I get information? How can I handle uncertainties?

A basic catalogue of direct and indirect impacts of changes in climate variables for different sectors of special interest for the urban structures provides the necessary background information.

For the regions of the Future Cities partners, trends for climate variables are provided, e.g. increase of heat days and increase of temperature during summer. Many projected trends have a reinforcing effect on the current situation such as more extreme rainfall might lead to increased storm water flooding events. Some are probably indifferent or might have even a balancing effect, e.g. milder winter temperatures mean less energy needed for heating leading to less greenhouse gas emission.



Climate projections for the UK 2009: projected temperature rise





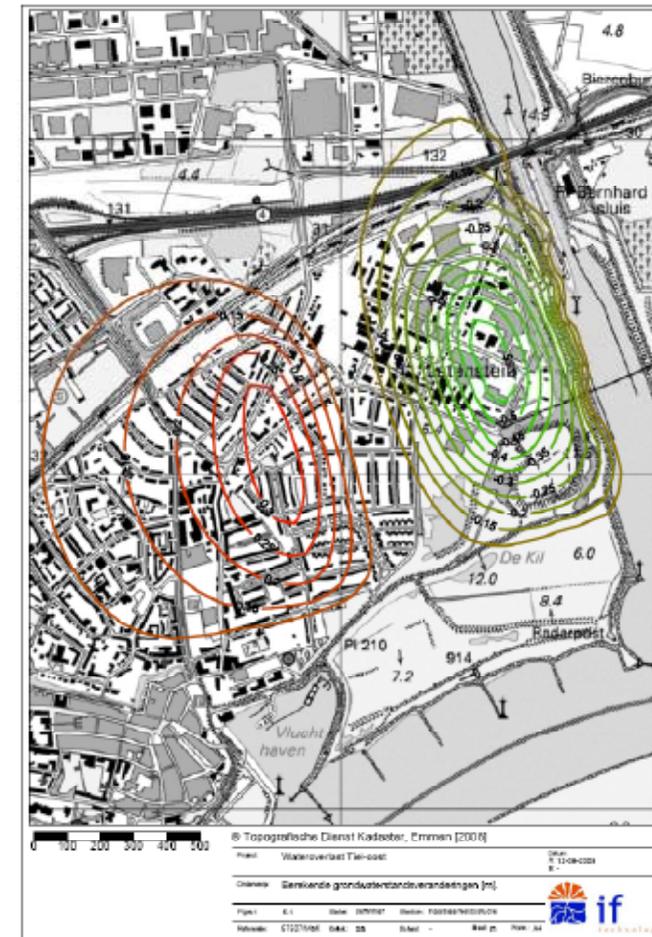
APPRAISE RISKS AND OPPORTUNITIES

A changing climate introduces risks but also offers some positive opportunities. Their appraisal is based on the results of the vulnerability check and the projected climate change trends. An evaluation matrix is proposed that can be used to classify risks and identify opportunities.

The risks are evaluated for each receptor and the corresponding weather sensitivity. Depending on the climate variable, it is necessary to distinguish between summer and winter.

Spotlight: Risks and opportunities in Tiel East

In the Dutch city of Tiel, local groundwater problems also create opportunities: By positioning sources and sinks for cold and heat storage in a smart way, local groundwater levels can be lowered in specific problem areas. This mechanism can also be used to tackle groundwater pollution. A business plan will give more insight into the cost efficiency of this combination of water and energy aspects. If possible, the system will be combined with residual heat from nearby factories. That way, climate adaptation will also serve economic and social purposes.



de Kort, A., Tiel

Opportunity for Tiel East: Usually, groundwater for cold and heat storage is pumped up and infiltrated in the same area. In Tiel East the groundwater levels are too high in some areas and comparatively low in others. By pumping up groundwater for cold and heat storage in the area where groundwater levels are too high (green lines) and infiltrating it in an area where the groundwater level is low (red lines), the groundwater levels can be counterbalanced.



EXPLORE ADAPTATION OPTIONS

The catalogue of adaptation options comprises structural measures in the categories green structures, water systems, energy efficiency, urban structure as well as awareness raising and educational measures. The presentation of adaptation measures focuses especially on their synergy effects related to climate protection and effects related to other aims which are on the agenda of cities, like coping with demographic change or regenerating industrial areas. These additional aspects of an adaptation measure facilitate actual implementation.

A database of adaptation options as well as combination possibilities of these are given and evaluated: What types of adaptation measures exist? Which combinations with other measures are possible and efficient? On each type of measure general information is provided, e.g. within the category “green structures” the types “green roofs”, “green walls” and “green open spaces” (e.g. court yards, alongside water bodies) are chosen.

Fact sheets inform about the Future Cities measures. They document the technical description and practical experience of Future Cities pilot projects and lessons learned: e.g. type and spatial characteristics of the measure – such as scale (region, town, quarter etc.) and use (city centre, business, residential), the adaptation problems which can be addressed with the measure and the synergies and conflicts encountered with other adaptation and mitigation measures or other sustainability aims.

Some exemplary measures which are implemented and evaluated in the partnership are described in the spotlights presenting interim results.

Spotlight: Vertical green in Nijmegen

Even though there are two parks in the centre of the Dutch city of Nijmegen, both citizens and entrepreneurs want more green in the city centre. For this reason in 2007 the city of Nijmegen developed an inspirational book with all kinds of ideas on how to make the city centre greener. One of the possibilities is vertical green. A green wall has been placed on the outside of an elevator shaft of a Nijmegen public building. First it was necessary to calculate the weight that this shaft can hold. A suitable construction for the green wall was found: containers from which the plants will grow supported by various rails. A system to provide water and nutrition for the plants is also installed.



An elevator shaft is an outstanding building element to demonstrate green walls in Nijmegen city centre.





After designing and clarifying the construction details the next step was to obtain planning permission. The experiences made with this first vertical green project in Nijmegen will be evaluated and will be the basis for future green walls. There are more walls in Nijmegen that can become green and contribute to improving the urban climate in city centre.

Spotlight: Adaptive measure in the water system – Heerener Mühlbach in Kamen

The German water board Lippeverband is creating a green-blue corridor in the city of Kamen to improve the city microclimate. In combination with the ecological enhancement of the water body “Heerener Mühlbach”, storm water from private properties will be disconnected from the sewer system to reduce potential sewer overflow in case of heavy rainfall. In addition, the tendency of the water body to dry out in summer is also reduced: With the use of rain water for the open water body the water cycle will remain sound even in dry periods.

In cooperation with the Lippeverband, the owners of properties alongside the Heerener Mühlbach can carry out the disconnection, e.g. retain and infiltrate the rain water coming from the roofs on their grounds. With this project the owners get an idea about individual possibilities to contribute to a better ‘city climate’ and to face climate change beyond well known mitigation measures. These activities are followed by the planning and the construction work for the ecological enhancement of the stream in 2011 and 2012 to complete the green-blue climate corridor.

Spotlight: Cooperation with multipliers – to spread the message in West Flanders

The West-Vlaamse Intercommunale (wvi), a regional planning and development association together with the city of Ieper organised a number of awareness raising actions for different target groups. The emphasis was on so-called multipliers who are likely to spread the message further and integrate it in their daily work and decisions.

Local politicians and civil servants visited Eva Lanxmeer (Culemborg, The Netherlands), a showcase of a new sustainable city quarter. Ideas were gathered for “The Flow” project in Ieper and it was shown that integrated sustainable development (people – planet – profit – process) is feasible without extra costs if well planned from the beginning of the process.

A regional guideline for new and regeneration housing projects in West Flanders addresses the municipalities of the region. The



Local politicians and civil servants from West Flanders in Belgium learn from the Dutch showcase.

guideline gives an overview of possible measures, from a basic to plus level, from which a municipality can choose according to its own ambition. The issues addressed are ecological, social and economic sustainability as well as process guidance.

Wvi cooperated with educational institutes for vocational training in leper by asking them to provide scale models of good insulation techniques for the houses and a plan for the sustainable lighting of the public realm. Through this cooperation, the institutes considered sustainable building and lighting models that until now have not been given enough attention in the training plans.

Spotlight: Awareness raising among stakeholders: guideline for the water board Emschergenossenschaft

The catchment area of the German river Emscher is one of the most densely populated regions throughout Europe: The water board Emschergenossenschaft has a responsibility for more than 2 million people regarding water and river basin management. Adapting to the effects of climate change is an important topic and the Emschergenossenschaft has to answer crucial questions: How is the Emscher catchment affected by climate change? Which of the present activities of a water board help to adapt to the local effects of climate change? The “Guideline Climate Change” gives answers. The document is a guideline for their own staff to understand the complexities of climate change, water cycle and the water board’s activities. Recommendations for planning new projects, maintaining the water cycle and running the operating facilities are given. The guideline is an awareness rising tool for regional stakeholders, but also an internal awareness raising tool for the staff of the Emschergenossenschaft, who are invited to develop own ideas for adaptation options.



The “mactable” – a planning tool to visualize spatial development helps to raise awareness among the involved local and regional stakeholders.





DETERMINE THE NEED FOR ACTION AND SELECT MEASURES

This module represents the linkage between the catalogue of adaptation options, the problems they address and the need for action which was identified.

The previous information and assessment steps made in the modules are taken into account resulting in a list of core problems and problem areas which are matched with suitable adaptation measures. Additionally, information is provided on how these areas can be identified.

To determine the core problems and problem areas, the appraised risks and opportunities are ranked and “hot spots” are identified: The result is a list of core problems which are to be addressed by adap-

tation measures, e.g. urban structures which are likely to heat up too much in an area where many older people live.

In the list of adaptation measures, suitable actions and combinations of measures are given which will help mitigate the core problems.

Spotlight: Developing Urban Climate Recommendations in Arnhem

Mapping the city climate of Arnhem related to overheating is one step, determining the consequences of this diagnosis is the second step needed. For this the city of Arnhem looks into the characteristics or

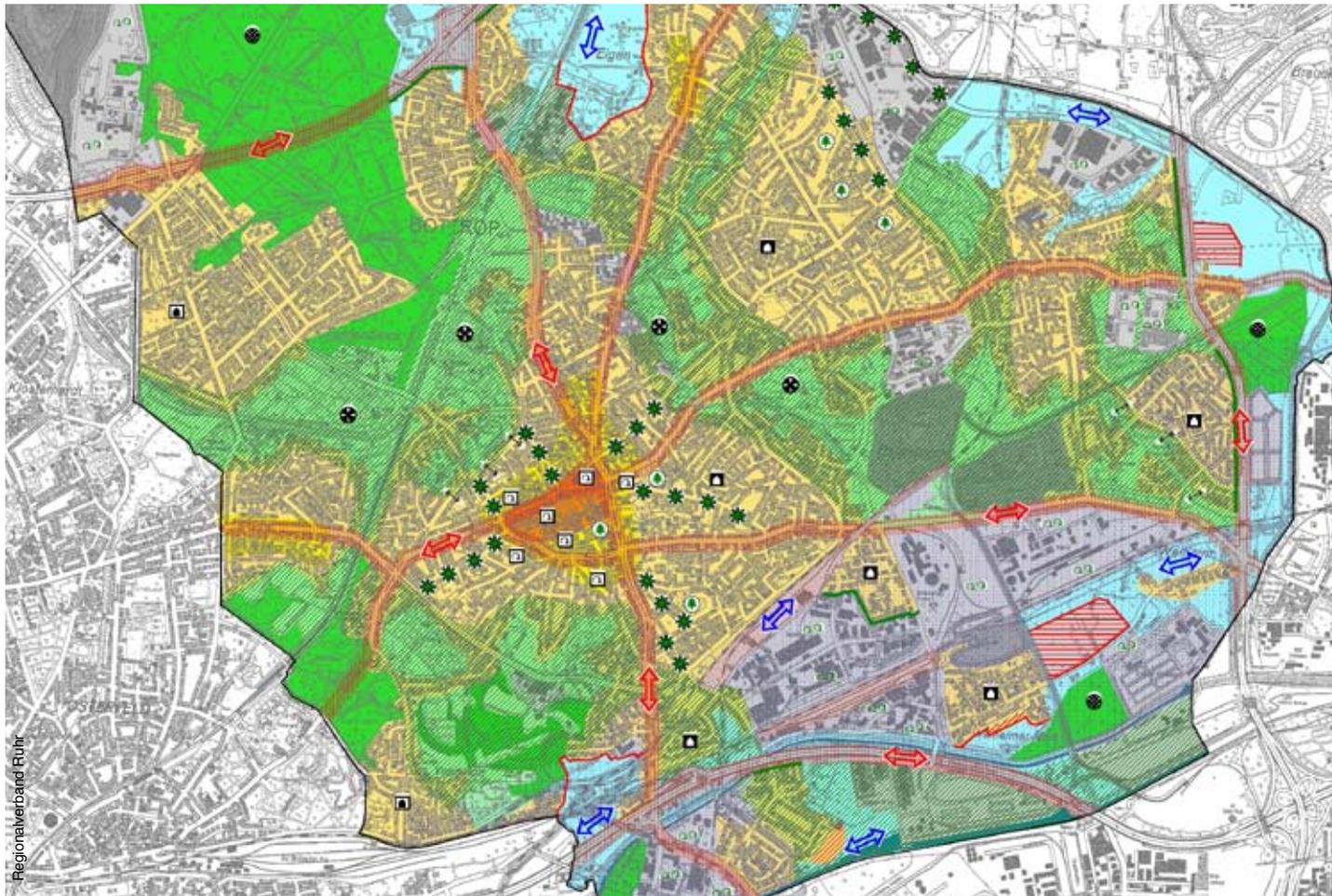


In the Southern part of Arnhem the shopping centre Kronenburg and the surrounding residential neighbourhood are a “climatic hot spot”: Long buildings block ventilation, parking without shading, lack of green space in residential area, high roof temperatures on shopping centre in summer.

SELECT MEASURES

land use of each 'heated up' area to determine whether it may lead only to uncomfortable situations or to serious health risks for certain social groups. The aim is to determine the urgency to act. This will lead to a series of actions, such as highlighting areas that should be

adapted to prevent serious health risks for its users and inhabitants, or building restrictions in areas to prevent building schemes that block cooling winds. Further actions comprise adaptive measures to improve the human comfort situation.



Example urban climate recommendation map of Bottrop, Germany; Recommendations are given for the protection of compensation areas and airflow corridors – e.g. further buildings prohibited and building restrictions – and for the improvement of climatic conditions: e.g. development and extensions of green areas (streets, walls, roofs, courtyards).



TRANSNATIONAL PARTNERSHIP IMPROVES RESULTS

The Future Cities Twinning Approach – practical experiences cross borders

In the Future Cities twinning sessions staff of Future Cities partners are discussing their measures and further developing their plans. In Brugge (Belgium) the sustainability aspects of the masterplan for the city quarter “The Flow” in Ieper were discussed and reviewed with the help of the international experts from the German water board Emschergenossenschaft, the city of Bottrop, and the Dutch city of Tiel. The outcome of this twinning was a valuable consideration for the preparatory studies on water and energy for the site.



The Future Cities partner discuss jointly to improve their plans and measures.

Another example is the joint support thanks to the twinning approach which the Dutch city of Arnhem and the English town of Hastings gave to the Belgium project partner to define the details for an energy study for the Ieper quarter. Arnhem already has developed an energy survey. The energy study shows that cooling concepts which keep the heat from the environment are available and should be preferred. An energy map shows where energy (gas, electricity and heating) is consumed and where sustainable energy potentials are located like wind, heat/cold-storage, solar power and so on. In a second step, Arnhem is looking for solutions to connect consumers and sustainable resources.



The masterplan for cold-heat-storage – light blue zones for cold and light red zones for heat storage – for the inner city of Arnhem shall allow to make best use of the available capacity.

Conferences and workshops to raise local interest

The projects are presented to the local and regional stakeholders in international conferences and workshops in all participating countries. In Dortmund (Germany), Rouen (France), Hastings (UK) and Tiel (The Netherlands) much interest was raised with the local

stakeholders for the topics of their local project. In Hastings, a regional seminar addressed the local and regional building professionals presenting and discussing the experiences from Rouen Seine Aménagement and wvi.



The Future Cities partnership has become a close cooperation in the light of mutual trust and openness from the start on. The individual expertise of all involved partners is used to closely exchange know-how and discuss occurring problems as well as joint solutions. In September 2009 the partnership visited the investment project of the UK partner in Hastings, South East England, during a working group meeting. Following that, a regional seminar about climate change organised by the UK project partners was widened up with the involvement of the European partners to make best use of the available transnational expertise.

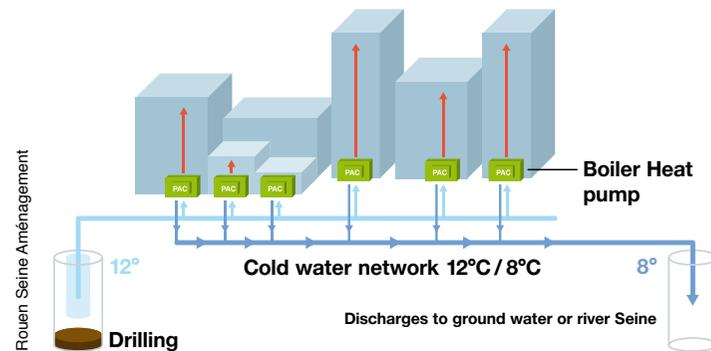


MORE ABOUT PARTNER PROJECTS – NEW VISIONS AND IDEAS

Spotlight: Renewable energy for reconstruction in Rouen

The potential for renewable energy was explored for the reconstruction site Luciline in the French city of Rouen. Using geothermal energy proved to be the favourable choice. A historical and documentary study confirmed the existence of two potentially exploitable groundwater aquifers. Other renewable energy sources had disadvantages: Biomass proved to involve too many implementation constraints and the site was less favourable for using wind power. The solar potential was estimated to supply half of the energy needed which calls for additional sources.

The projected energy needs are based on the development of low consumption buildings of residential (consumption of housing will be



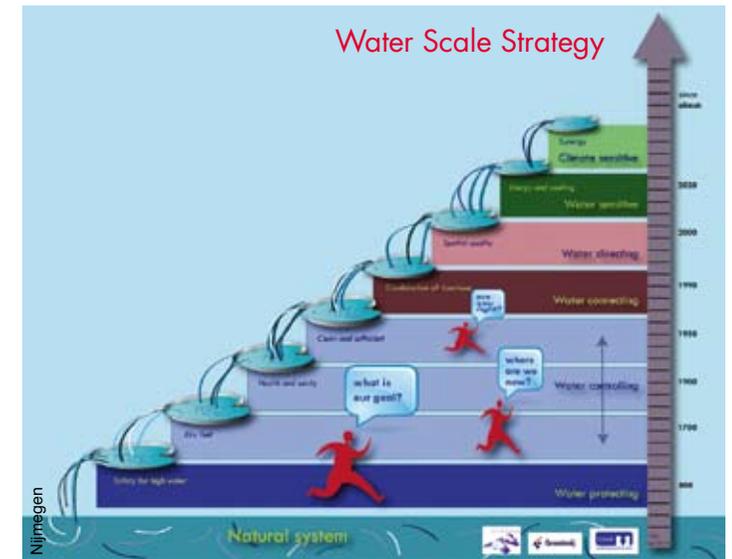
The planned system for the Luciline area: hot water network with boiler heat pumps at buildings

less than 65 kWh primary energy/m²) and office buildings for heating, ventilation, hot water and lighting. For the hot water production different combinations of solutions, including traditional solutions, are studied and evaluated concerning the CO₂ emission.

A geothermal water network combined with boiler heat pumps in buildings appears to be the best choice.

Spotlight: Watervision Nijmegen

Nijmegen has developed together with the Water board a Water Vision with guiding models and maps which show the water history of Nijmegen. Innovative is our new long term strategy on integrated water development. The basis of this strategy is that a higher level will be only achieved when first all lower levels have been realised. This way of combining water management and spatial planning elements has not been done before in The Netherlands. The goal in the future is to become a water sensitive city or go even a step further



The long term strategy of Nijmegen shall lead to a climate sensitive city.



The "water game" comprises the real data of Tiel East.

to succeed in becoming a climate sensitive city. For that high goal, all different departments in the municipality have to work together.

Spotlight: A game for a serious issue

In Tiel, an awareness raising measure has played an important role in bringing stakeholders together. By playing the so-called "water game" stakeholders like inhabitants and the water board switched roles and gained insight in each other's interests, thus improving the process. Now, the development of the integral water scenario for Tiel East has resulted in a water contract between the municipality of Tiel and Waterboard Rivierenland, comprising short and long term water measures. One of the possible long term measures to prevent flooding and fight seepage water is a climate dike: a very broad dike on which one can live, work and relax. As a short term measure a so called "water square" will be created to store water temporarily during heavy rainfall.

Spotlight: Training and trade for the climate in Hastings

In Hastings, in an educational measure a large terraced Victorian property was converted in an ecofriendly way. Schools, colleges and business can access a training DVD, leaflets and attend open days on the site. A thermal imaging camera is used by estates, surveying and housing teams across Hastings Council to measure heat distribution and loss in offices and homes. While applying this tool within the administration and outside, awareness is sharpened.



John Denham, Secretary of State for Communities, accompanied by Michael Foster MP and Carol Biggs, Deputy Director of Hastings Trust, visited Hastings on 25th March 2010. Trainees are learning about the benefits of increased fabric insulation, improved air tightness, controlled ventilation, efficient heating and hot water systems, efficient lighting and fittings, water saving devices and rainwater harvesting – and how these work in practice.

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