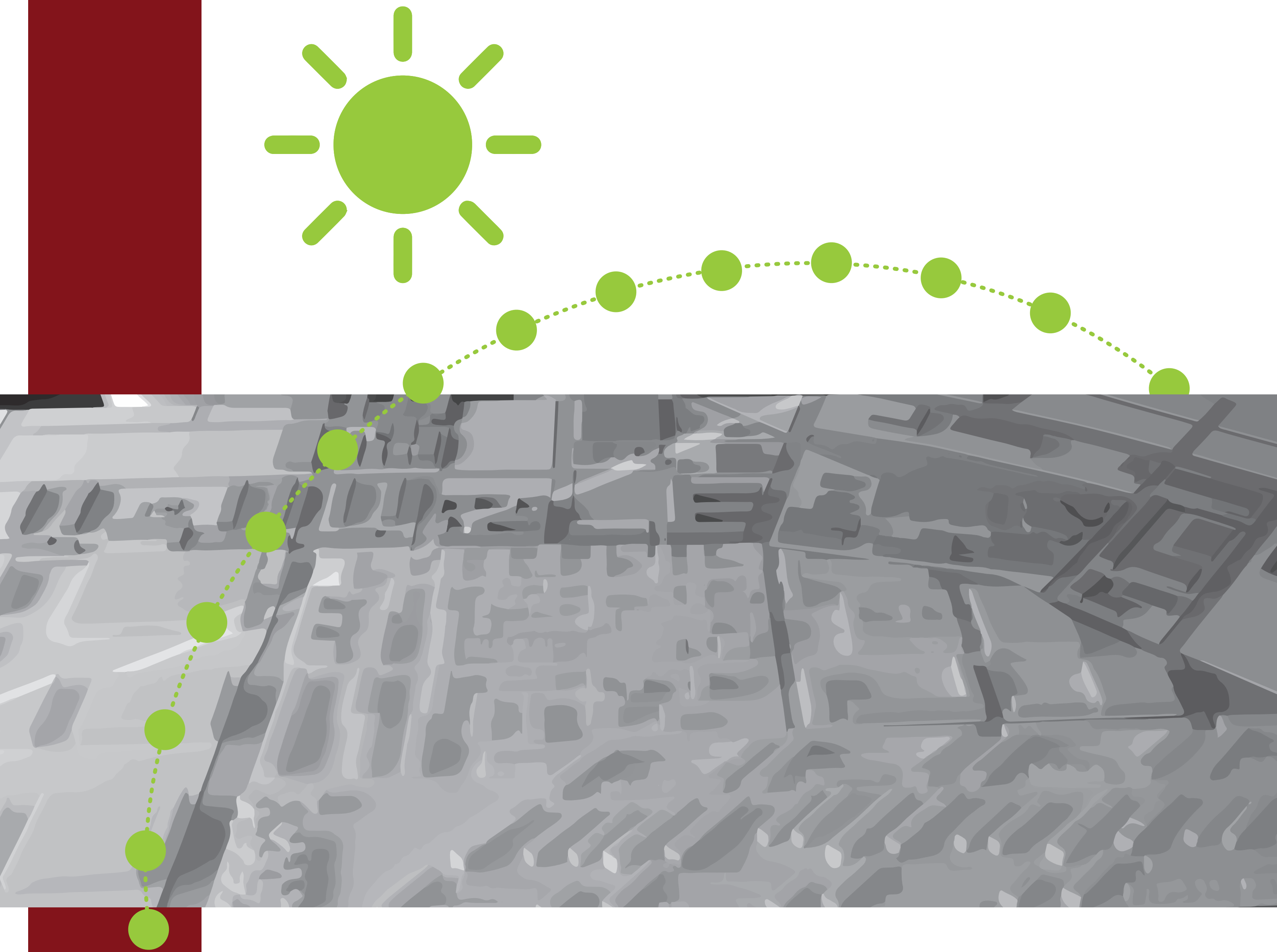

Summer Schools on Solar Energy in Urban Planning

Teaching Methodologies and Results

IEA SHC TASK 51 | SOLAR ENERGY IN URBAN PLANNING | HTTP://TASK51.IEA-SHC.ORG

IEA SHC Task 51 Solar Energy in Urban Planning

Task 51/Report D2

Summer Schools on Solar Energy in Urban Planning- Teaching Methodologies and Results

Berlin Adlershof- 19th until 26th of September 2016

Editors and Authors:
Tanja Siems (University of Wuppertal)
Katharina Simon (University of Wuppertal)

Contributor Section Tools "EnOB-Lernnetz" and "DECA":
Susanne Hendel (University of Wuppertal)

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Title Page: Katharina Simon, University of Wuppertal, Institute for urban design and urban research

Between City and Energy

Experimental Urban Research

The format of the summer schools manages to connect university teaching with current research and to bring students closer to the subject by means of real case studies. This was also the goal of the interdisciplinary summer school "City in Transformation“. The interdisciplinary EnEff:Stadt summer school, which took place in Berlin-Adlershof and at the University of Applied Sciences Berlin, had the focus on solar energy design and planning in the urban context .

The summer school “City in Transformation” took place between the 19th and the 26th of September 2016 within the framework of the IEA SHC Programme Task 51 “Solar Energy in Urban Planning” in Berlin-Adlershof sponsored by the Federal Ministry for Economic Affairs and Energy (BMWi) in Germany. The summer school aimed at looking beyond the boundaries of everyday teaching at universities and colleges. In a team of different and diverse disciplines, students were able to approach on different viewing points the specific topic of urban and energy design.

The planning and implementation of solar energy in the urban context is still a major challenge for planners. If the demand for a sustainable neighbourhood, as social, economic, ecological and energy requirements has to be met, then the complexity of the tasks ahead are huge and have to be solved. The summer school tried to illuminate these interfaces more precisely and to find appropriate answers for upcoming questions. Based on this, students from different disciplines should develop concrete strategies with a focus on the optimal use of solar potential for the development area in Berlin-Adlershof, which would then reveal new possibilities for the interface between urban development and energy efficiency and, at the same time, also fit into the existing overall concept.

In intensive group work, accompanied by lectures and on-site guided tours with local experts, four concepts for the site in Berlin-Adlershof were developed in inter-disciplinary teams by the students using the given different analogue and digital methods and tools. The concepts were generated and evaluated with software tools for analysing solar potentials. At the end these were presented as plans on Din A0 panels and in physical build models.

The event ended with a public presentation of the students work and their results discussion in an open panel including the international experts from the IEA SHC Task 51.

We would like to thank our sponsor, the Federal Ministry for Economic Affairs and Energy, as well as the EnEff:Stadt and EnOB research initiatives in Germany. We would also like to thank our cooperation partners Prof. Dr. Susanne Rexroth from the University of Applied Sciences Berlin, Dr. Gustav Hillmann and Margarethe Korolkow from the Institute for Building, Environmental and Solar Research in Berlin (IBUS), Susanne Hendel from the Bergische Universität Wuppertal as well as Anja Hanßke from the Technical University of Berlin for the support during the preparation and implementation of the summer school. We would also like to thank Dr. Beate Mekiffer from WISTA-MANAGEMENT GMBH for her participation in the concept development as well as for the organisation of the informative on-site visit, which took place together with Mr. Frank Lauterbach. We would like to thank Mrs. Beate Glumpf, Mr. Frank Wittwer and Mr. Simon Hamperl for the constructive guest criticism of the concept development.

This summer school is an applied example of a successful collaboration between teaching, research and practice.

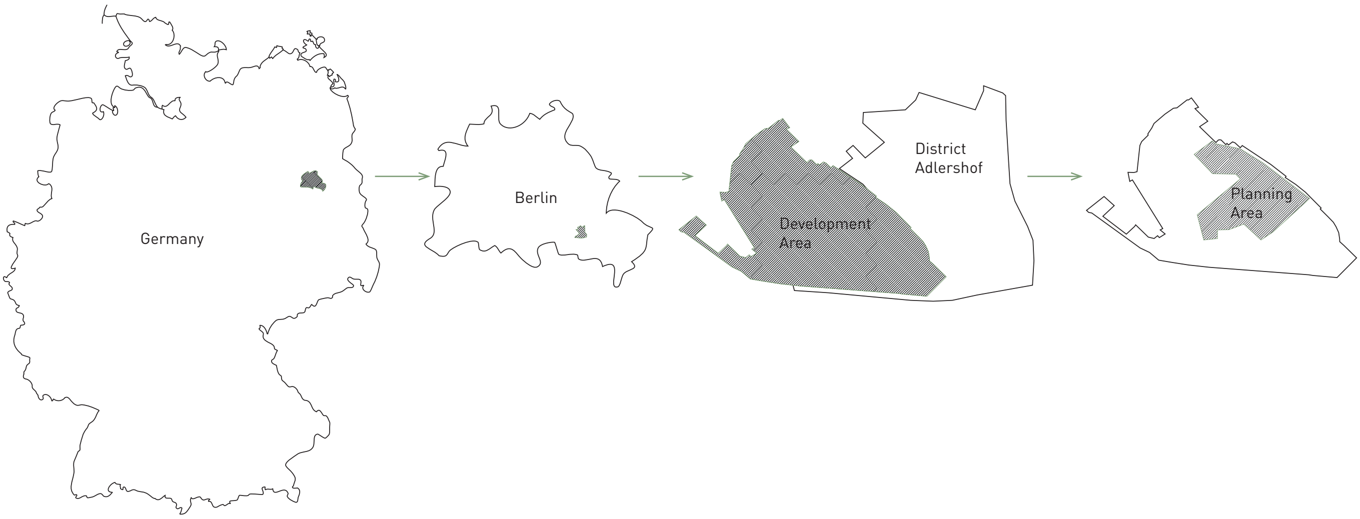
Tanja Siems and Katharina Simon

Wuppertal in January 2017

Content

3/3 Results

Location


Germany
Berlin
District
Adlershof
Development
Area
Planning
Area


Centre Adlershof
S
Technological Location and
Development Area

Berlin-Adlershof

A Technological Location

Half an hour by city railway to the South of today's centre of Berlin, the history of Adlershof began about 250 years ago as a farm. A location for science has been connected with the Adlershof quarter for over 100 years. Adlershof was the location of the first airfield for engine-propelled aviation from around 1910, and developed into a state-of-the-art technology and media location in Germany in 2012-despite the historical cuts which resulted with the division of Berlin. In 2013, the preparations began for the BMWi-funded research project "Energy Efficiency Berlin Adlershof 2020", in which Adlershof was created as a test ground for research into energy-efficient construction which it still is today. Numerous efficiency measures should initially be implemented at the site by 2016. They should be closely aligned with the "overall concept of energy efficiency" developed in the previous project phase.

Today's Adlershof still consists of the old town centre, where nearly 17,000 people live. Located east of the city railway between Köpenick and the Teltowkanal, the old city centre has been somewhat isolated from the new development area in Berlin Adlershof. Whereas in former times a strict separation of the two places could be recorded, a fusion of the original centre with the development area is today´s objective.

As the most famous technology centre in Germany, Adlershof has a total area of 4.2 km² and accommodates university and non-university research facilities as well as technology-oriented companies. Ten non-university research institutes, six institutes of the Humboldt-University Berlin and some 1,000 companies and institutions can be found in the technology park. This results in almost 16,000 employees and around 6,500 students who are present in the area every day.

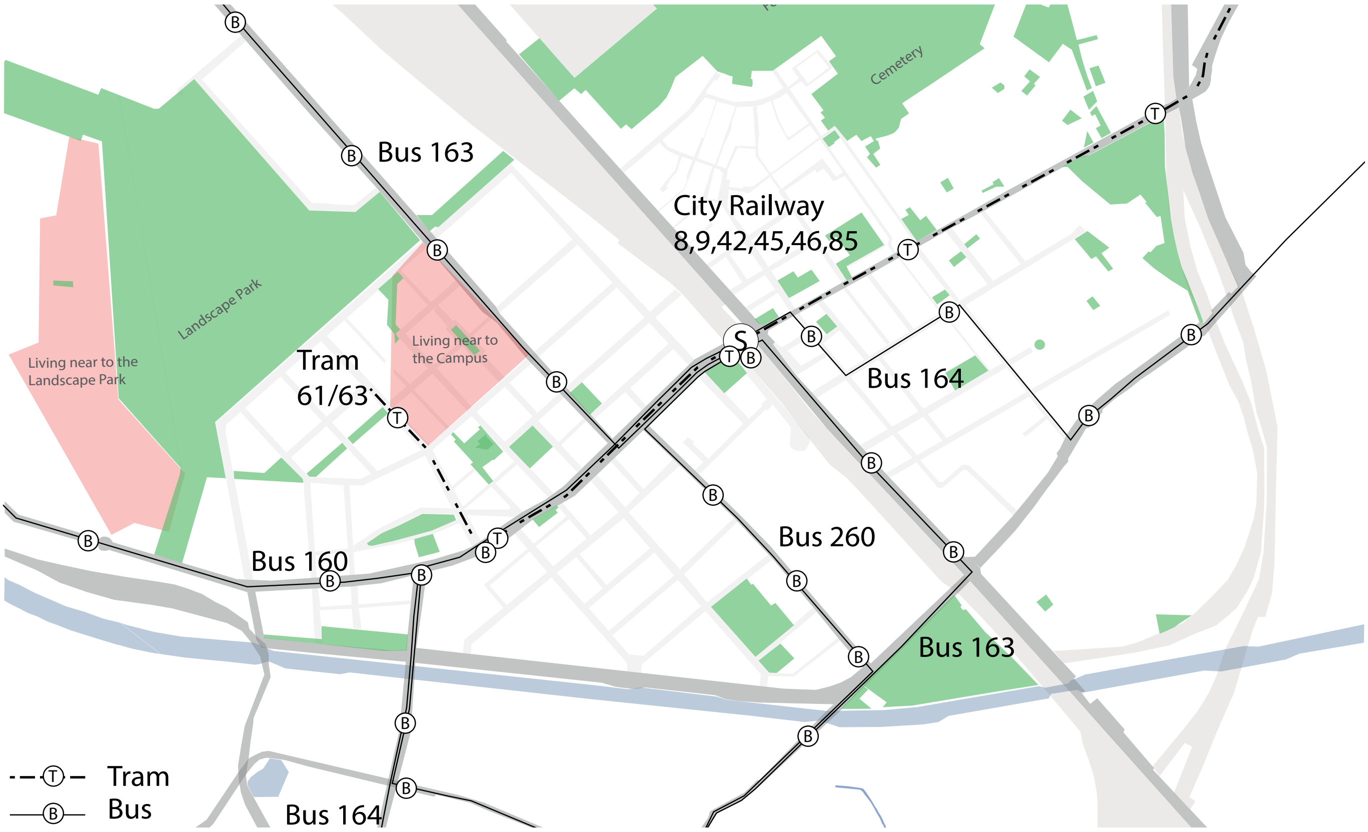
The focus of the companies is on the following areas:

- Photostatic and optics
- Photovoltaic and renewable energies
- Micro systems and materials
- Information technology (IT) and media
- Biotechnology and the environment
- Analytics

With the establishment of further residential uses, the expansion and further development of infrastructure facilities such as services, leisure facilities etc. over 360 commercial enterprises, shops, hotels and restaurants, as well as almost 400 homes, have now made Adlershof into an integral quarter. The development is still ongoing.

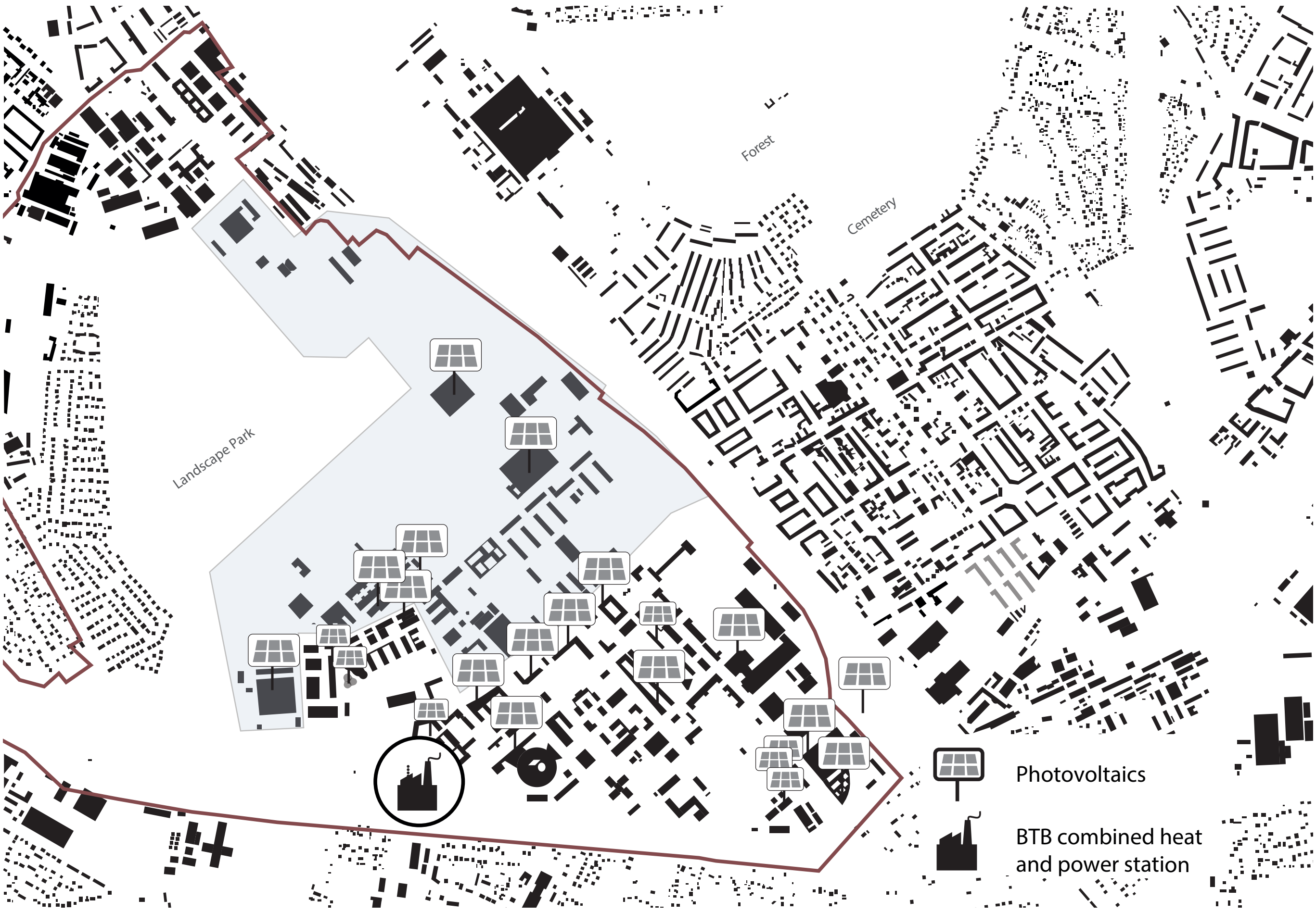
Living in the Neighbourhood

In addition to the location for numerous research and technology facilities, Adlershof is developing into a popular residential area. A wide range of different service industries have settled in the district. Social, cultural, gastronomic facilities supported by other local amenities, as well as sports facilities, can easily be reached on foot.



A District with Energy

The optimal energy infrastructure is the focus. The district is mainly supplied by BTB's combined heat and power plant via the district heating network. Numerous photovoltaic modules with different technologies are installed on various buildings, either on the roofs or in the façades.



City in Transformation

Solar Energy in the Urban Context

For the first time ever, the EnEff:Stadt (EnEff:City) summer school held in Berlin addressed the interface between a city and its energy. The Berlin Adlershof development area was considered from an urban planning perspective. The aim of this summer school was to develop an energy-efficient master plan that includes solar energy.

The 2016 summer school considered the Berlin Adlershof case study. The Adlershof development area offered students a variety of starting points to deal with issues relating to the relationships between urban planning processes and energy implementation strategies.

Different versions of urban development and energy proposals were prepared for the remaining Adlershof extension areas. These were intended to yield new ideas and impetus for the further development of this district.

The task of the summer school was to produce a master plan for the incomplete area of the Berlin Adlershof district within one week. The aim therefore was to develop an urban design that equally took account of high energy demands, yet conceptually resulted in a coherent overall concept.

The following milestones were compiled:

- Generate an urban development analysis of the Berlin Adlershof case study.
- Develop several urban development concepts in the form of a master plan. These are to include the development of usage proposals and urban typologies, and transport and technical infrastructure planning. The aim is to create a district with high quality architecture and energy provision.
- Evaluate the energy needs for the newly planned area; use the District Energy Concept Adviser (DECA) software tool; identify potential energy links to the current status like energy provision, networks, etc.
- Estimate solar potentials using the EnOB-Lernnetz as an e-learning platform.

The map on the right shows the entire Berlin Adlershof development area bordered in black. This needed to be considered and analysed to achieve a seamless transition between the existing and the new building structures. The area bordered in red indicates the area to be planned. Sections A1 to A8 were specifically to be developed.

New strategies and approaches for an urban master plan were generated on site in close interaction with the assembled team of interdisciplinary supervisors. This was part of the input presentations that accompanied the summer school. The existing city layers were initially investigated using urban analysis, with the aim of identifying the strengths and weaknesses of the district and to reveal potential.

The findings of this analysis provided the basis for design of the district, which had to answer questions on utilisation ratios, positioning and composition of different settlement typologies as well as infrastructure and energy development. Physical and software-based three-dimensional models illustrated various urban development options.

These options were determined using software tools that enabled examination of shading coefficients, identification of potential sources of solar radiation, development of an energy demand forecast and coverage of energy requirements for the newly created construction area.

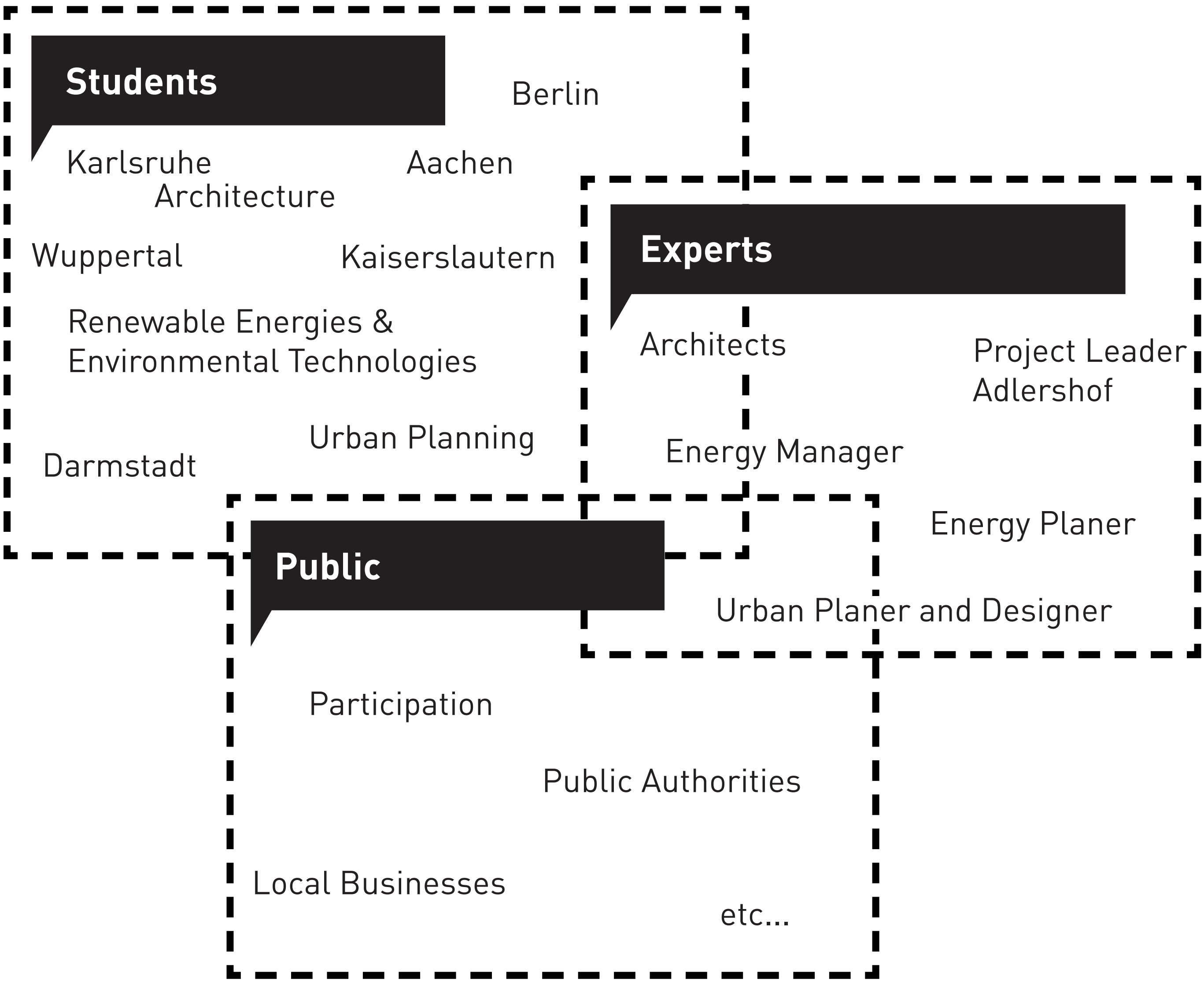
The results were presented and discussed in a final public presentation.


A8
A7
A6
A3
A2
A5
A1
A4

Interdisciplinary

Exchange of disciplines

Summer schools aim to expand the students field of vision. This includes the strengthening of cooperation with different disciplines in order to approach a complex task from different perspectives and with a focus on different aspects. This is the reason why collaboration with architects, urban planners and energy designers was important to fulfil the requirements of the task. The participation of the experts on the ground, as well as the exchange among each other, was a decisive step towards the master plan.



Interdisciplinary

Expectations

The expectations of the students regarding the summer school were similar. Some were looking forward to getting to know other students as well as working together, while others were looking for professional exchange with the other disciplines in order to get to know more methods and approaches to a specific task. One goal was however pursued by all students: They wanted to learn from each other and to develop the best possible strategy for the development area in Berlin Adlershof in their group.

"I´m looking forward to this summer school here in Berlin! Above all, because many master students are involved. I can still use a lot of tips and tricks as a bachelor candidate!"

MAYA F.

"I am really looking forward to working with the other participants! I expect exciting discussions and, above all, interesting research approaches."

YVES R.

"I think the cooperation with the technicians will be very interesting and we will all benefit from working together in the course of our studies! I hope so to expand and consolidate my basic knowledge. The most important thing for me is the exchange between each other and good group dynamics."

LISA B.

"A lot of creative heads, different thinking approaches and a super exciting and up-to-date topic! That is why I am here!"

MORITZ S.

"We as students of the HTW here in Berlin are looking forward to the working methods of architecture and urban development students! We hope to get a good insight through the cooperation. The interfaces of the cooperation will determine friction points, which then need to be solved as best as possible. I am very excited and hope for good cooperation."

PHILIPP T.

1/3 Methodology

Urban Research – Methodology and Format

Experimental Urban Research

Methodology and Format

One goal of the summer school was to support the planning and design process with different methods. Here typical methods such as site-visits were applied, but as well more complex methods such as the expert discussion were used. To determine solar potentials and to evaluate the neighborhood energetically the development process was supported with analogue and digital tools in the form of model building as well as software.

In order to get an overview of the area at the beginning of the summer school, students began an on-site visit through the district. They were accompanied by an expert group from the WISTA-MANAGEMENT GMBH. The experts gave detailed information about the city planning strategy and the energetically oriented projects in Berlin-Adlershof. After the three-hour tour, the students were able to obtain their own overview of the premises, so that they could directly commence with the analysis later on.

During the whole week, there were numerous input lectures and seminars from the scientific supervisors of the organising universities. The student´s results were presented in small groups and discussed with project participants as well as experts on a daily basis. The results were documented in plans, models and short film interviews to enable a future overall documentation of this interdisciplinary collaboration.

The interdisciplinary teams were assembled right at the beginning of the work process. . Students from the technical area of architecture and city planning from all over Germany were supported by students with an energy planning background.

The interdisciplinary groups started with a comprehensive analysis of the existing urban structure in order to examine the strengths and weaknesses of the area. Within this framework, the participants were able to identify the urban and energetic potentials so that they could develop a strategic plan. While the entire area of Adlershof was investigated during the analysis stage, the strategy plan was mainly confined to the construction sites A1 to A8 (refer to the map on page 11), although of course it has numerous effects on the entire district.

As a basis for the investigation, the group was provided with extensive data and planning documents for the area. In addition, a publication was prepared in advance as a reader, which summarised all necessary information about Adlershof and presented general planning advice.

The participants were able to concentrate directly on the analysis and develop several strategies and scenarios on this basis for the urban structure, typologies, as well as developing overall energetic concepts.

After the intensive analysis stage, work was then carried out with the help of styrodor models, which the students were able to make directly in the studio. Several strategies were developed on a daily basis and were then always intensified further. Not only the urban structures were investigated, the interdisciplinary teams were also able to immediately identify energy potentials and further refine them in optimisation processes.

Parallel to the design process with the physical models, several software solutions were used in addition. The solar potential of the respective urban development strategy was examined, and optimisation measures could be assumed in the model based on the results of the examination.

In essence, two software tools were used to investigate the energetic potential: Firstly, the District Energy Concept Adviser (DECA), and secondly the EnOB Learning Network. The detailed functions of these two programmes will be explained in a later chapter.

Methodology and Format

Planning Approach

METHOD

Intensive interdisciplinary supervision

Interdisciplinary team work

APPROACH - Urban Survey analysis

Deliberation of urban layers
Identification of strength and weaknesses and highlighting potentials

APPROACH - Evaluating the Analysis

Functions & urban typologies & , traffic and technical infrastructure

Distribution of usages, position and composition of different typologies of settlements as well as landscape and infrastructural development strategies

APPROACH - Concept development in variations

Urban and infrastructural concepts for the urban quarter to be developed on the basis of the evaluating analysis

APPROACH - Concept realisation

Development of the urban and infrastructural concept by Diagrams, sketches, collages, renderings development models.
The final results are presented in plans and models.

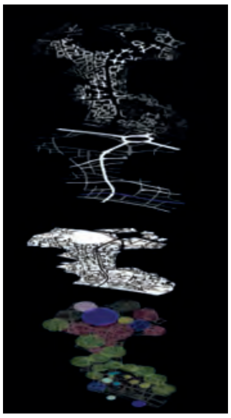
METHOD

Concept development with various Tools

TOOLS & METHOD POOL

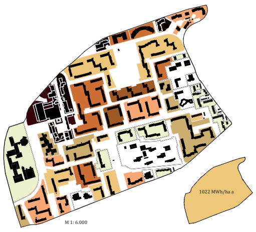
Aim of the approach

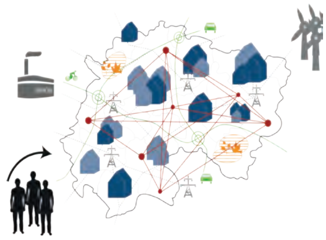
Development of urban strategies in plans and models



METHOD

Interdisciplinary input lectures





METHOD

Intensive supervision of tutors

METHOD

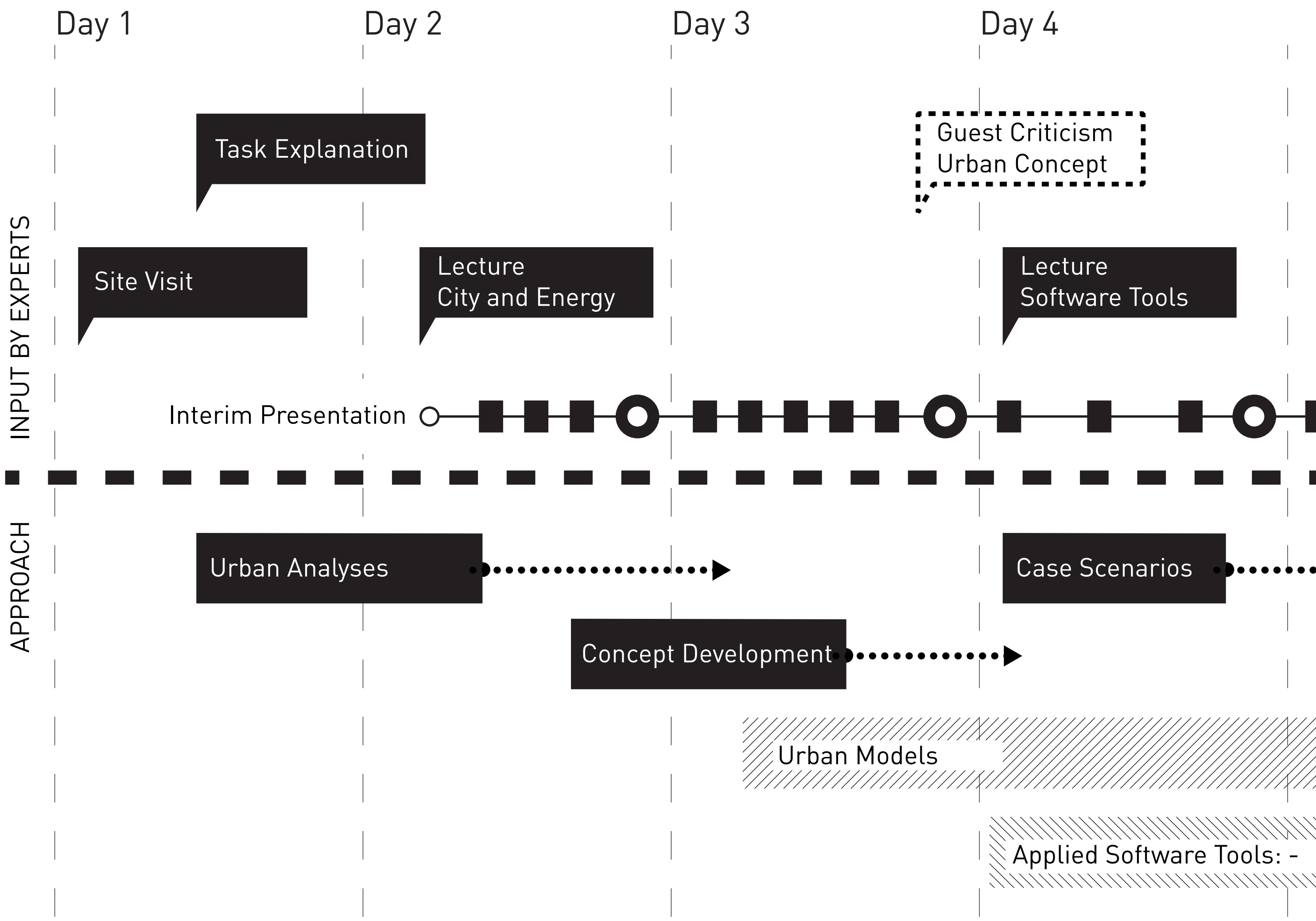
topic relevant presentations for peer learning

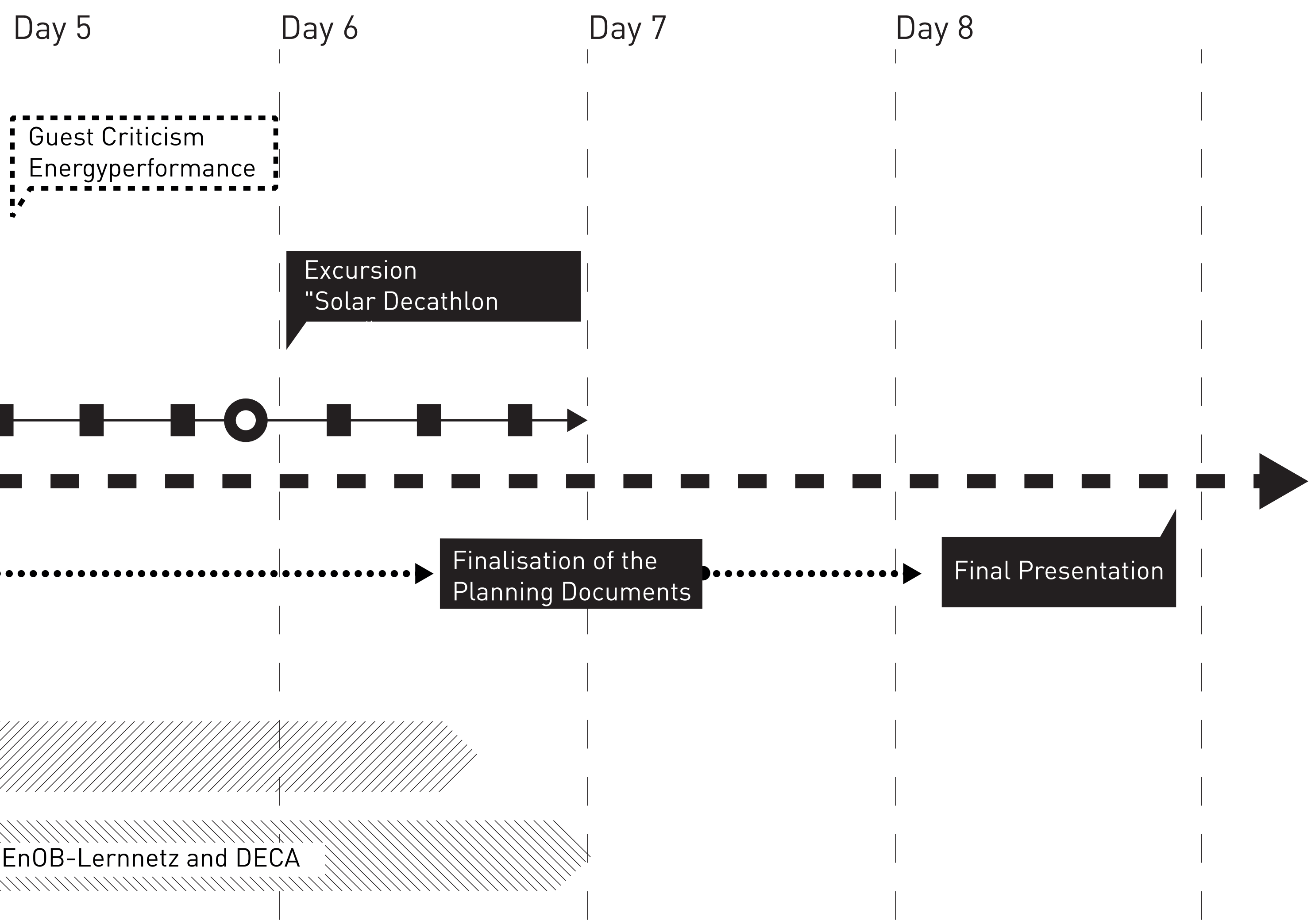
METHOD

In-between presentations with tutors and experts

Methods and Tools in chronological order

Timeline

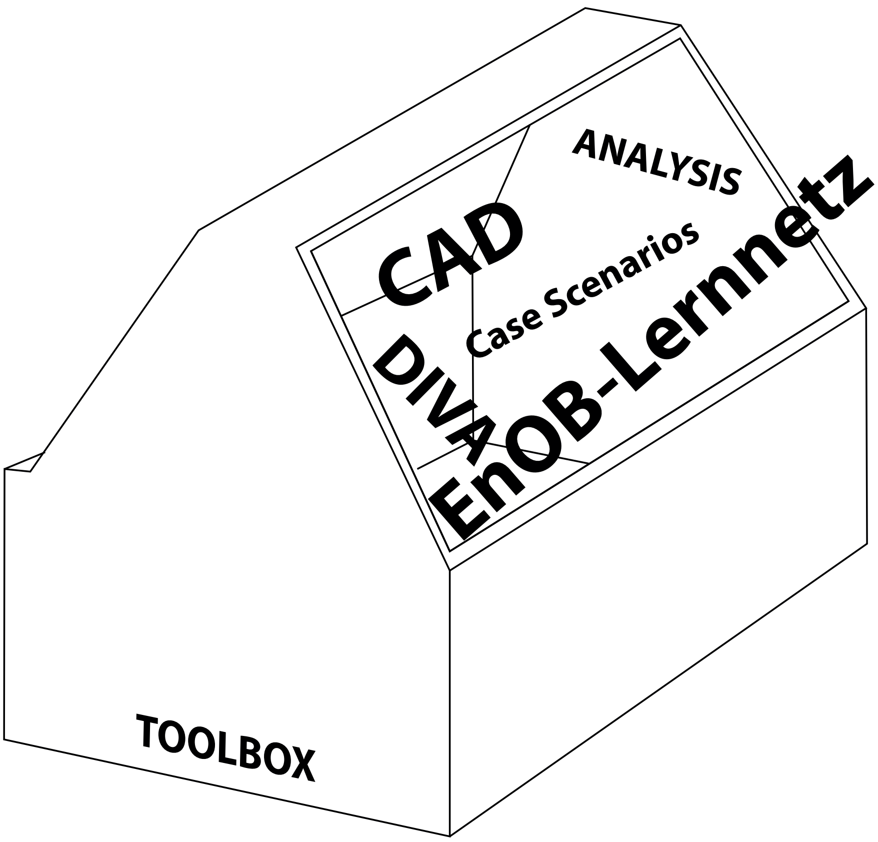



Day 5
Day 6
Day 7
Day 8
Guest Criticism
Energyperformance
Excursion
"Solar Decathlon
Finalisation of the
Planning Documents
Final Presentation
EnOB-Lernnetz and DECA

Methods and Tools

Toolbox

The planning and design process consists of several stages which correlate over time. In each of these stages, planners are required to make decisions that determine the subsequent process. In order to accompany this complex process, various supporting tools could be made available for the planners. Depending on the task position and stage, these tools vary. Furthermore, it has to be considered that many tools have been developed for certain professions and for this reason are only partially universally applicable. The situation was similar in relation to this summer school. The students from different core areas had to deal with the analogue and digital tools provided and apply them accordingly. This chapter explains the importance and the application field of the tools used during the summer school.



Site Visit

Methodology

Model Building and Visualisation

The first sketches and urban development concepts were then presented by students in 3D from working models. Every group began modelling at a different planning time. Some groups started with the construction of a city plan model parallel to the first design ideas, while other groups starting by sketching the first ideas on paper and began modelling at a later point in time.

The advantages of model building are obvious here. The extension of the two-dimensional drawing into a third dimension enables an improved assessment of the design variants. Building shapes, building heights, distance areas, density, etc. can be better assessed by the planners. Furthermore, the existing concepts can be quickly optimised by means of displacement, subsequent compaction, loosening, rotating etc. Spontaneous ideas can be visualised in 3D by using a model.







In addition to hand drawings, sketches and physical models, the visualisation in 2D and 3D CAD and graphic programs is very important tool for planners. Therefore different software programs can be used in order to generate a first idea and finalise this into the masterplan. The advantage of CAD programs and simulation tools in particularly is the interface connection and the real time visualisation. This creation of digital three-dimensional models allows during the design process as well the right estimation of energy performance and solar irradiation. The use of the software tools depends highly on the various discipline and varies on top to the preferences of the users.

Tool

EnOB-Lernnetz

EnOB Lernnetz is designed as a Java based multi-platform network with integrated simulation tools for sharing and exercising study contents.

Since 2007 the development of the EnOB Lernnetz is funded by EnOB, a research initiative for Energy Optimized Building, which is supported by the Federal Ministry for Economic Affairs and Energy. The EnOB - enob.info - research is based on buildings with a low primary energy demand and a high user comfort as well as low investment and operating costs. Lernnetz opens the possibility to use the EnOB findings in the area of teaching and student project work.

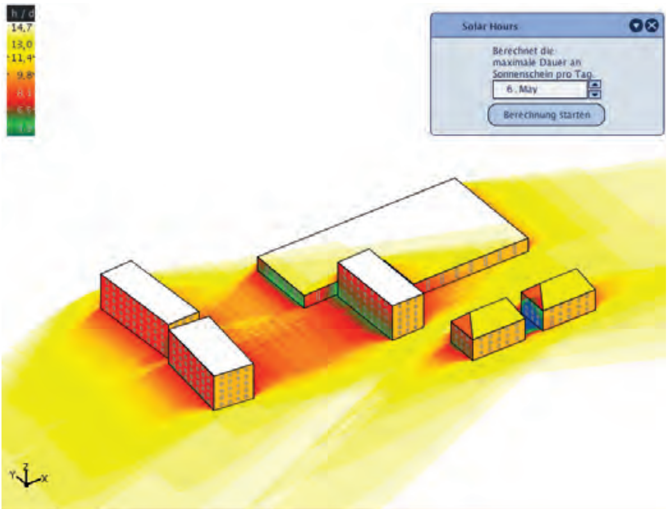
The title "Lernnetz" has its origin in the idea of using an eLearning platform like Illias to combine a database containing research findings with simulation tools in the field of building physics and share them with students. Almost every University uses eLearning platforms already to organize courses and seminars, therefore the Lernnetz with its integrated tools is accessible to students without installation or a separated user rights management.
A further advantage of the eLearning based simulation tool solution is the reduction of different software students have to use while studying.

Between 2001 and 2004 was the first development phase of the Lernnetz and back then it was part of the BMBF eLearning initiative as "Multimediales Lernnetz Bauphysik". Fundamental technologies of the Lernnetz simulation tool were developed between 2007 and 2015.

The main body of work has been done by the Karlsruhe Institute of Technology KIT and was part of a dissertation project. Through an additional funding by the Federal Ministry for Economic Affairs and Energy the development of the simulation tool for solar potential analysis in an urban scale could be finalized and didactically tested at the University of Wuppertal.

For data security and stability reasons the latest version of the Lernnetz is not attached to an eLearning platform like Illias. To test and fully develop the project editor and the simulation tools the separation from a sharing and learning platform is necessary but only temporary. The indoor climate simulation is as an additional extension currently under development.
All simulations are using a joint 3D CAD model and a database, which contains all necessary data. For creating and editing the 3D model Lernnetz has an integrated and simplified CAD editor – the project editor. In the project editor, it is possible to add preconfigured buildings on a plane surface. At the moment only the project editor for urban scale modelling is useable. The room and single building editor while already havening been created is not ready for the test phase yet.
Under the link http://lernnetz.fbta.uni-karlsruhe.de/enob-webstart/ the latest version of the Lernnetz can be downloaded as an editor, tool and data package. The only requirement to run the Lernnetz package is the latest version of Java.

In the latest Lernnetz edition three simulations are operable – calculation of solar irradiation on horizontal and inclined surfaces, simulation of shading and hours of direct sunlight.



To increase the calculation, speed the implemented calculation algorithm has been simplified. For example, only the shading of direct sun light is taken into account while reflections of the surrounding are ignored.

The simulation results of solar irradiation and hours of direct sun light are displayed in false color in the 2D top view as well as in the 3D perspective view and can be exported as a .png and .jpg image.
The calculated shadows are shown in a grey scale for a selected time and date or in a dynamic course over a selected period as well as an additive overlay of shadows for the selected timespan. The greyscale shadow result can be exported as an image as well.

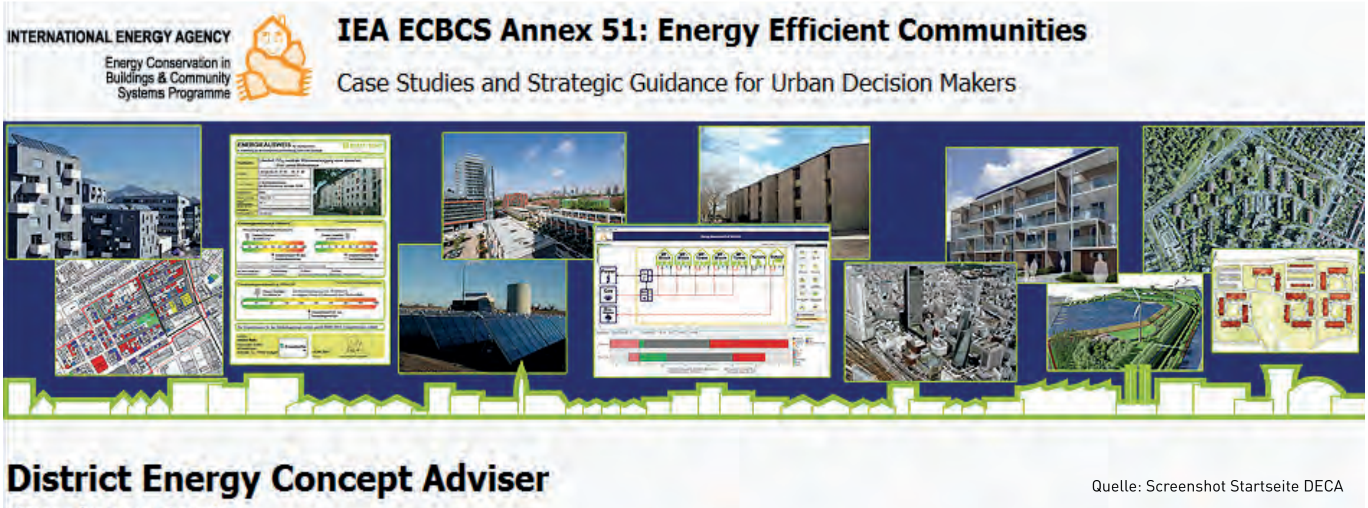
The results of the solar irradiation calculation can be exported as numeric values in a.csv format. The export shows the solar irradiation for each surface with a different orientation, inclination and building as a total value in kWh as well as a specific value in kWh/m2 and also provides information about the surface, for example surface area, orientation and inclination.

Overall Lernnetz is made for students of architecture, who want to deepen their knowledge in the field of building physics or need to do conceptual studies.

Low system requirements and the multi-platform functionality open the possibility for fast and substantiated results and realizations for a wide range of students, which makes it a perfect tool to use during a summer school. The Lernnetz webstart package under the above-mentioned link was primarily introduced and tested during the summer school "Stadt im Wandel" in Berlin in September 2016.

After a short introduction, the students were able to create and evaluate their concept studies with the simulation tools integrated in Lernnetz– solar irradiation, shading and hours of direct sunlight. They also used the Lernnetz to calculate the solar potential of their final urban design approach. Thanks to the Lernnetz the conceptual studies made in Berlin were deepened in the field of potential solar energy use as well as natural lighting. Finally, the Lernnetz did also support the communication in the interdisciplinary teams.

(Text: Susanne Hendel)



Quelle: Screenshot Startseite DECA

Tool

DECA District Energy Concept Adviser

Because the District Energy Concept Adviser is not a project of us at the University of Wuppertal or a project of one of our research partners the following description originate from the official DECA Webpage, which can be found under http://www.district-eca.com/.

Within the framework of the German research initiative EnEff:Stadt (launched by the German Federal Ministry for Economy and Technology), Fraunhofer Institute for Building Physics IBP has developed a computer software to support actors in the field of urban planning during the first stages of planning energy-efficient district concepts. This software was developed in collaboration with international partners from IEA ECBCS Annex 51 "Energy Efficient Communities"and comprises a set of individual supporting tools. The very heart of the software is a tool for the energy assessment of districts, which uses archetypes and other pre-set configurations to allow for a simple and quick data input mapping all the buildings in the district. Thus, it takes the user just a few steps to identify the energy saving potential of various strategies in the areas of building construction, technical building systems, and centralized supply systems. Other included tools are a case study viewer with 19 exemplary energy efficient city quarters, information on energy efficient technologies and strategies and a benchmarking tool for measured energy use.

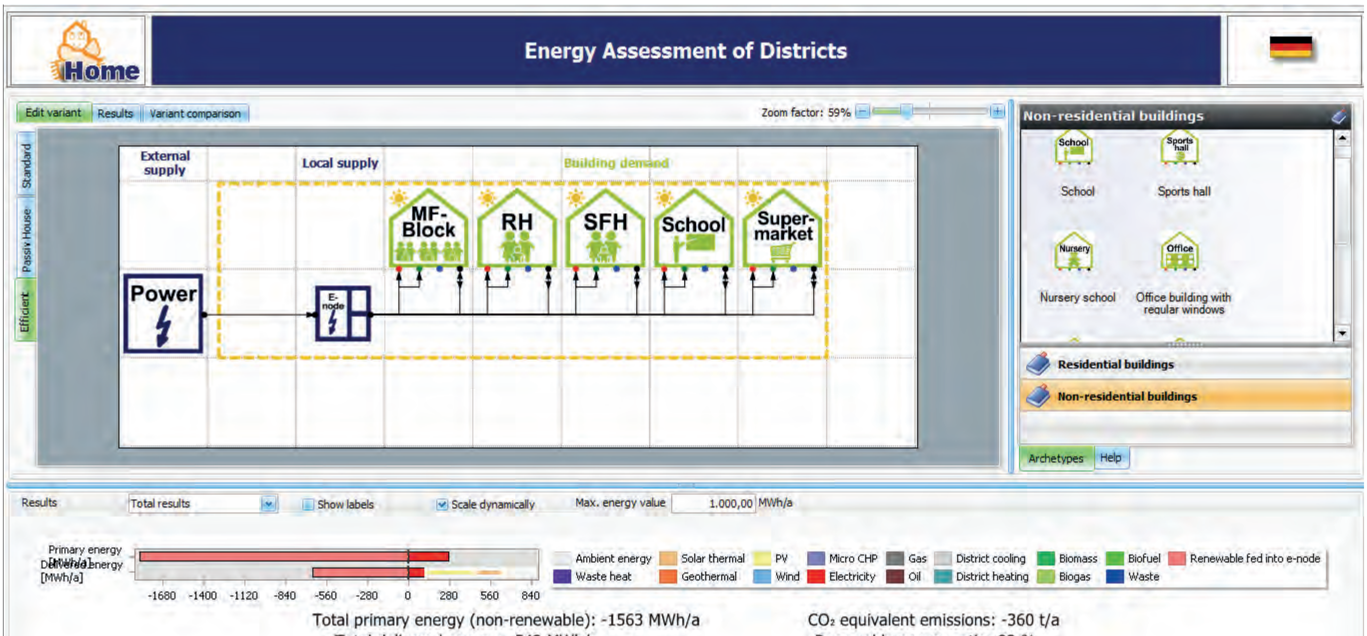
The development of the District Energy Concept Adviser was funded by the Germany Ministry of Economy and Technology under the project no. 0327400N.

The following different tool sections are included in the District Energy Concept Adviser tool:
With the help of the Performance Rating tool the user can compare the energy use of a certain district with the national average of a similar district.

The Case Studies of Energy Efficient Districts have been provided by the national representatives in the IEA ECBCS Annex 51. Studying the 19 included exemplary case studies of energy efficiently new built or renovated quarters will give inspirations for own projects but will also inform on lessons learned.

Various Strategies and Technologies can contribute to energy efficiency in quarters. This tool section gives a short overview on applicable measures and includes many links for further information, mostly to specific IEA annexes and tasks that deal in detail with certain technologies.

The Energy Assessment of Districts enables the user to calculate the energy performance of various energy concepts



Quelle: Screenshot Oberfläche DECA

on the demand and the supply side. The supply can be centralized like for example a local district heating system or decentralized with boilers or heat pumps but also in combinations of both. Results are presented as delivered energy, primary energy and CO_2 emissions.

In the section, Basic a list of international and national reports dealing with energy efficient quarters can be downloaded.
The participating organizations of the IEA Annex 51 have been listed in the last section Contact.

For accessing the download area, a login is needed. To register (see main menu on the right), limited personal data is asked for, which helps us to get an overview of the users and to provide you with information on updates, etc.

The District Energy Concept Adviser was designed for MS Windows. When running the application on alternative operating systems, the use of appropriate virtualization software or an MS Windows emulator is required.

Use of D-ECA during the summer school "Stadt im Wandel"
During the summer school "Stadt im Wandel" in Berlin in in September 2016 D-ECA could, similar to the tool Lernnetz, successfully been used by the students for their conceptual studies after only a short introduction. Because of the intuitive handling of D-EAC the student teams were able to quickly compare their energy and supply strategies and to work out a substantiated concept. The Combination of both tools, D-ECA and Lernnetz opened the students the possibility to discuss the reasonable amount of regenerative energy usage in their district on a higher level.

(Text: Susanne Hendel)

Guest Criticism

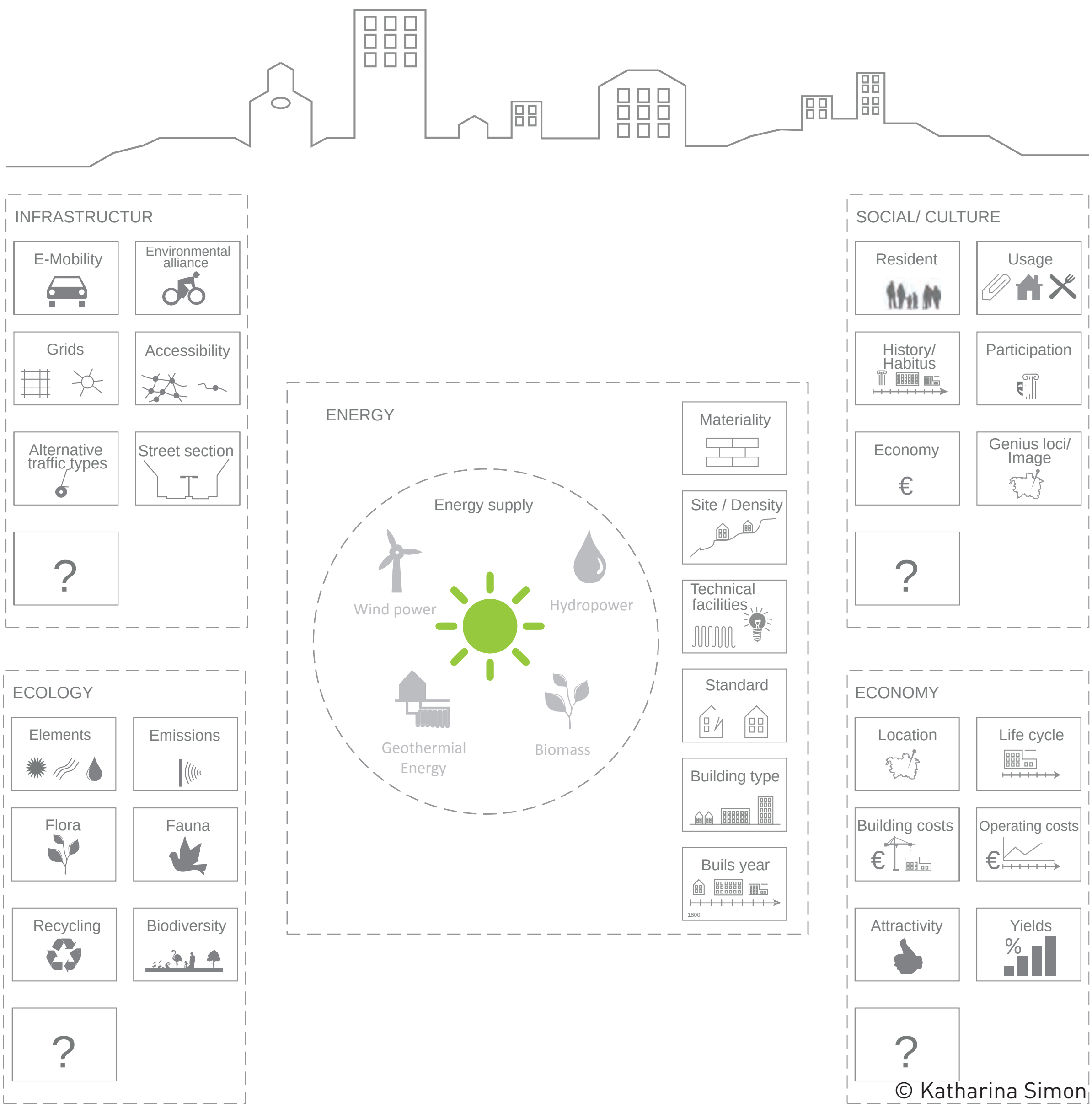
2/3 Concepts

Berlin Adlershof- Concepts

New ideas for Adlershof

Strategy Plan Adlershof

The preparation of the strategic plans was executed in groups with students from different disciplines. The aim of this interdisciplinary work is the exchange of knowledge between the students, which is usually rarely practised at the universities. Understanding for the other discipline is essential in later professional life and should be trained at an early stage. In exchange with other specialist disciplines, new strategies are developed, when necessary, as a result of different perspectives. Although the focus of the task was on a concept with optimal solar gains, other aspects cannot be neglected in the urban design process. A combination of different subjects, which can have a different weighting in each design, leads to a holistic strategy plan that was the goal of this summer school.

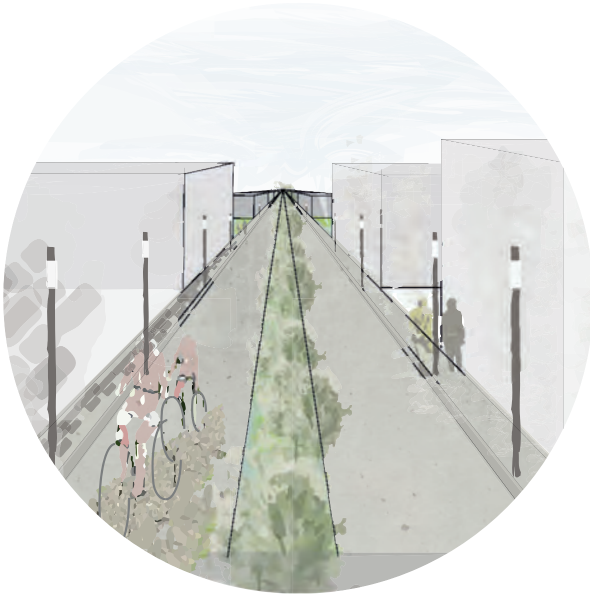


Strategy Plan 1

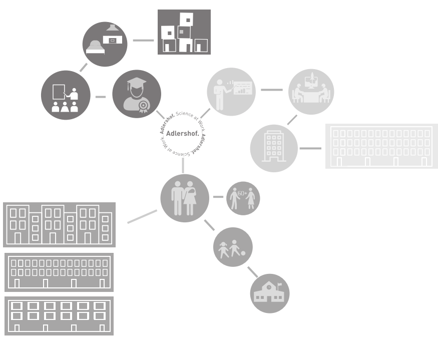
Bikeway

The conceptual approach of the "Bikeway" design provides the interface between an optimised orientation of the buildings with regard to exposure and solar potentials and the infrastructure development, with a core focus on e-mobility.

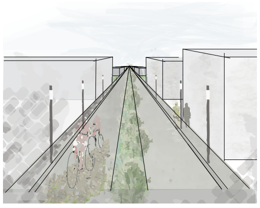
A focus, in addition to the energy concept, is on the development of the district based on the electro-mobilised bicycle traffic as well as on public transport as a possible alternative to motorised individual traffic. Supported by concepts such as car sharing, bike sharing and e-mobility, the "Bikeway" should become the main traffic route within the district. This would then reduce the CO2 emissions in the district, the noise levels from motorised traffic would be minimised and a traffic-calmed street for playing, as a meeting place and meeting space for all residents and visitors to the district could be created. The zoning and orientation of the building structure is to be planned with a view to the optimal orientation for the use of solar harvesting. The rather large-scale angular, rowed and terraced buildings are loosened in the south east by smaller scale development structures such as town houses, which are oriented towards the green space.



In addition to the compulsory roof greening, rainwater collection basins are planned for the natural cooling of the area between the houses, which ensures natural evaporation in case of excessive heat and therefore cooling for the living and working areas. The energy concept includes PV systems, some of which are located on the roofs andpartially on the building façades. In addition to these façade elements, shading elements are also equipped with PV collectors. At regular intervals along the "Bikeway", battery charging stations are located, the so-called "Reloadbars", which can be used to directly charge e-bikes.

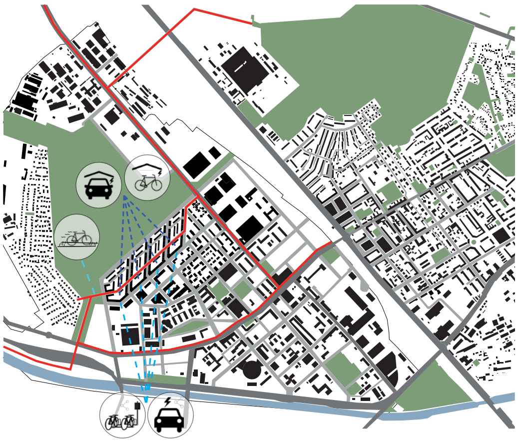


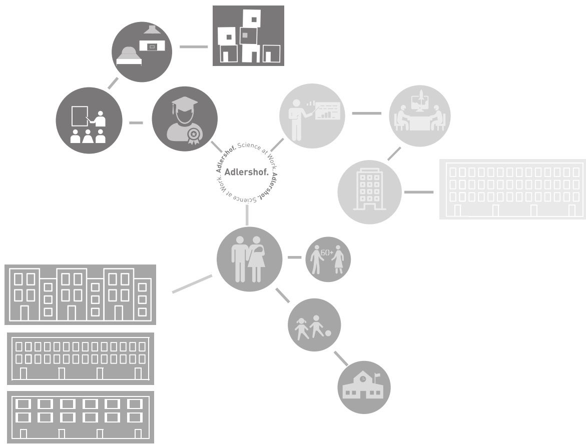
residential buildings
residential buildings existence
technology buildings
communal buildings
industrial buildings
mixed district



1,5 floor-space index (GFZ) 0,4 coverage ratio (GRZ)

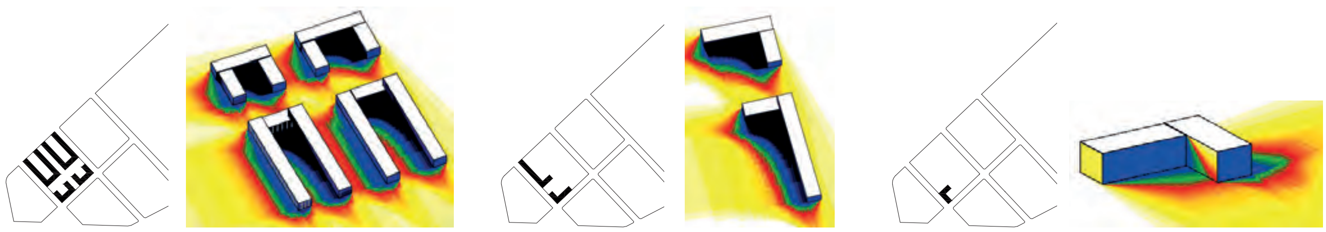
townhouses
apartments
kindergarten and education
office buildings

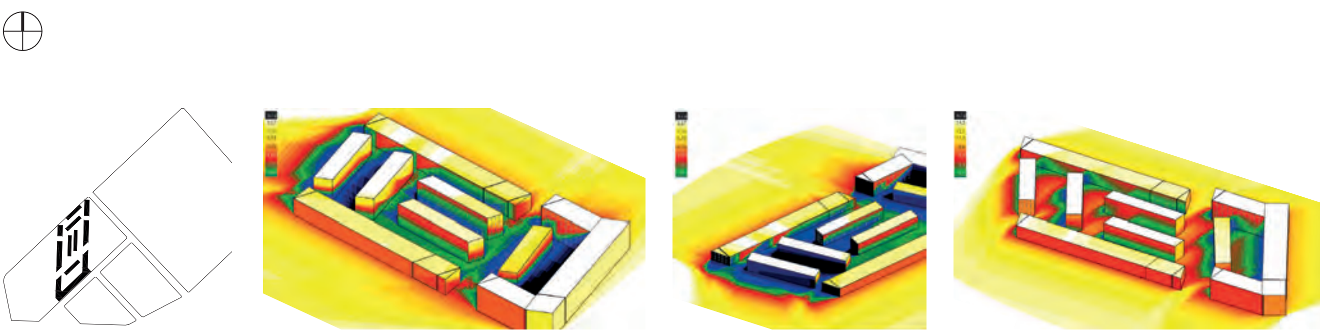




insolation and urban planning

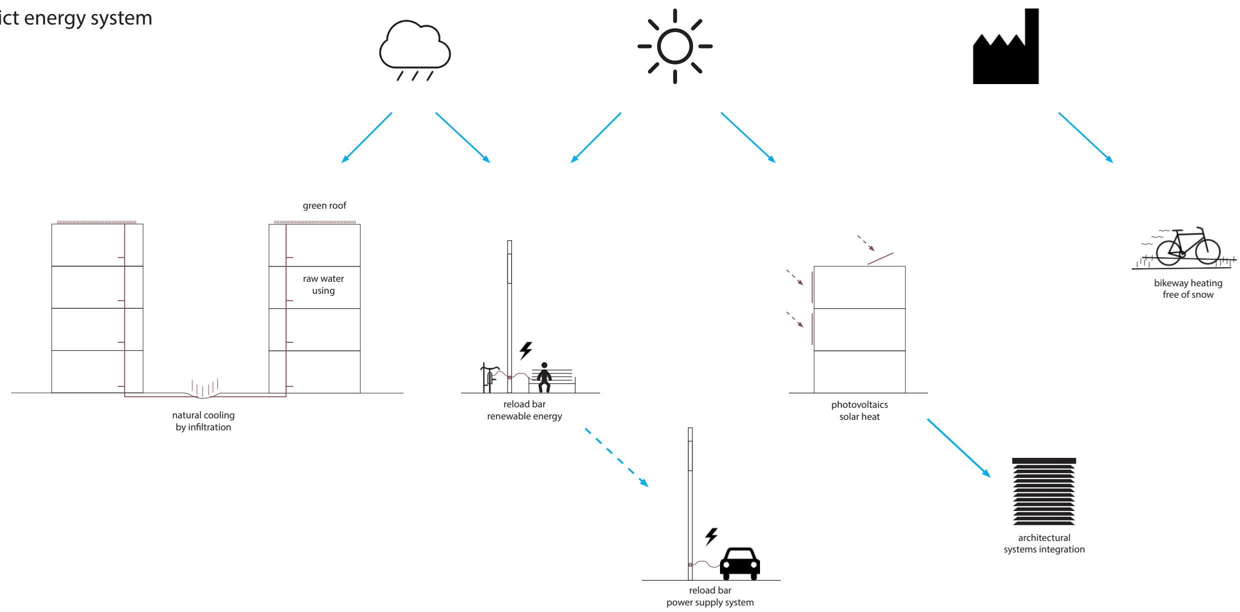
variant analysis





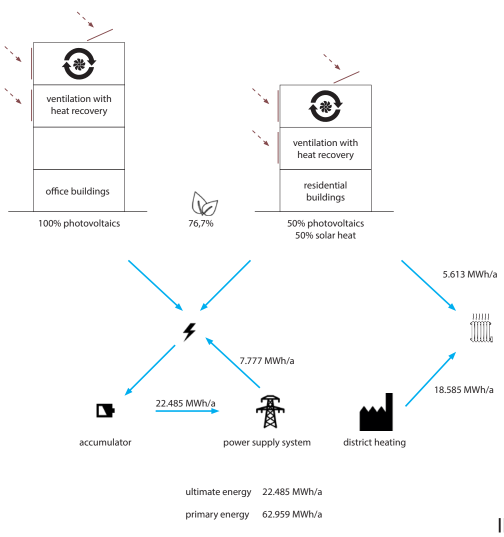
Strategy- Bikeway

district energy system

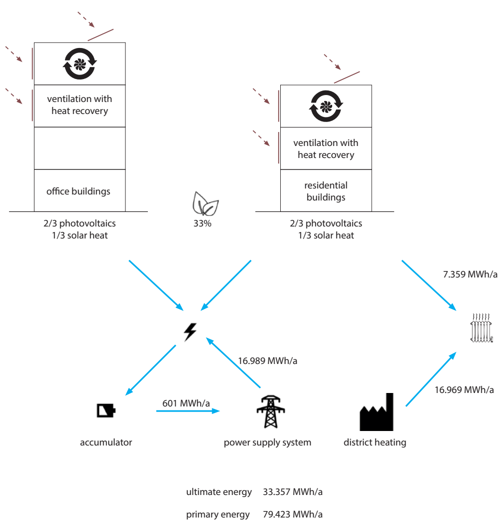


energy variants

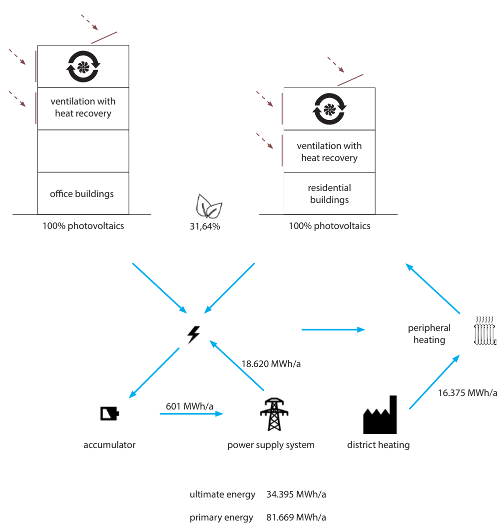
I.



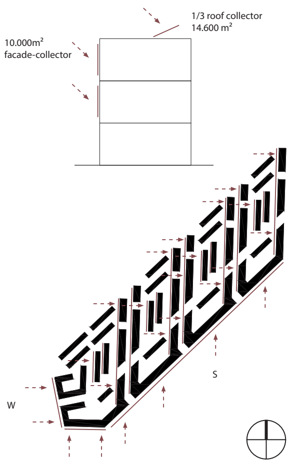
II.

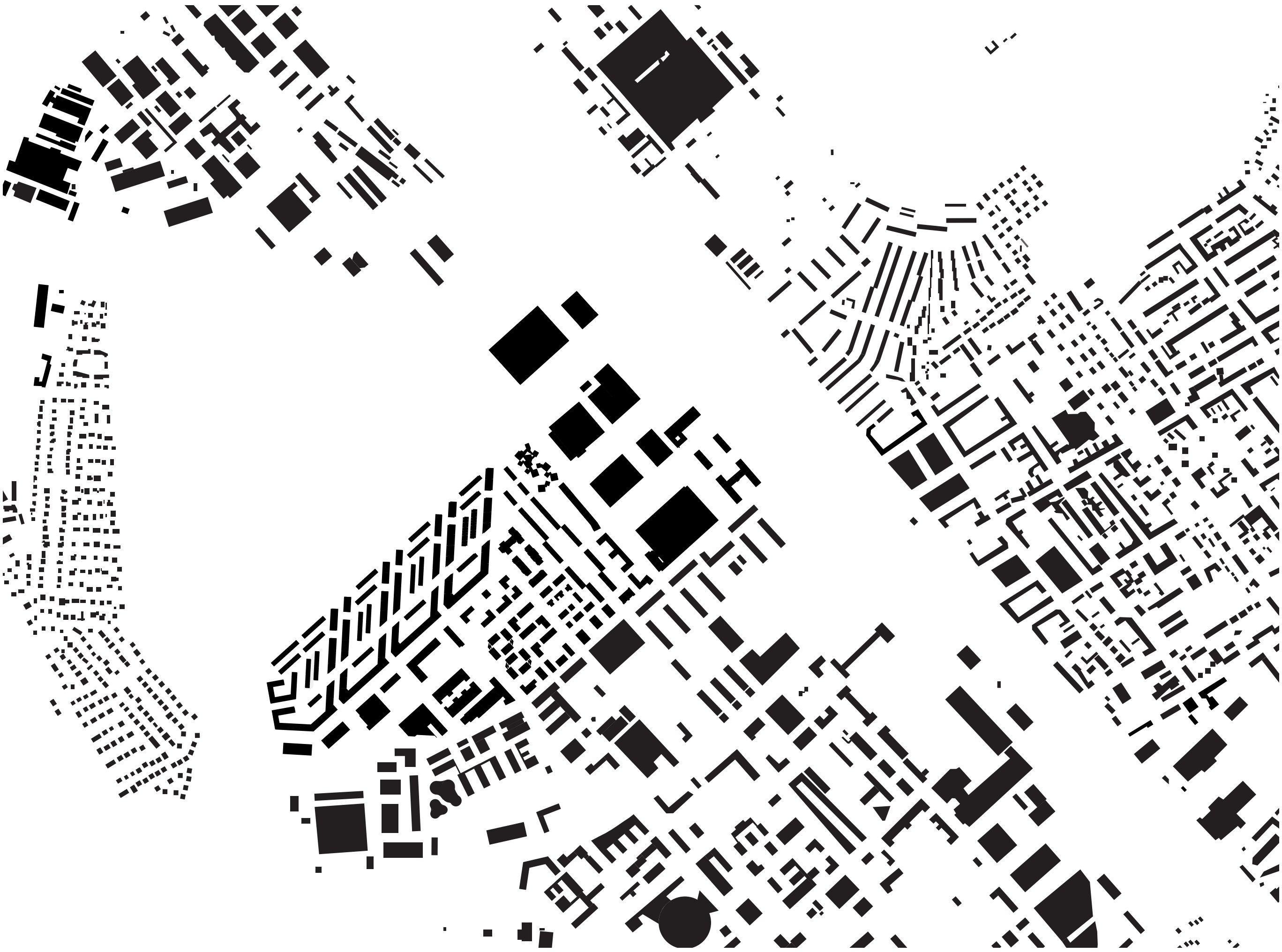


III.



collector surface - photovoltaics and solar heat





Strategy Plan 2

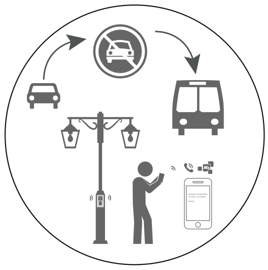
Car-free Living

The concept "Car-free living" refers to the landscape park and the building plots from A1 to A6.

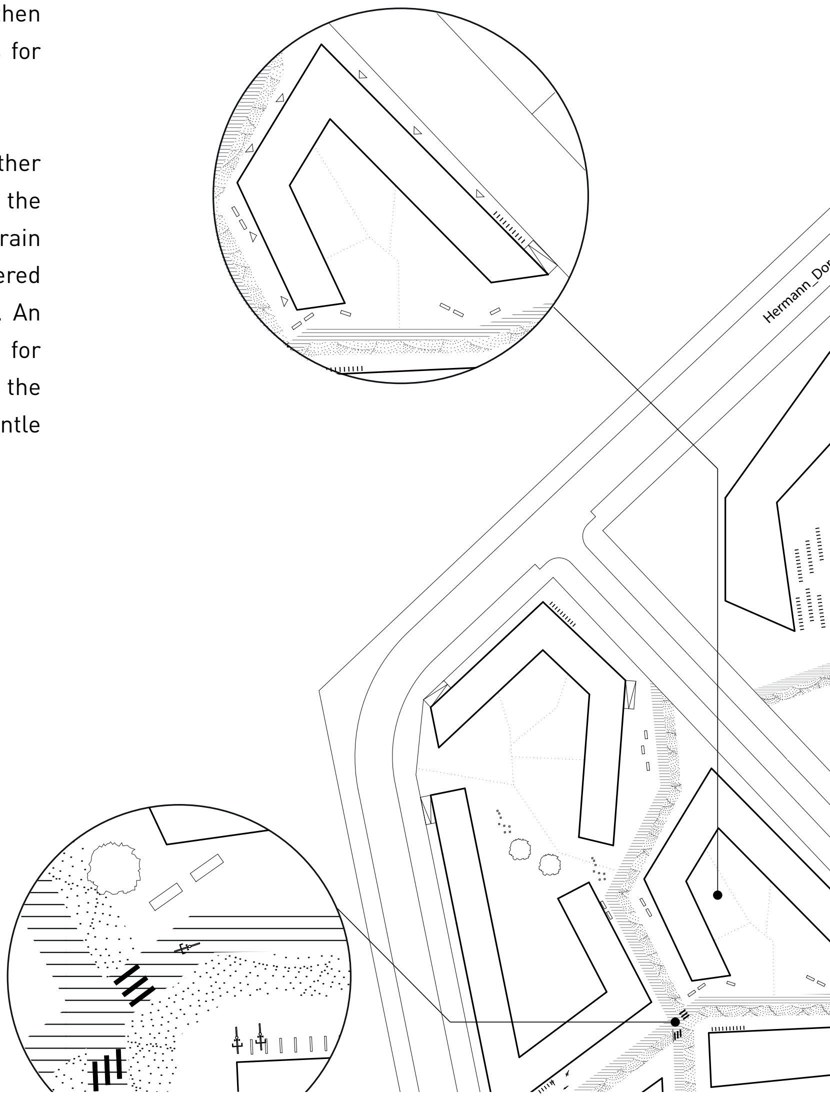
The previous mobility concept within the district will be replaced by dismantling the paved roads and introducing bicycles and footpaths. A zebra crossing and the paving of the paths will regulate the bicycle traffic in order to guarantee the pedestrian´s safety on the streets in the district. Every residential building has a bicycle storage room in the cellar which can be reached via a ramp. Furthermore, the daily resources such as the day-care centre, the primary school, the doctor, the chemists and the market place will be easily accessible on foot.

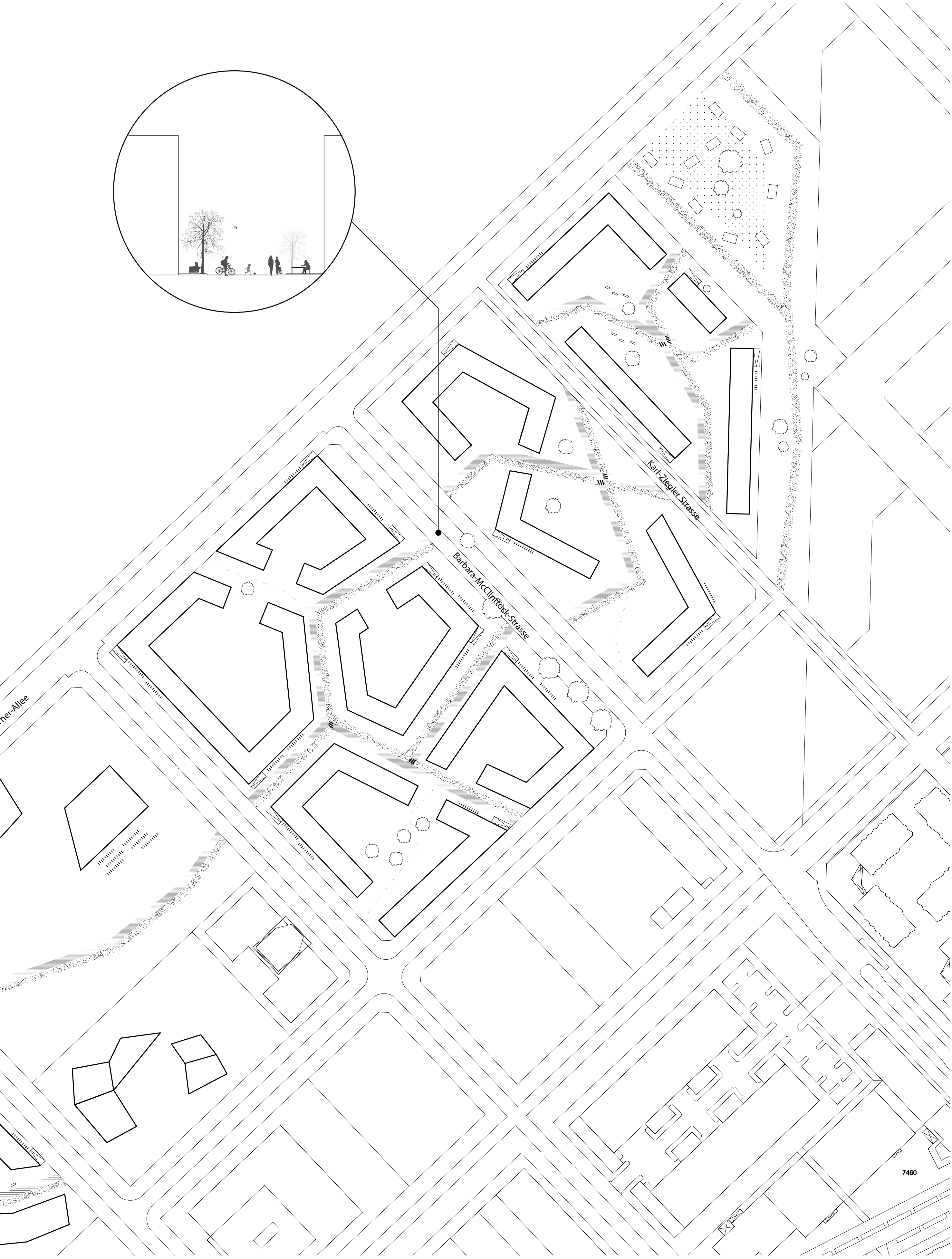
This design only makes it possible for motorised individual traffic to reach the southern limit of the predefined building plots, the areas for the dormant traffic are covered by the centrally located car park on the construction area A7. The options are then supplemented by car-sharing as well as charging columns for the use of the mobile electric vehicles.

An electric bus is available for the additional transport to other locations. This will be available for the district as well as the southern technology park and offers trips to the S-Bahn train stop. To optimise the utilisation, the district bus can be ordered as required via an App or via a number of street lanterns. An exception will be introduced for the delivery to shops and for waste disposal in the time window 8-10 a.m. Access to the planned weekly market is also permitted to set up and dismantle the stalls.



If you need, call the electro bus!

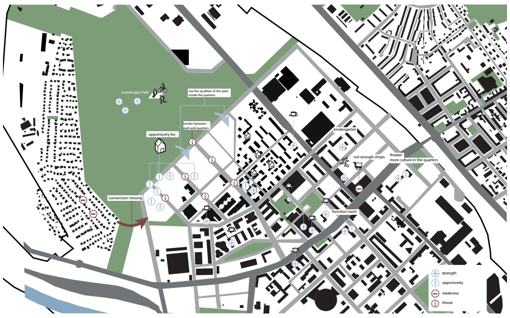




Karl-Ziegler-Strasse
Barbara-McClintock-Strasse
ner-Allee
7460

Car-free living quarter Adlershof – Expanding the living space to the roads

Autofreies Wohnquartier – Die Straße wird für die Einwohner zurückerobert



SWOT Analysis Adlershof w.S. / *SWOT Analyse Adlershof o.M.*

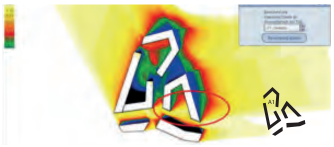
Traffic System Adlershof w. S. / *Verkeherskonzept Adlershof o.M.*

Distribution von functions and user / *Verteilung der Funktionen und Nutzer/-innen*

Site plan Adlershof M 1:50000 / *Schwarzplan 1:2000*

Investigation of solar radiation and clouding / *Untersuchung der Sonneneinstrahlung und Verschattung*

Details on A1 / 1st Variation
Problem: Circled building cause extreme shadowing into the inner yard.

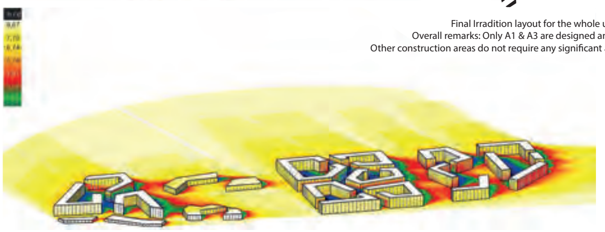


Details on A1 / 2nd Variation
Solution: Remove highlighted building. This allows more sun exposure into the inner yard.

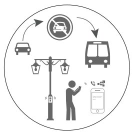
Details on A3 / 1st Variation
Problem: Circled building cause extreme shadowing into the inner yard.

2nd Varia
Solution: Remove highlighted building. This allows more sun expo
into the inner yard. Opening for the whole building is located at sc
and no longer nc

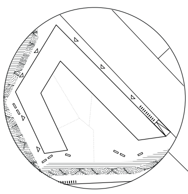
Final Irradition layout for the whole urban district
Overall remarks: Only A1 & A3 are designed and optimized
Other construction areas do not require any significant adjustments.

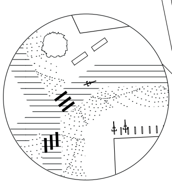


construction field *Baufeld*	coverage ratio *Grundflächenanzahl (GRZ)*	floor-space index *Geschossflächenanzahl (GFZ)*
A 1	0,13	0,4
A 2	0,19	0,3
A 3	0,35	1,4
A 4	0,35	1,4
A 5	0,35	1,4
A 6	0,35	1,0
A 7	0,2	0,4
A 8	0,4	0,8



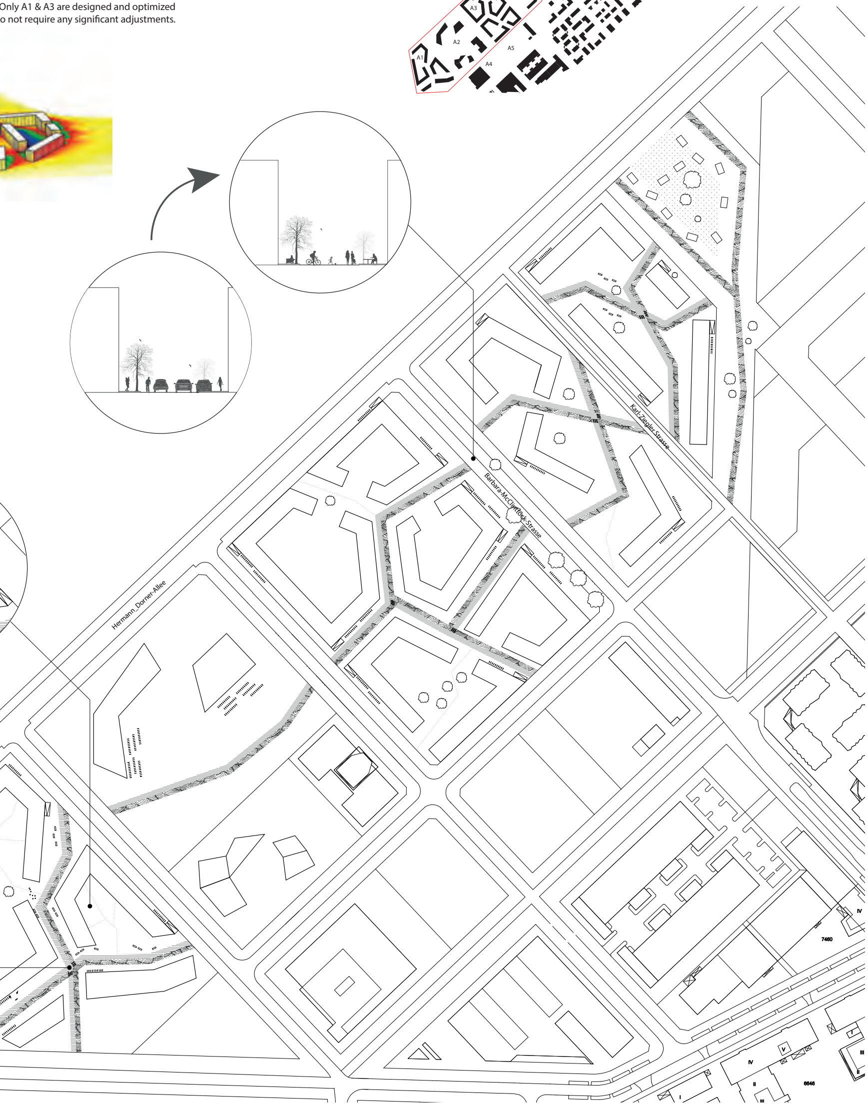
If you need, call the electro bus!





10 arrangements for the quarter

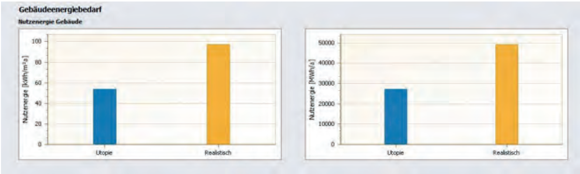
1 Pedestrians and bikers share the streets
2 Crosswalks and pavings regulate the bicycle traffic
3 Good reachability for daily requirements
4 Cars are allowed to drive to the southern border of the quarter
5 Rescue vehicles, the fire department and handicapped persons are allowed to enter the quarter by car
6 An e-bus line connects the quarter with the southern technology park and the S-Trainstation,
can be ordered by an App or some streetlamps
7 Delivery for shops and disposal is allowed at 8-10 a.m.
8 The weekly market might be accessed by motor vehicles for set up and dismantling
9 The streets for motorised traffic are speed-30 km/h-zones
10 Each residential house has its own bicycle cellar



Site plan Adlershof M 1:2000 / *Schwarzplan 1:*

Energy requirement calculation & Energy concept / *Energiebedarfsberechnung DECA*

Building energy consumption / *Nutzenergiegebäude*

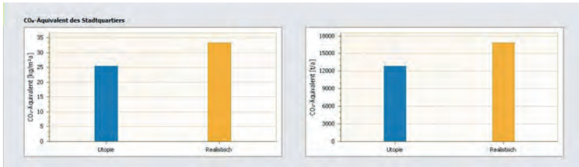


	Total / *Gesamt:* MWh/a
Utopia / *Utopie*	27205,10
Realistic / *Realistisch*	49125,87

Urban-quarters Overall by Energy Source Deployed End-energy for the Urban quarters+
Stadtquartier gesamt nach Energieträgern Bereitgestellte Endenergie für das Stadtquartier+

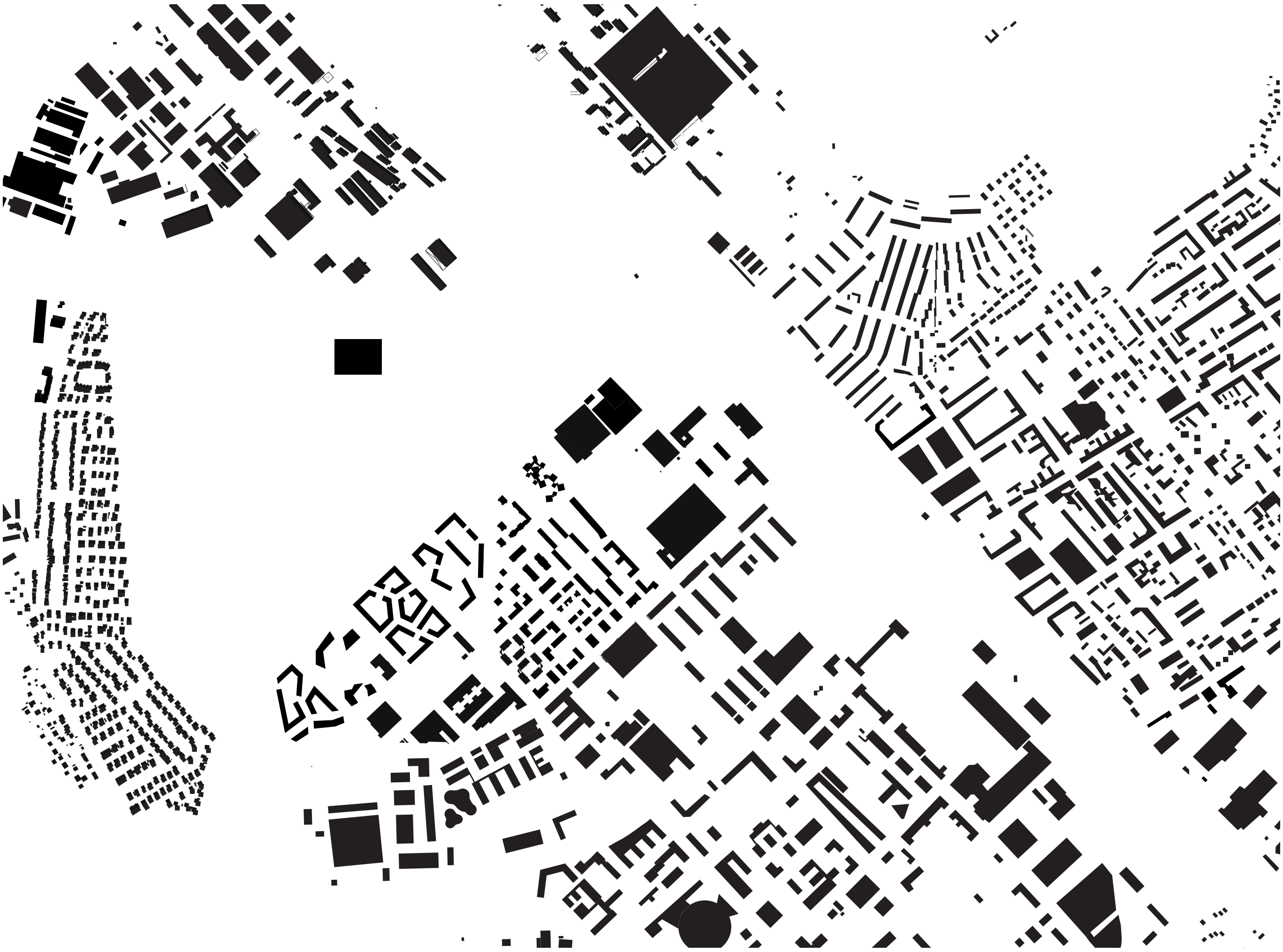
Primary energy and CO2-balance of the Urban District & Urban District's Primary Energy Balance /
Primärenergie und CO2-Bilanz des Stadtquartiers & Primärenergiebilanz des Stadtquartiers

Urban-district CO2-Balance / *CO2-Bilanz des Stadtquartiers*



	Utopia *(Utopie)*	Realistic *(Relistisch)*
Total requirements of the urban district of non-renewable primary energy (without accounting for feed current) *Gesamtbedarf des Stadtquartiers an nicht erneuerbarerPrimärenergie (ohne Bilanzierung des eingespeisten Stroms)*	45842,59 MWh/a	60960,87 MWh/a
Total requirements of the urban district of non-renewable primary energy (with accounting for feed current) *Gesamtbedarf des Stadtquartiers an nicht erneuerbarer Primärenergie (mit Bilanzierung des eingespeisten Stroms)*	45842,59 MWh/a	59247,72 MWh/a
Renewable Energy Percentage (feed current is considered as a substitute for non-renewable primary energy) *Anteil erneuerbare (eingespeister Strom gilt als Ersatz für nicht erneuerbare Primärenergie)*	34,98 %	35,64 %

Energy concept Adlershof



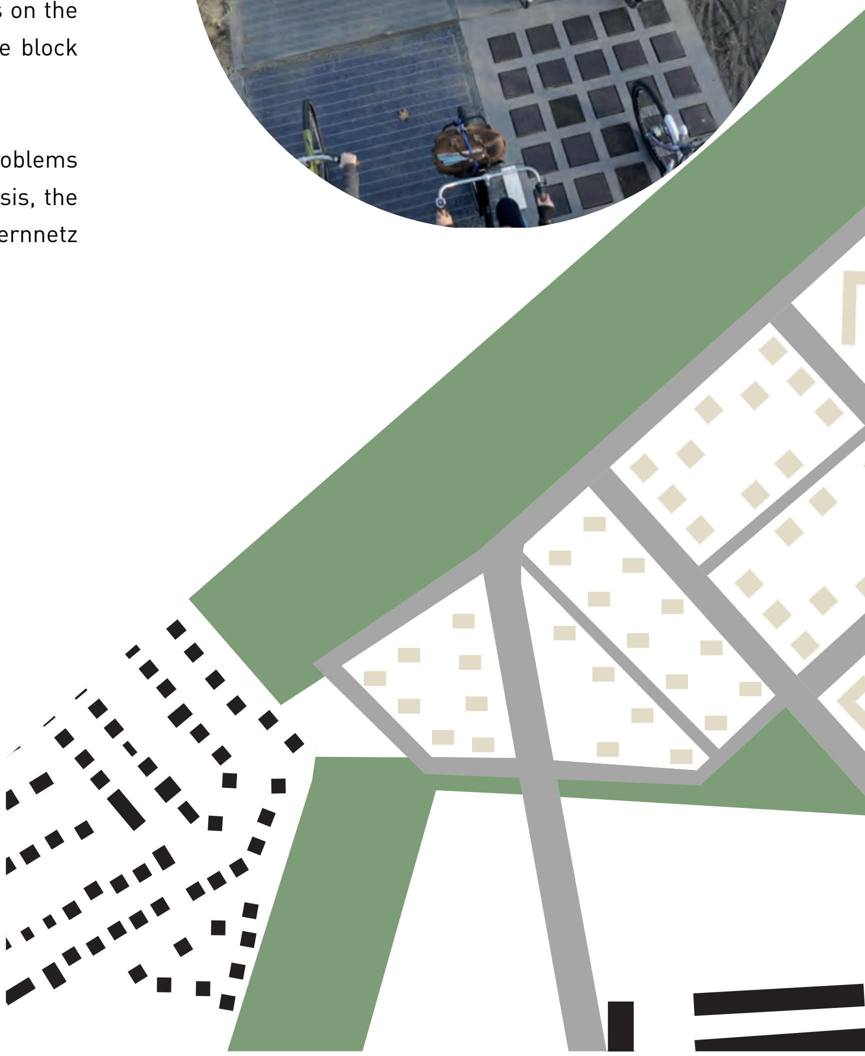
Strategy Plan 3

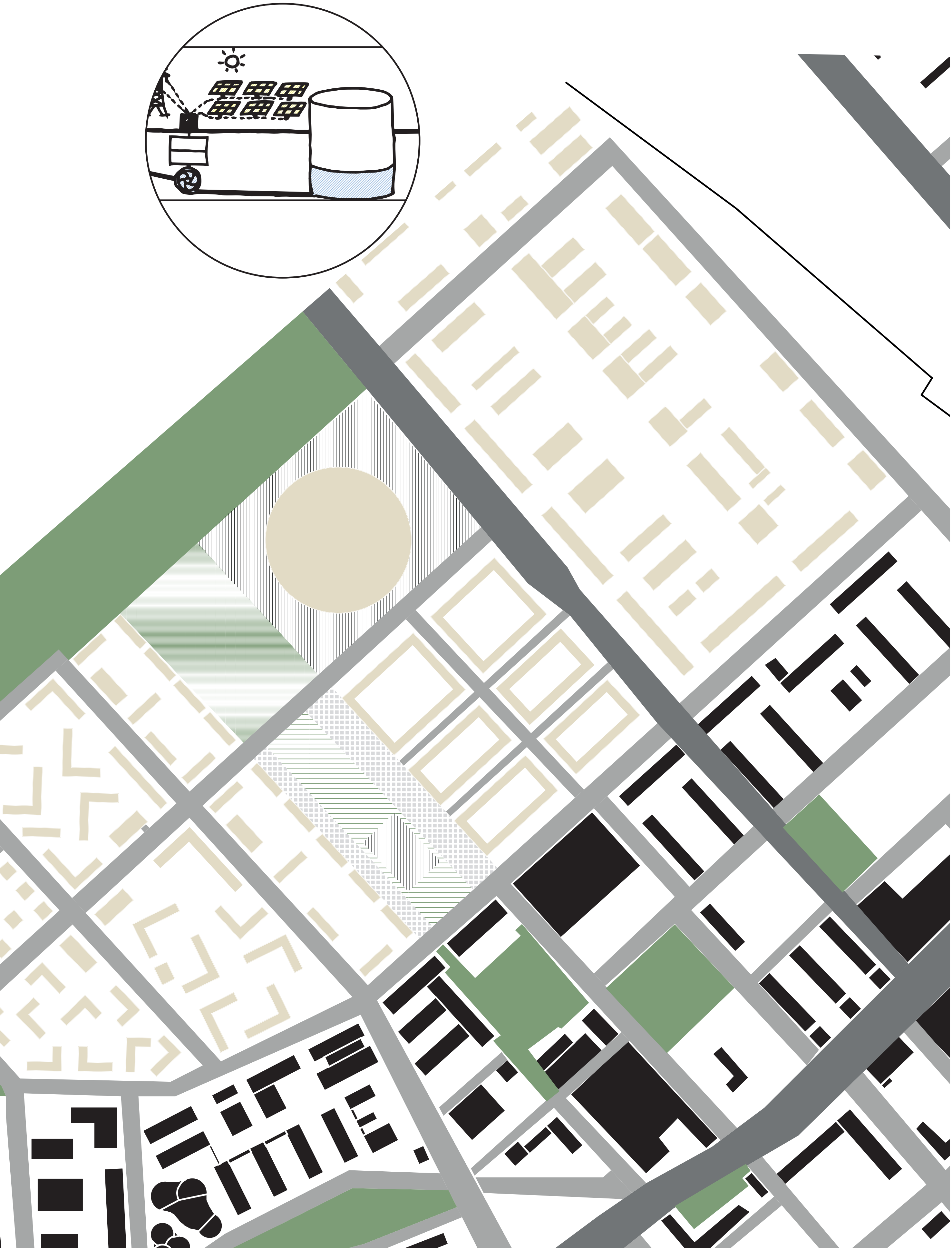
Green District

In order to achieve optimal utilisation of the building plots, in-depth analysis was carried out with regard to building structure and development density. The inner city block perimeter offers a basic urban planning advantage. It allows a clear demarcation from the public street area, the inside courtyard has a rather private character. On the other hand, the boundaries between public and private space are blurred in the loosened building method.

A general objective was to pave over as little space as necessary. For this reason, there are no paved roads for motorised traffic. The "streets" are intended to become meeting places and playgrounds for families and residents within individual districts. The residential development planned in the West forms the transition between a family home settlement and "Green District". A higher degree of urbanity will be cautiously generated by a planned ascending storey level and increased building density. From semi-detached house settlements on the building plots A0 and A1, the compaction extends to the block perimeter.

Especially for the densely built structure, shading problems within the building blocks could be identified. On this basis, the building structures were optimised using the EnOB-Lernnetz tool in order to achieve optimum use of solar energy.



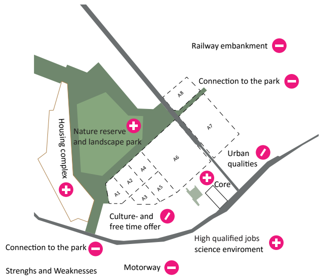


Green area distribution actual state

- Natur reserve (Entry is not allowed)
- Major traffic pathway
- Landscape park
- Aerodynamic park
- Reschulding
- Planning area
- City core
- Housing complex

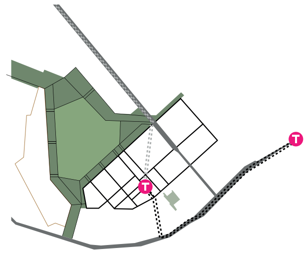
Park orientation actual state

- Natur reserve (Entry is not allowed)
- Major traffic pathway
- Landscape park
- Aerodynamic park
- Planning area
- City core
- Housing complex



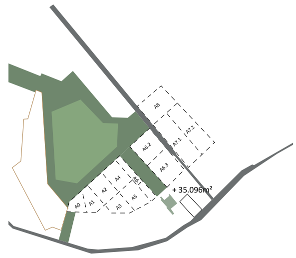
Strenghs and Weaknesses

- Positive factors
- Negative factors
- Missing factors



Transport infrastructure actual state

- Cycle- and Walkway through the park
- Road
- Tram stations
- Tram rails
- Planned tram rails

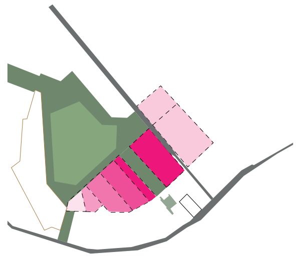


Green area distribution intended situation

- Natur reserve (Entry is not allowed)
- Major traffic pathway
- Landscape park
- Aerodynamic park
- Planning area
- City core
- Housing complex

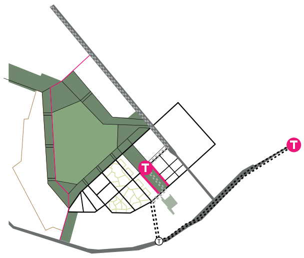
Park orientation intended situation

- Natur reserve (Entry is not allowed)
- Major traffic pathway
- Landscape park
- Aerodynamic park
- Planning area
- City core
- Housing complex



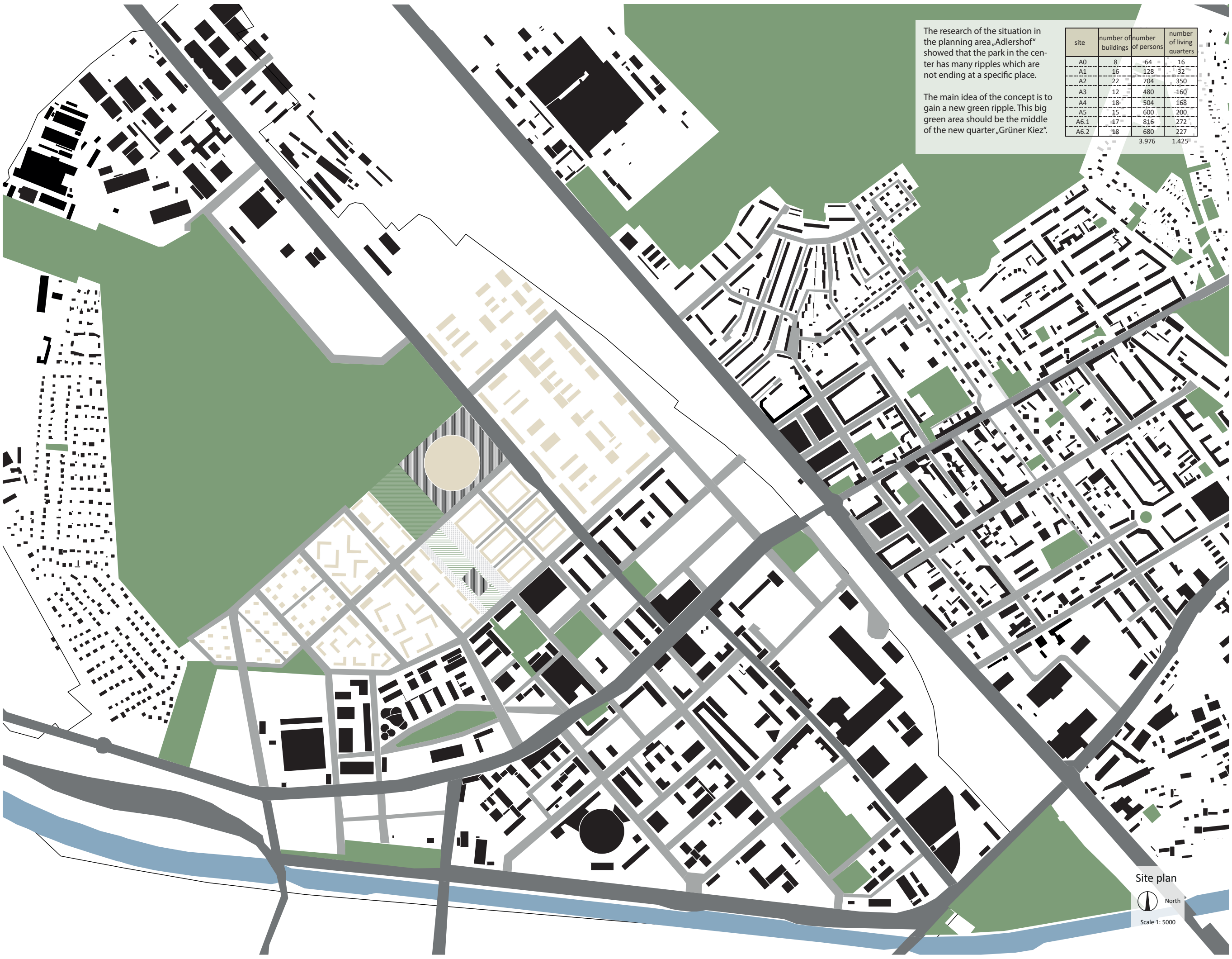
Land utilization

- Semi-detached houses
- Multi family houses
- Mixed use area
- Commercial business / offices



Transport infrastructure intended situation

- Cycle- and Walkway through the park
- Road
- Tram stations
- Tram rails
- Planned tram rails
- Shared space
- Traffic calmed
- Solar cycleway



The research of the situation in the planning area „Adlershof“ showed that the park in the center has many ripples which are not ending at a specific place.

The main idea of the concept is to gain a new green ripple. This big green area should be the middle of the new quarter „Grüner Kiez“.

site	number of buildings	number of persons	number of living quarters
A0	8	64	16
A1	16	128	32
A2	22	704	350
A3	12	480	160
A4	18	504	168
A5	15	600	200
A6.1	17	816	272
A6.2	18	680	227
		3.976	1.425

Building structure and building density studies for A.3

Different concepts of the urban structure and density of the buildings were researched.

The urban building-type as a block has a clear boundary towards the street. It is orientated to its interior space, to the yard. In contrast to that, in the more open quarters the borders between public and private space are blurred.

The residential buildings in the west of the area form the connection between the one-family-houses and the Green Kiez. Through increasing height and density of the buildings a continuously increasing urban atmosphere can be achieved. Semi-detached houses are planned for the plots A0 and A1.

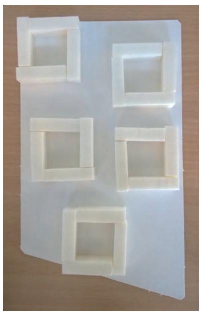
Most of the quarters are built with L-shaped houses. In this way we can achieve optimized depth of well-lid living spaces.

Für die Baufelder wurden diverse Konzepte zur Baustruktur und zur Bebauungsdichte untersucht.

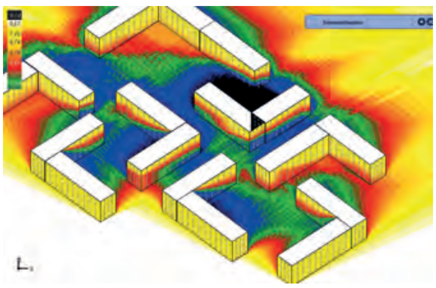
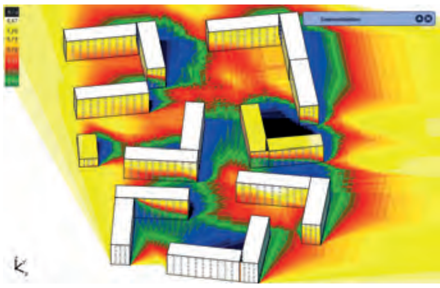
Der innerstädtische Bebauungstyp Blockrand, mit klarer Abgrenzung zum Straßenraum hin, definiert sich über einen introvertierten Innenhof. Im Gegensatz dazu verschwimmen in der aufgelockerten Bebauung die Grenzen zwischen öffentlichen und privaten Außenraum.

Die Wohnbebauung im Westen bildet den Übergang von der Einfamilienhaussiedlung zum Grünen Kiez. Schrittweise wird durch ansteigende Geschossigkeit und bauliche Dichte mehr Urbanität erreicht. So sind für A0 und A1 Doppelhaussiedlungen vorgesehen. In den folgenden Baufeldern verdichtet sich die offene Bauweise bis sie am Grünen Kiez in der geschlossensten baulichen Variante, im Blockrand, endet.

In den Übergangsbaufeldern hat sich eine L-Form durchgesetzt. Sie bietet eine optimale Wohntiefe, sodass Wohnungen gut belichtet werden können. Neben der flexiblen Möglichkeit die Gebäude anzuordnen und somit eine gewisse Verspieltheit in den Wohngebieten zu schaffen, entstehen im Außenraum größere und kleinere Einheiten zur individuellen Nutzung. Da jedes Baufeld möglichst wenig versiegelt werden soll, gibt es kein Autoverkehr innerhalb der einzelnen Quartiere und die Bewohner können mit ihren Kindern den Außenraum für sich nutzen.

Quarter A5 Shadows-Studies


Quarter A5 Shadows-Studies with Lernnetz
Baufeld A5 Verschattungsstudien mit der Lernnetz

Quarter A6.1 Versions and Shadows

For the mixed use area next to the "Grüner Kiez" we looked at the different types of buildings in regards to their urban inclusion, their effect on the streetscape as well as their shadows:

Version 1+2:
In specific the shadows in the inner corners of the backyards can be identified as most critical. In addition we could identify a clearly defined edge towards the street on the west side of the plot.

Version 3: There are less shadows but the edges towards the street are still not satisfying.

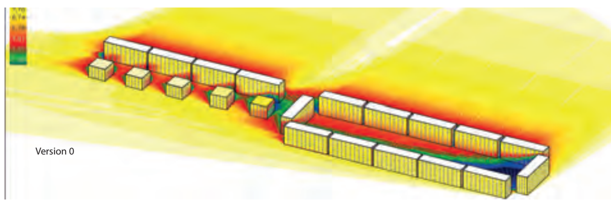
Version 4: We achieved a clear border to the streets and the inner yards offer adequate private space. The building structure offers a good transition to the living and urban quarters.

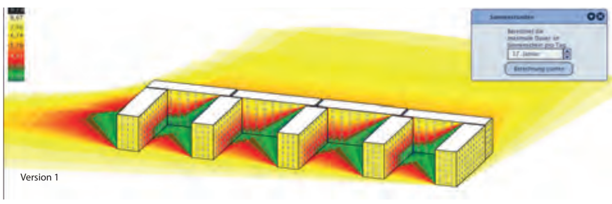
Für das Mischgebiet, welches unmittelbar an den Grünen Kiez grenzt, wurden verschiedenste bauliche Varianten auf ihre städtebauliche Eingliederung, ihre Wirkung im Straßenraum sowie die Verschattung hin untersucht:

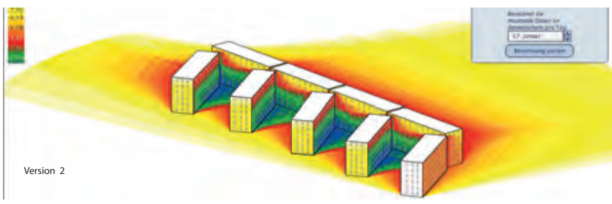
Variante 1+2: Die Verschattung in den tiefen Ecken der Innenhöfen wurden als kritisch eingeordnet. Als weiterer Mangel stellte sich die fehlende klare Raumkante zur westlichen Straße hin heraus. Auch der Raum zwischen den Gebäudearmen wurde als zu undefiniert bezüglich seiner Nutzung als öffentlicher oder privater Außenfläche gewertet.

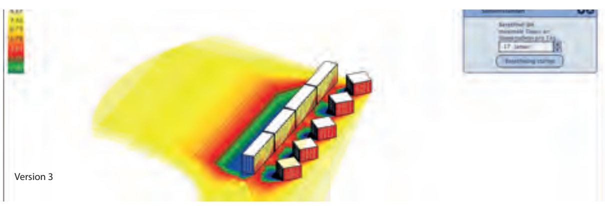
Variante 3: Die Verschattungssituation ist gegenüber Variante 1 und 2 verbessert worden. Die Einfassung und Abgrenzung des Grundstücks gegenüber des Straßenraums war jedoch nicht zufriedenstellend.

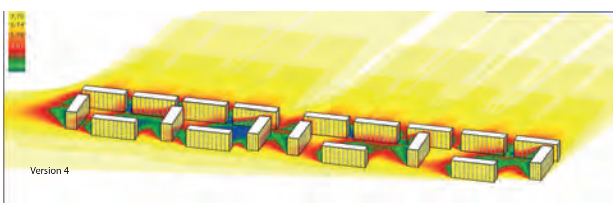
Variante 4: Eine klare Abgrenzung zur Straße hin konnte erreicht werden. Die entstandenen Innenhöfe verfügen einen angemessenen privaten Außenraum. Die Bebauungsstruktur bietet ganz im Entwurfskonzept, der zum Grünen Kiez hin ansteigenden Urbanität, eine optimalen Übergang zur Blockrandbebauung in A6.2.



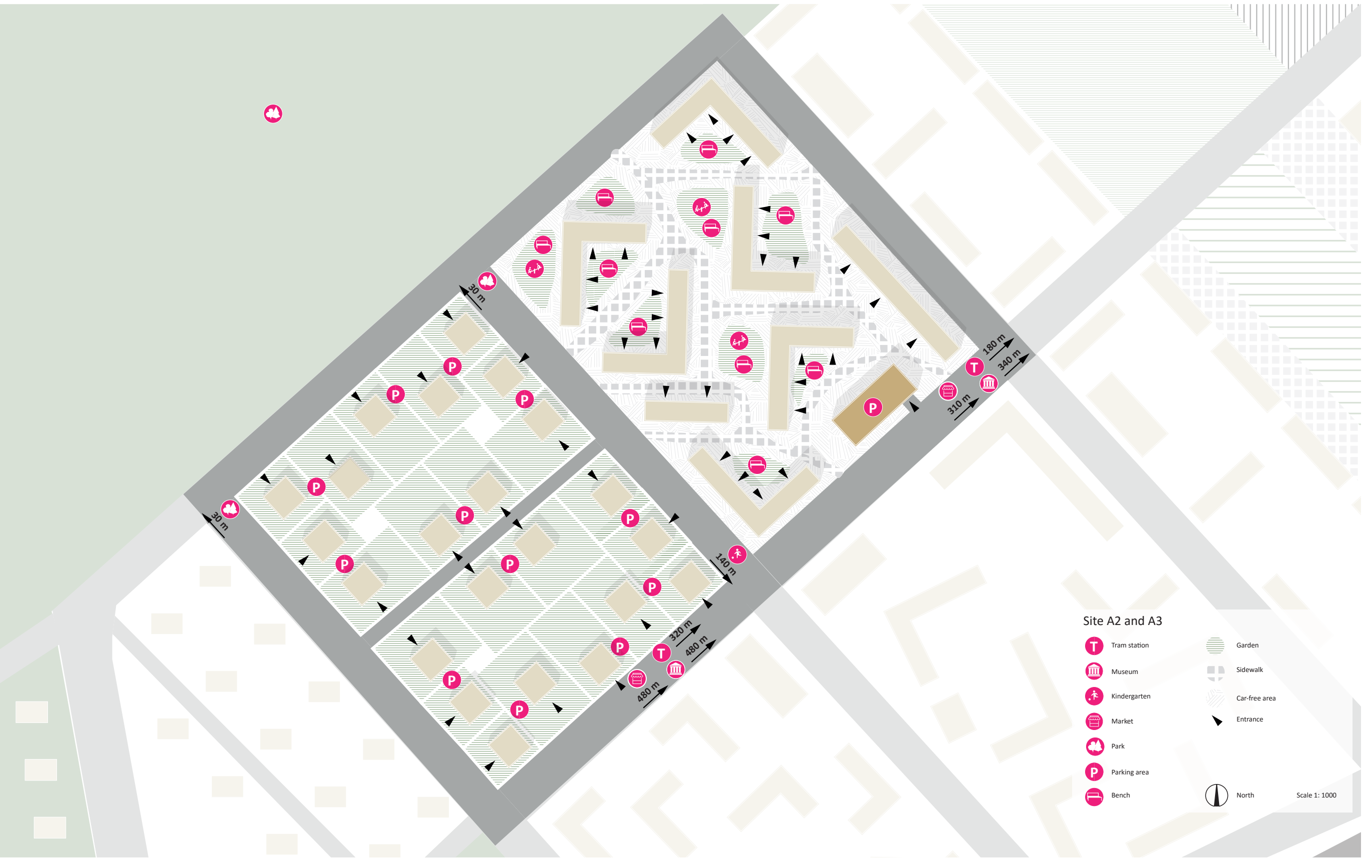


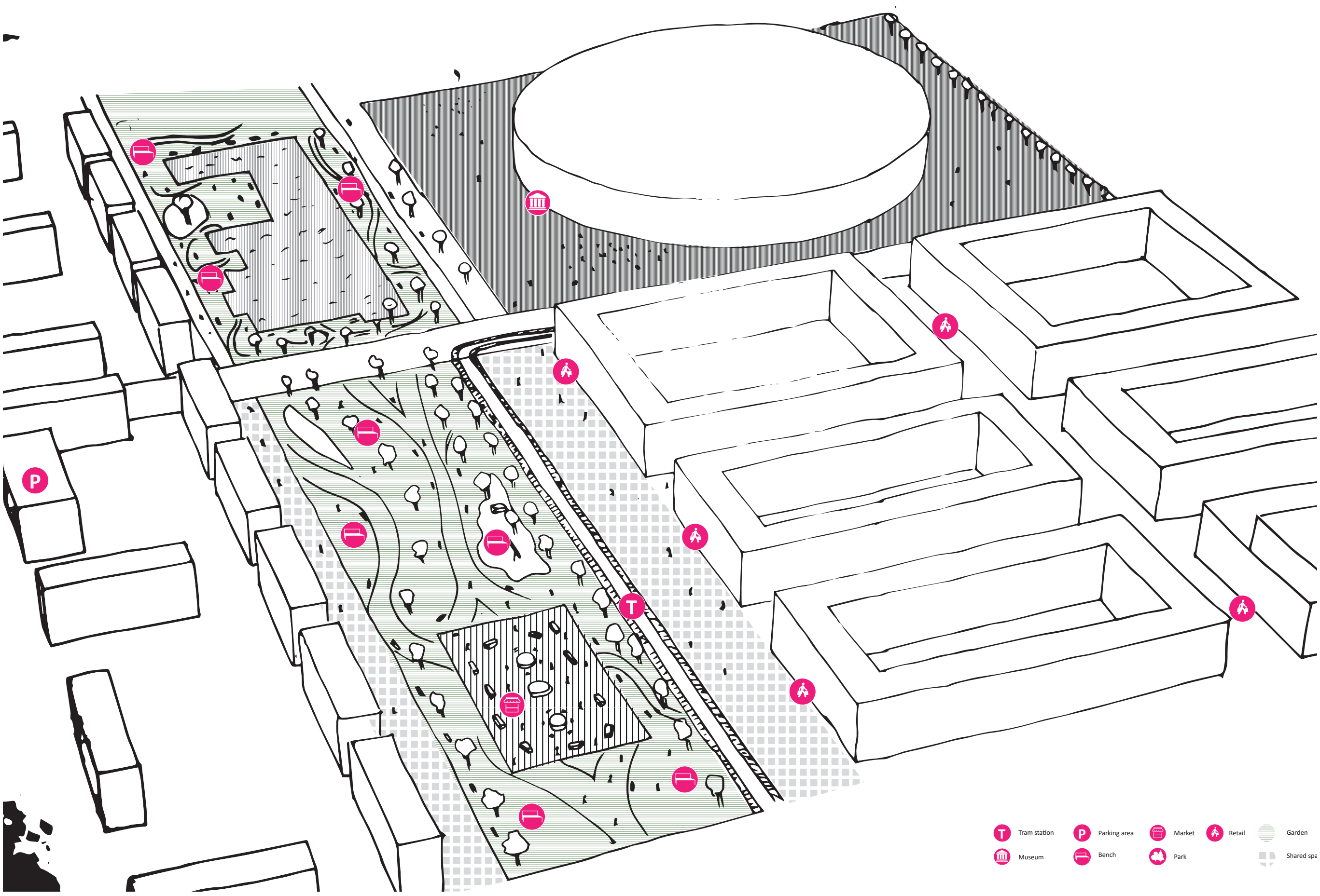


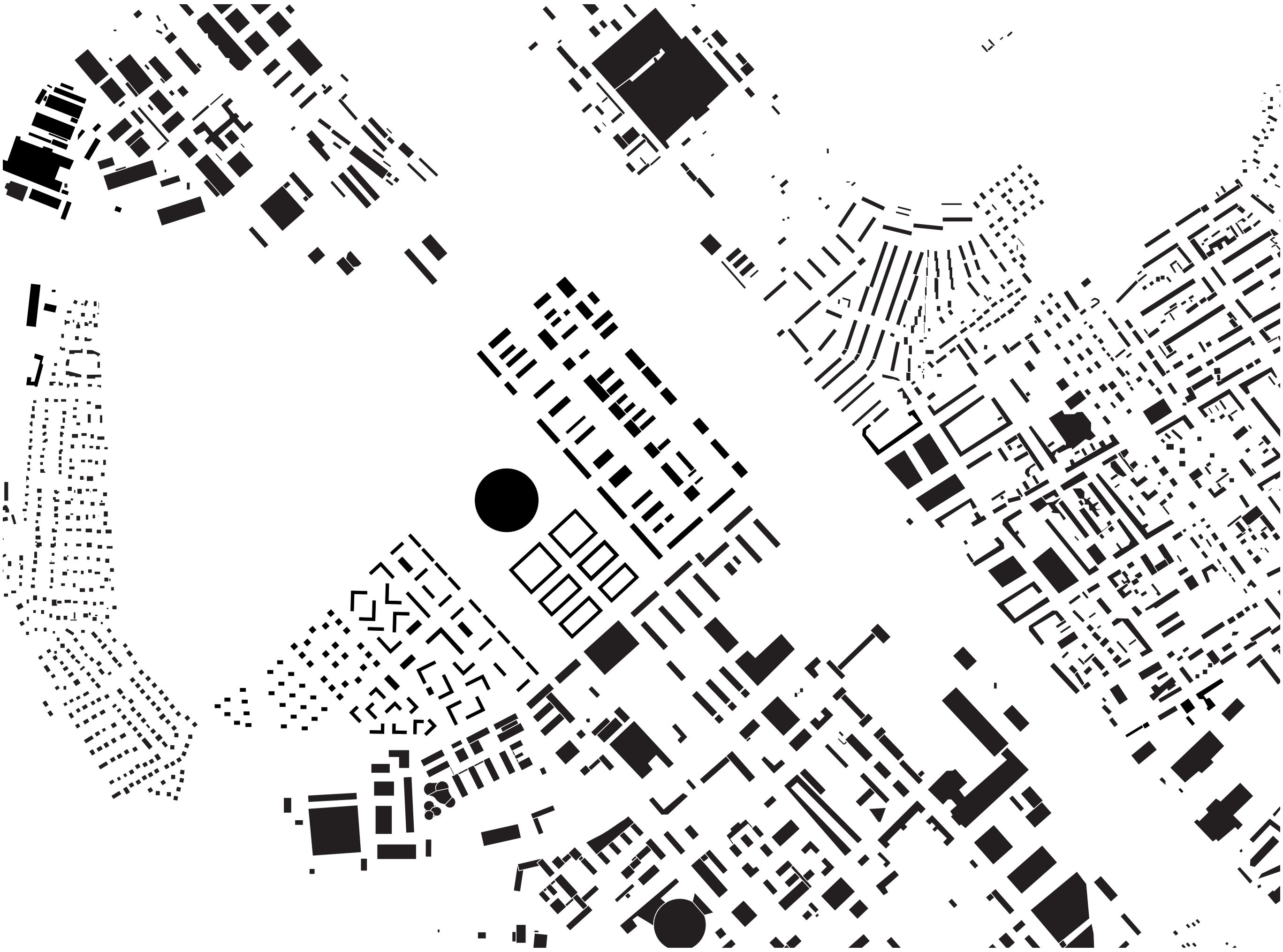




Strategy- Green District







Strategy Plan 4

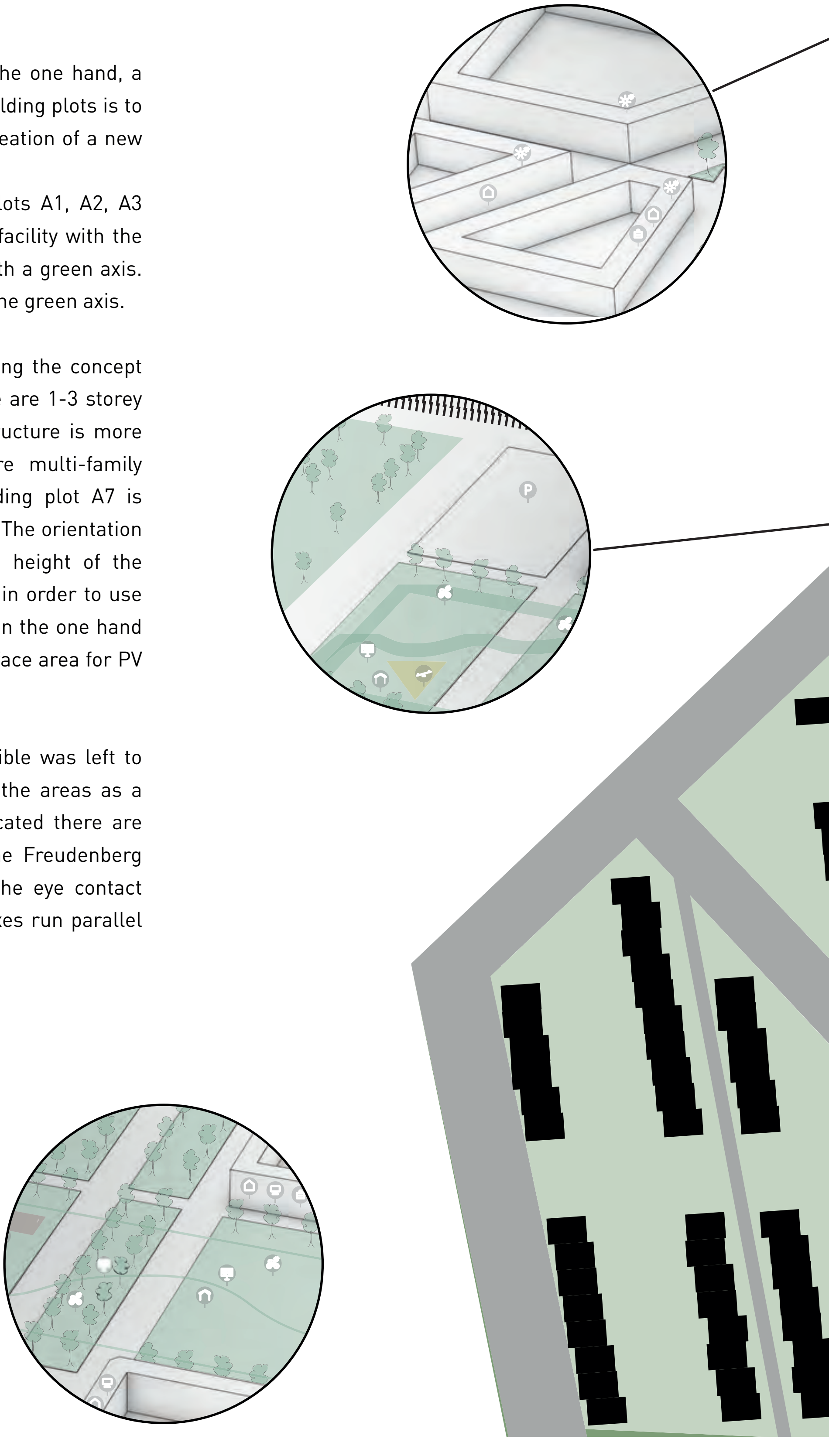
Campus Life

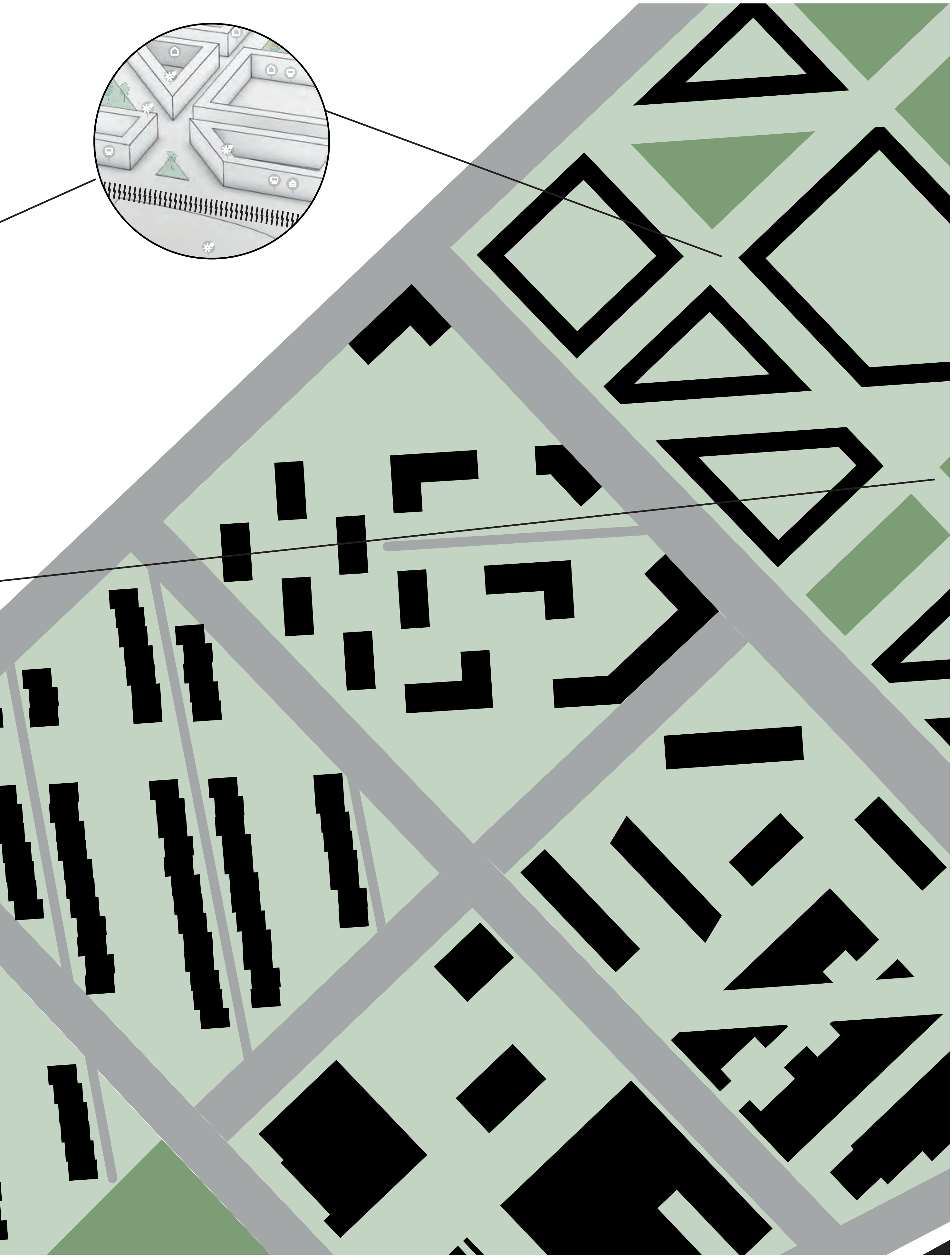
The concept for life on the campus refers to the landscape park and the building plots A1, A2, A3, A6 and A7.

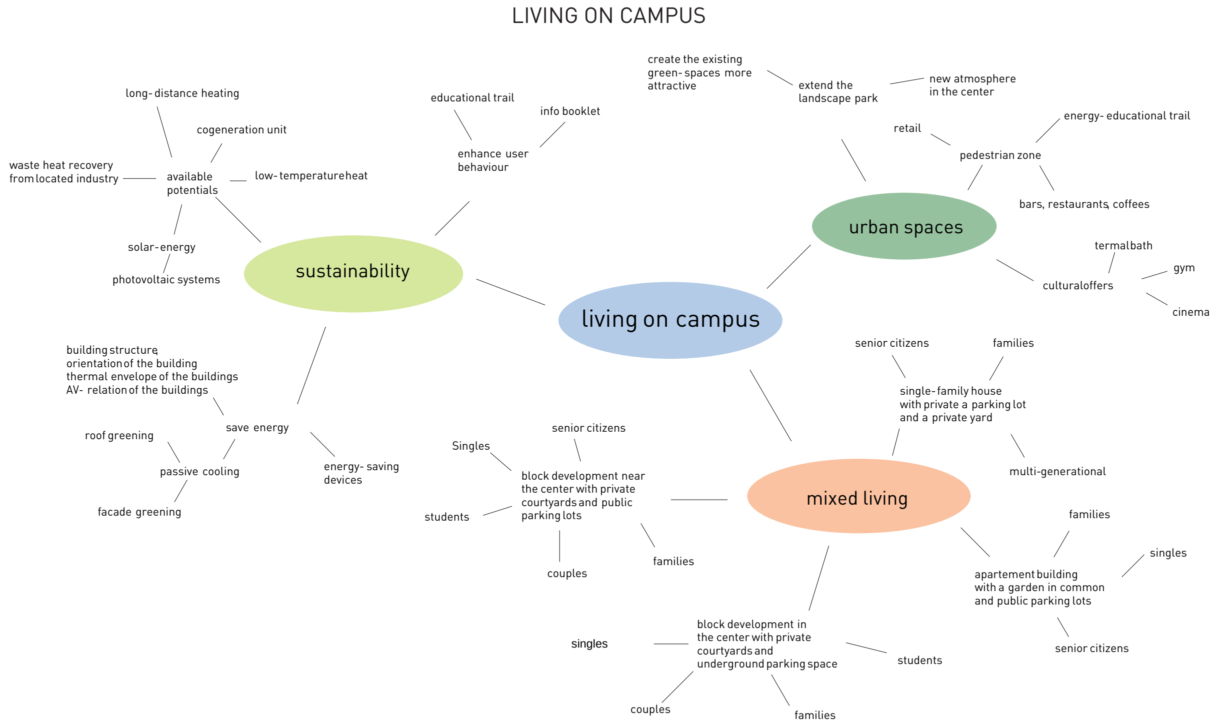
The concept follows three main objectives. On the one hand, a functional distribution and a link between the building plots is to be ensured, on the other hand the goal is the creation of a new urban centre.
A residential area is located on the building plots A1, A2, A3 and A7, building plot A6 connects the research facility with the park and is characterised by its urban centre with a green axis. Numerous shops and businesses are settled on the green axis.

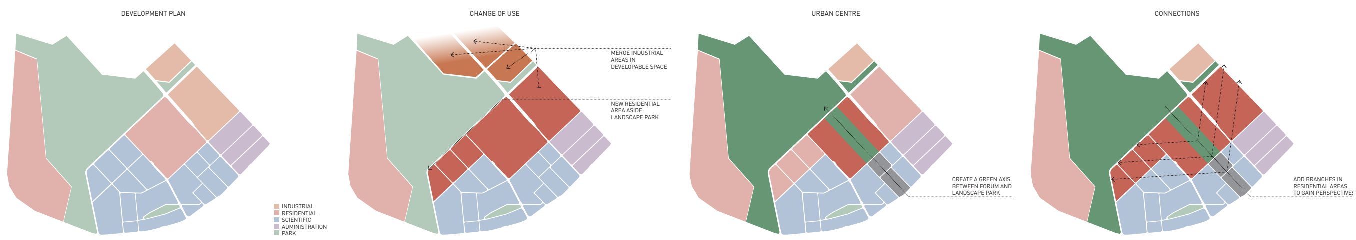
Three different building types were defined during the concept planning. On the building plots A1 and A2, there are 1-3 storey detached and terraced houses. The building structure is more coarse-grained on building plot A3, there are multi-family houses as well as a children´s nursery. Building plot A7 is planned with a block building with mixed usage. The orientation of the axes as well as the differences in the height of the buildings are oriented towards the sun's course in order to use the maximum solar energy. The roofs are used on the one hand as roof gardens and, on the other hand, as a surface area for PV systems.

Between the buildings, as much space as possible was left to introduce green areas into the city and to use the areas as a PV system. In addition, the thermal springs located there are operated by the excess heating power from the Freudenberg Power Plant. The axes have been created by the eye contact between the building plots. Individual viewing axes run parallel and serve as a pedestrian route.



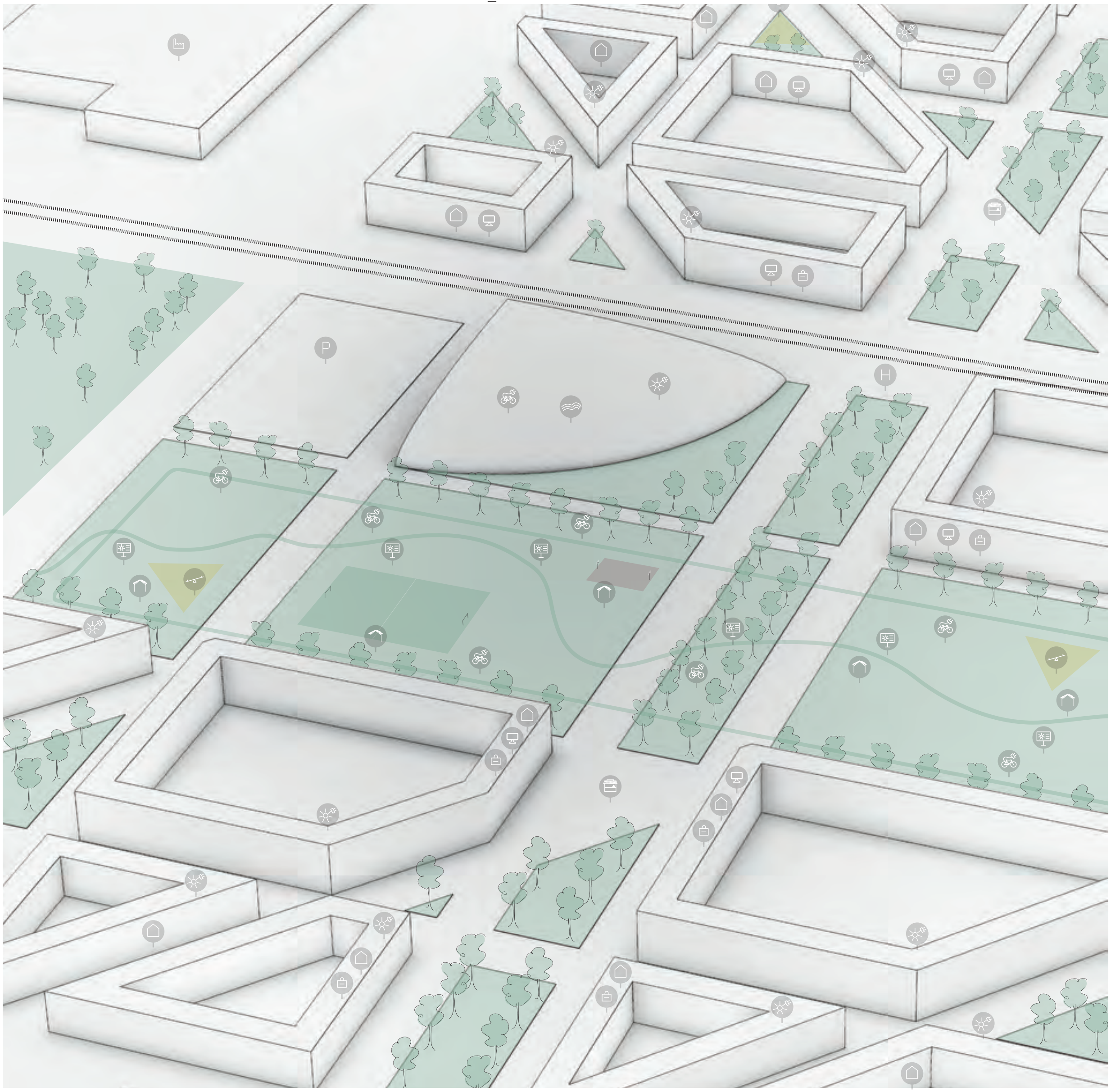


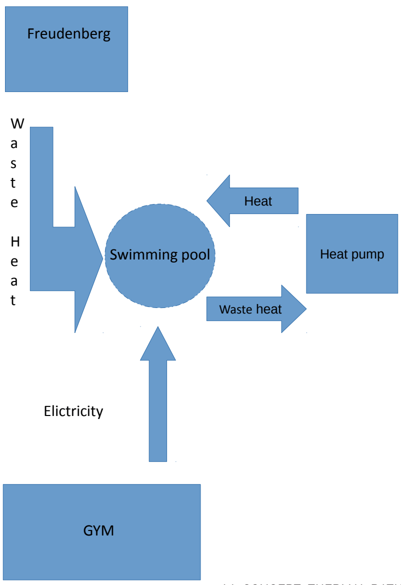




SITE PLAN
1.5000

A6_MIXED USE DISTRICT





A6_CONCEPT_THERMAL BATH

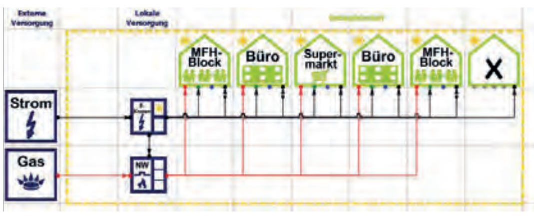
A RECREATIONAL AND EDUCATIONAL WALKWAY THROUH THE CENTRAL GREEN AREA EXPLAINS VARIOUS WAYS TO SAVE AND PRODUCE SUSTAINABLE ENERGY. DEMONSTRATED WITH HAND-OPERATED DEVICES.

A PARCOUR WITH TEN DIFFERENT EXERCISES SHOWS PRACTIALLY HOW POWER CAN BE CONVERTED TO ELECTRICITY. AN EVALUATION BETWEEN SOURCES IS POSSIBLE. (MENPOWER VS SUNLIGHT)

MIXED USE BUILDINGS IN THE CENTRE FACING THE PARK PROVIDE SPACE FOR STORES, RESTAURANTS, BISTROS, AND MORE LOCAL AMENITIES ON THE GROUND FLOOR. OFFICE SPACES, MEDICAL PRACTICES AND FURTHER SERVICES ARE LOCATED ABOVE. ROOFS EQUIPPED WITH PHOTOVOLTAICS.

THE THERMAL BATH IS LOCATED NEAR THE INDUSTRIAL AREA. IT OBTAINS WASTE HEAT OF FREUDENBERG TO WARM UP ITS POOL. ITS SHAPE IS DESIGNED TO ACCOMODATE THE HIGHEST AMOUNT OF PV POSSIBLE ON THE ROUNDED ROOF.
A SMALL AMOUNT OF ELECTRICITY IS PRODUCED BY USERS OF THE GYM MACHINES.

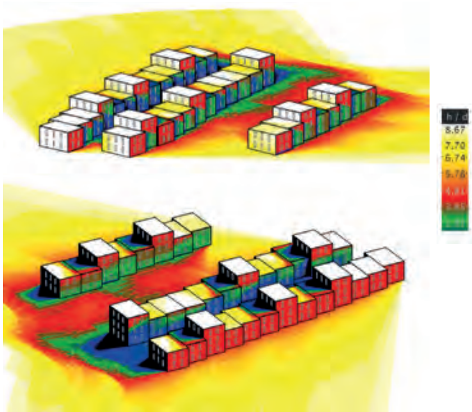
- RESIDENTIAL
- OFFICE SPACE
- RETAIL AND GASTRONOMY
- INDUSTRIAL
- PHOTOVOLTAICS
- SOLAR WALK
- KEEP-FIT TRAIL
- THERMAL BATH
- MARKET
- PLAYGROUND
- PAVILLION
- PARKING
- TRAM



A6_CONCEPT_ENERGY SUPPLY

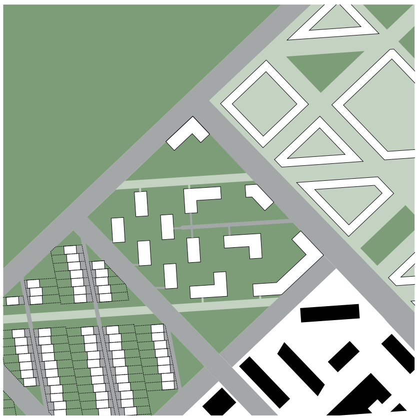
A1/A2_ROW STRUCTURE

A1/A2_SITE PLAN_1.2000

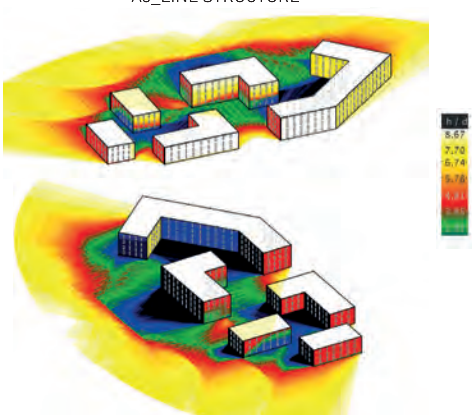


A1/A2_SOLAR IRRADIATION

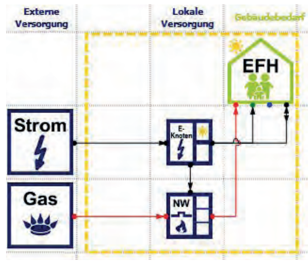
A3_LINE STRUCTURE



A3_SITE PLAN_1.2000

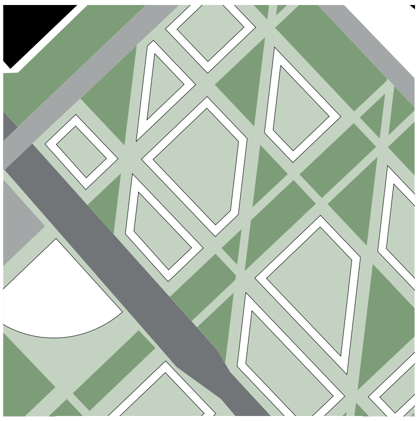


A3_SOLAR IRRADIATION

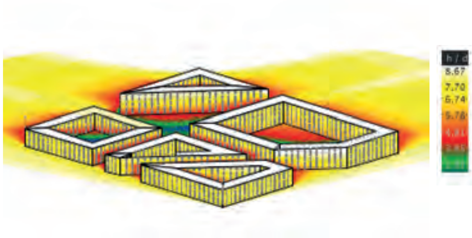


A1/A2/A3_CONCEPT_ENERGY SUPPLY

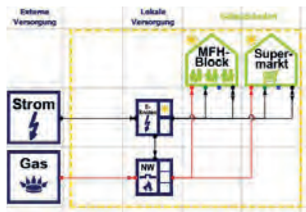
A7_BLOCK STRUCTURE



A7_SITE PLAN_1.2000

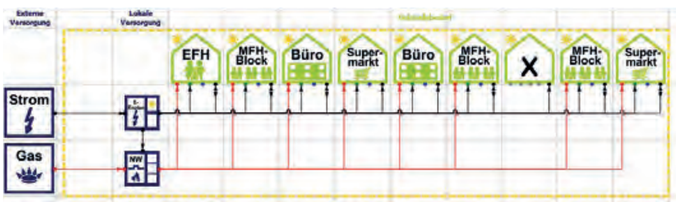


A7_SOLAR IRRADIATION



A7_CONCEPT_ENERGY SUPPLY

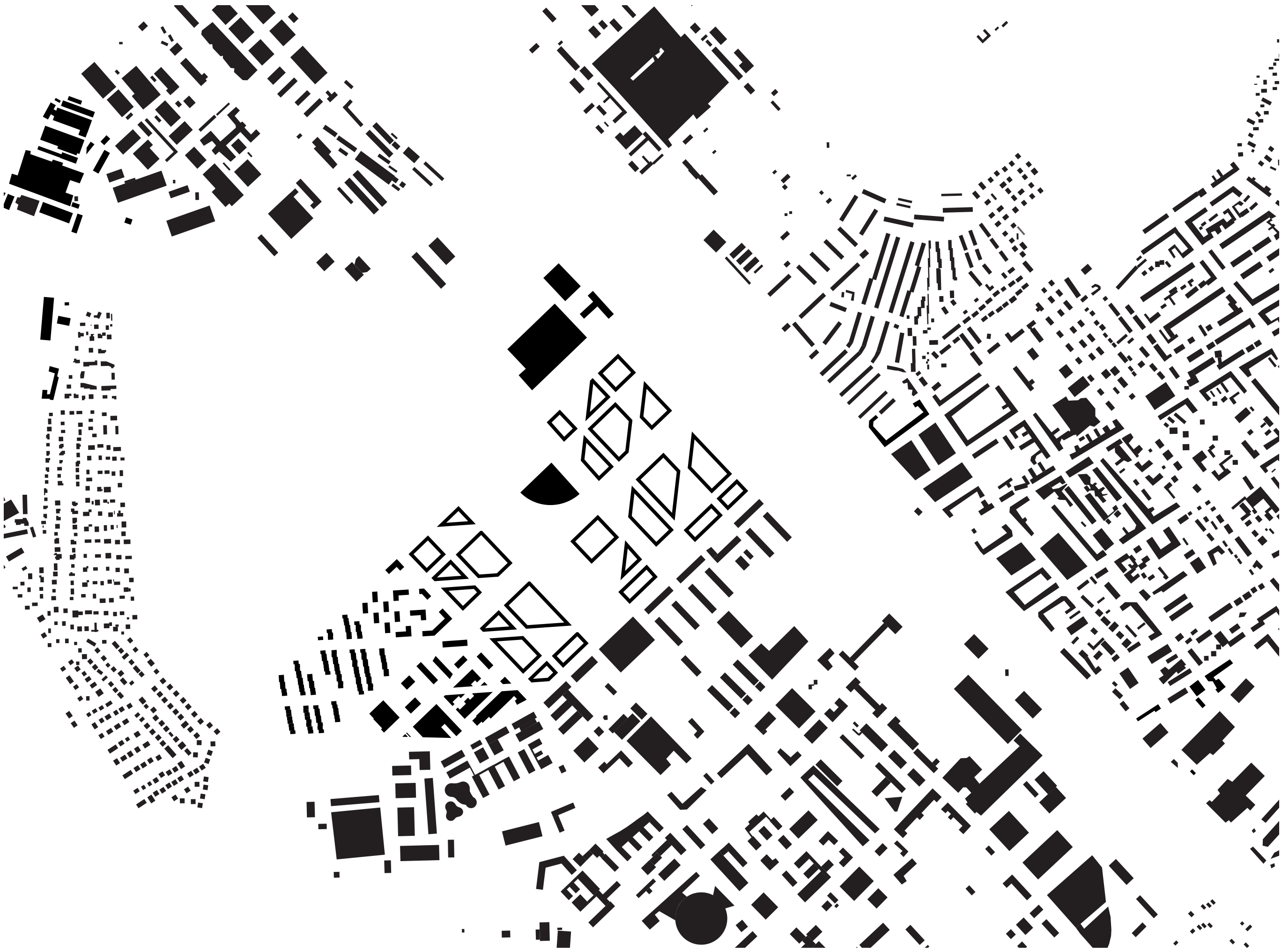
WHOLE DISTRICT



WHOLE DISTRICT_CONCEPT_ENERGY SUPPLY

• Habitable surface (A1, A2, A3): 20361,60 m²	ultimate energy demand: Primary energy demand: CO2 equivalent::	21 kWh/m²a -59 kWh/m²a -14 kg/m²a
• Industrial real esate + (A6): 105897,10m² Living space	ultimate energy demand: Primary energy demand : CO2 equivalent:	74 kWh/m²a 98 kWh/m²a 26 kg/m²a
• Habitable surface (A7): 77920,45 m²	ultimate energy demand: primary energy demand: CO2 equivalent:	75 kWh/m²a 118 kWh/m²a 32 kg/m²a
• Total area	ultimate energy demand: primary energy demand: CO2 equivalent:	60 kWh/m²a 106 kWh/m²a 29 kg/m²a
Renewable energy:		35 %

WHOLE DISTRICT_BALANCE



3/3 Results

Strategy Plan- Results

New Strategies for Adlershof

Public Final Presentation

The final presentation of the 'EnEff:Stadt summer school' took place at the Adlershof Forum, the centre of the entire development area. Surrounded by the campus of the Humboldt University of Berlin and prominent monuments of the German aviation history, a modern congress centre has been created. It is the perfect location to present the extensive results of the summer school.

Since the presentation was open to the public all interested parties, inhabitants of the area, planners, project managers, stakeholders, decision-makers and in addition the international partners of the IEA Task 51 were able to participate in the discussion. Within the IEA Task 51, various teaching methods are developed in relation to the topic of solar energy use in the urban context and then tested and evaluated in different workshops with students and educators. For this reason, the developed teaching methods within the interdisciplinary 'EnEff:Stadt summer school' as a testing ground were of particular importance for the heads of sub-task D for education Tanja Siems and Katharina Simon. Therefore it was important that the case study offers a comprehensive range of relevant criteria for the interdisciplinary summer school for the students.

The development area Adlershof guaranteed this complex range of tasks concerned within the urban development area, and therefore offered the students a wide range of research components. During the intensively supervised days, the students were able to comprehensively deal with the questions regarding the urban planning processes and energetic implementation into the strategies. In form of comparative studies, these urban and energetic proposals for the Adlershof expansion areas were developed, with the aim of creating new ideas and impulses for the further development of the site. At the end the results presented by the students were ranging from urban strategy plans to technical drawings and energetic calculations to build urban scale models.

The introductory words for the public discussion were held by Maria Wall as the head of IEA Task 51, to provide an overview of the interrelated interdisciplinary Summer school in Berlin within the international research project.

Afterwards Susanne Rexroth of the University of Applied Sciences in Berlin presented the Adlershof development area with its urban and energetic tasks and challenges, followed by Tanja Siems from the Bergische Universität Wuppertal explaining the theme and procedural methods of the Summer school.

Immediately following these introductions, the students had the opportunity to present their own energy concepts and urban strategies in a format of short presentations and on the basis of the produced plans and urban models. Furthermore the different approaches of the students, also in regards to the working process in the different interdisciplinary groups, were presented. Alternative design approaches were generated ranging from experimental to purely conceptual strategies. Whilst one group devoted itself in particular to urban and infrastructural aspects, another group created an urban concept that focused intensively on the optimal orientation of the building structure for focusing on the use of solar gains. The given planning tools and methods enabled the students completely to new approaches in the planning and design process and therefore diverse results were produced.

In addition, the interdisciplinary cooperation between different academic and practise related specialist led to unusually wide-ranging design approaches, which created at the end of the intense daily workshops innovative concepts. In the following public discussion, these concepts were explained and argued on the basis of a question and answer round. Based on the high level of participation within the discussion rounds a great level of interest in the student´s work became apparent.

This compact format of a summer school always requires a clearly defined framework, a clearly formulated task and intense strategic work beforehand. Only in this way a combination of academic and practical input in seminars, lectures, tutorials and guest criticisms, innovative results can be produced in such a short period of time.

Final Presentation

Impressions















Impressions














We would like to thank all supporters and partners for the friendly support of our project:

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Gefördert durch:

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SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

CITY IN TRANSITION
Solar Energy in Urban Planning
June 2017
English Version

IMPRINT

Project:
City in Transition - Solar Energy in Urban Planning
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Project management:
Tanja Siems/ Katharina Simon

Editors und Authors:
Institute for urban design and urban research
Tanja Siems/ Katharina Simon

Contributor Section Tools "EnOB-Lernnetz" and "DECA":
Institute for building physics and technical services
Susanne Hendel

With the support of the students:
Alexandra Brezinski/ Nina Müller/ Nils Schäfer

Layout template:
Bärbel Offergeld

Layout implementation:
Katharina Simon

Photos:
Margarethe Korolkow
Theo Lorenz
Nils Schäfer
Tanja Siems
Katharina Simon

Participants:
Marie Vassilissa Airaudo, Lisa Beyerle, Julia Blasius, Daniel Branchereau, Alexandra Brzesinski, Geraldine Derdulla, Jan-Philipp Ehrlich, Maya Hörner, Hertta Liisa Immonen, Alexander Jänike, Suna-Maria Knell, Theresa Lörsch, Nina Müller, Toni Reichelt, Yves Reinhard, Kezban Saritas, Nils Schäfer, Moritz Scharwächter, Tobias Schmidt, Daniel Tauber, Konstantin Thurow, Jirim Toysim, Nikolai Werner, Sascha Wigger.

University of Wuppertal
Institute for urban design and urban research
Prof. Dr.-Ing. Tanja Siems
Haspeler Straße 27
42285 Wuppertal
Tel. 0049 202 439 4262

E-Mail: staedtebau@uni-wuppertal.de
Web: http://www.splusu-arch.uni-wuppertal.de

Annex - IEA Solar Heating and Cooling Programme

The Solar Heating and Cooling Technology Collaboration Programme was founded in 1977 as one of the first multilateral technology initiatives ("Implementing Agreements") of the International Energy Agency. Its mission is to enhance collective knowledge and application of solar heating and cooling through international collaboration to reach the goal set in the vision of solar thermal energy meeting 50% of low temperature heating and cooling demand by 2050.

The members of the IEA SHC collaborate on projects (referred to as "Tasks") in the field of research, development, demonstration (RD&D), and test methods for solar thermal energy and solar buildings.

A total of 58 projects have been initiated, 50 of which have been completed. Research topics include:

- Solar Space Heating and Water Heating (Tasks 14, 19, 26, 44, 54)
- Solar Cooling (Tasks 25, 38, 48, 53)
- Solar Heat or Industrial or Agricultural Processes (Tasks 29, 33, 49)
- Solar District Heating (Tasks 7, 45, 55)
- Solar Buildings/Architecture/Urban Planning (Tasks 8, 11, 12, 13, 20, 22, 23, 28, 37, 40, 41, 47, 51, 52, 56)
- Solar Thermal & PV (Tasks 16, 35)
- Daylighting/Lighting (Tasks 21, 31, 50)
- Materials/Components for Solar Heating and Cooling (Tasks 2, 3, 6, 10, 18, 27, 39)
- Standards, Certification, and Test Methods (Tasks 14, 24, 34, 43, 57)
- Resource Assessment (Tasks 1, 4, 5, 9, 17, 36, 46)
- Storage of Solar Heat (Tasks 7, 32, 42, 58)

In addition to the project work, there are special activities:

- SHC International Conference on Solar Heating and Cooling for Buildings and Industry
- Solar Heat Worldwide – annual statistics publication
- Memorandum of Understanding – working agreement with solar thermal trade organizations
- Workshops and seminars

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For more information on the IEA SHC work, including many free publications, please visit www.iea-shc.org