



TECHNISCHE
UNIVERSITÄT
DARMSTADT

ENB

TECHNISCHE UNIVERSITÄT DARMSTADT
FB ARCHITEKTUR PROF. CHRISTOPH KUHN
FG ENTWERFEN UND NACHHALTIGES BAUEN

Internationale summer school

2013-2015

Interkulturelle Weiterentwicklung von Konzepten für das energieeffiziente Bauen und die nachhaltige Stadt der Zukunft in den Jahren 2013-2015

Abschlussbericht des interkulturellen Lehrangebots der
TU Darmstadt, gefördert unter dem Az: 31348/01-25
von der Deutschen Bundesstiftung Umwelt

von

Prof. Christoph Kuhn
Christoph Drebes
Dr. Steffen Wurzbacher

Darmstadt 2017

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06/02		Projektkennblatt der Deutschen Bundesstiftung Umwelt			
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Kooperationspartner	TU München Fakultät für Architektur – Lehrstuhl Bauklimatik und Haustechnik				
Zielsetzung und Anlass des Vorhabens					
Die summer school ist im Themenfeld des nachhaltigen und energieeffizienten Baues verankert und verfolgt hier das Ziel einer internationalen Vernetzung und Zusammenarbeit von Universitäten und den teilnehmenden Studierenden. Der globale Themenkomplex des Klimawandels und der Ressourcenverknappung wird in länderübergreifender Zusammenarbeit von Studierenden aufgegriffen und in Verbindung mit ausgewiesenen Wissenschaftlern und Forschenden in Lösungsansätze, auf den Schlüsselebenen Städtebau und Hochbau, zusammengeführt. Die Umweltrelevanz dieser Thematik wird dadurch deutlich, dass in Städten ca. 80% des weltweiten Energieverbrauchs anfallen und Gebäude ca. 40% aller Kohlendioxidemissionen verursachen.					
Darstellung der Arbeitsschritte und der angewandten Methoden					
Die summer school nimmt sich dieser Problematik auf besondere Weise an. Hochrangige Wissensvermittlung und kreative Arbeit in interkulturell zusammengesetzten Teams regen an, innovative Lösungen für die dringlichen gesellschaftlichen Aufgaben zu finden, dies vernetzt sowohl auf den städtebaulichen, wie auf hochbaulichen Bearbeitungsebenen. Durch interkulturellen Austausch zwischen Studierenden und Universitäten wird ein intensiver Wissens- und Erfahrungstransfer angeregt. Gestartet mit dem Thema „active buildings – active cities“ in der summer school 2013 und daran nahtlos anknüpfend die Behandlung des Themas „adaptive skins in urban structures“ in der summer school 2014 wurde die Serie mit dem Thema „sufficiency strategies in urban architecture“ im Sommer 2015 beendet.					
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Ergebnisse und Diskussion

Die ganzheitliche Auslegung der Veranstaltung von der aktiven Solarenergienutzung über die Kombination von Architektur und Technik bis zur Beeinflussung von Effizienzstrategien in Gebäuden auf die Nutzer und Nutzungsweisen führte zu einer umfangreichen Zusammenstellung kulturell geprägter differenzierter Herangehensweisen und inhaltlicher Beiträge der summer school eigenen Fragestellung. Dabei zeigte sich in jeder der drei Veranstaltungen ein weltweit gegebenes intensives Interesse zur Arbeit am viele Disziplinen berührenden Thema einer nachhaltigen Errichtung und Betrieb von baulichen Strukturen. Die Teilnehmergruppen setzten sich daher neben dem überwiegenden Teil an Architekten auch ganz wesentlich aus fachlich angrenzenden Disziplinen zusammen, wodurch neben rein architektonischen Fragen Aspekte der Gebäudetechnik, Bau- und Stadtklimatik wie auch der Soziologie Berücksichtigung fanden.

Öffentlichkeitsarbeit und Präsentation

Im Zuge der Projektlaufzeit wurden jährlich zum Abschluss einer jeden Veranstaltung die Ergebnisse der studentischen Arbeiten gepaart mit den wesentlichen Aussagen der geladenen Fachexperten zusammengestellt und als Dokumentation der Veranstaltung als Druckexemplar und digital verfügbar gemacht. Dabei wurden diese Broschüren einerseits den Teilnehmern zugestellt, zur Bewerbung folgender Veranstaltungen genutzt und auf Anfrage an ein interessiertes Fachpublikum im Rahmen von universitätsinternen Veranstaltungen, wie fachbezogenen externen Veranstaltungen weitergegeben. Auch im Zuge weiterer Bestrebungen des Fachbereichs Architektur der TU Darmstadt wurden diese Broschüren gerne zur Präsentation des eigenen Profils eingesetzt.

Die summer school und ihre inhaltliche Ausrichtung wurde daher auch außerhalb des universitären Umfelds wahrgenommen, was zur Einladung zum 2. DB-Kongress zum Thema des suffizienten Bauens führte. In einer Präsentation und Posterausstellung wurde das Konzept und Teile der Ergebnisse der Serie an summer schools zur Nachhaltigkeit in Architektur und Stadt dargestellt. Durch sporadisch weiterhin eingehende Anfragen zur Teilnahme an einer erneuten Veranstaltung zeigt nachdrücklich die Relevanz der gewählten inhaltlichen Ausrichtung der Veranstaltung und den erreichten Bekanntheitsgrad des Formats.

Fazit

Zusammenfassend lässt sich der Verlauf der Veranstaltung und die daraus erwachsenen über die summer school hinaus wirkenden Verbindungen auf privater und beruflicher Ebene als umfänglichen Erfolg attestieren. Entsprechend den beantragten Vorstellungen wurde mit den drei sehr international ausgerichteten Veranstaltungen ein weiterer Beitrag zur weltweiten Etablierung der an der TU Darmstadt seit vielen Jahren gelebten Grundvorstellung zur Entwicklung nachhaltig ausgelegter Architekturen und Stadtstrukturen erreicht werden. Über etablierte Kontakte zwischen Universitäten und Studierenden zeigte die jüngste Vergangenheit bereits einen weiterhin anhaltenden Austausch an Wissen und durch Studienaufenthalte von Studierenden der TU Darmstadt an den teilgenommenen Universitäten.

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Interkulturelle Weiterentwicklung von Konzepten
für das energieeffiziente Bauen und die nachhaltige
Stadt der Zukunft in den Jahren 2013-2015

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Kurzfassung

Die in den Jahren 2013-2015 ausgerichteten internationalen
summer schools am Fachbereich Architektur der TU Darmstadt
verfolgte das Ziel einer internationalen Vernetzung und
Kooperation zwischen Universitäten und Studierenden im
Themenfeld des energieeffizienten und nachhaltigen Bauens.
Die komplexen globalen Herausforderungen des
Klimawandels und der Ressourcenknappheit bedingt eine
transnationale Zusammenarbeit von Studierenden zu den
zentralen Themen des Urbanismus in Planung und Bau. Die
Umweltrelevanz dieses Themas wird veranschaulicht
durch den städtischen und gebäudebezogenen Verbrauch.
Städte beanspruchen bis zu 80% des weltweiten Energiebedarfs,
während der Anteil der Bestandsgebäude alleine einen
Anteil von 40% an der Emmission von Kohlendioxid hat.

In internationalen und kulturellen Teams wurden die Teilnehmer
gestützt durch inhaltlich bezogene Expertenbeiträge angehalten
kreativ und inhaltlich fokussiert innovative Lösungen für spezifische
Aufgabenstellungen zu finden. Die Aufgabenstellungen orientierten
sich an aktuell relevanten Fragestellungen zur nachhaltigen Stadt-
und Gebäudeentwicklung. Der intensive interkulturelle Austausch
zwischen den Teilnehmern und Universitäten hatte als einen
über die zweiseitigen Veranstaltungen hinausgehenden
Erfahrungs- und Wissenstransfer anzuregen.

Es wurde bei der Auswahl der über Bewerbungsverfahren
erreichten Teilnehmer und Universitäten Wert darauf gelegt, dass
sich das Teilnehmerfeld aus Gruppen und Einzelteilnehmern
zusammen stellte, die regional bedingt unterschiedliche
Ausgangslagen und herangehensweisen erwarten ließen um
einen größtmöglichen Austausch erreichen zu können.

Die jährlichen erarbeiteten Ergebnisse wurden nach Abschluss
der Veranstaltung zusammengetragen und in Form einer
abschließenden Dokumentation den Teilnehmern angeboten.

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CHAP. I Zusammenfassung

summer school team 2013
active buildings-active cities



summer school team 2014
adaptive skins in urban structures



summer school team 2015
sufficiency strategies in urban architecture



1. Interkultureller Austausch

Das Forschungs- und Lehrkonzept der summer school Serie hatte als wesentliche Projektziele die internationale Vernetzung und den interkulturellen Austausch. Dabei sieht der Fachbereich Architektur der TU Darmstadt eine Notwendigkeit, nachhaltiges und energieeffizientes Bauen in der Lehre verstärkt in einen internationalen Kontext zu stellen. Mit der weiterhin bestehenden Absicht durch eine zunehmende internationale Öffnung des Fachbereichs und des Lehrprogramms wird die Maßgabe verfolgt die interkulturellen Austausch zu fördern.

Betrachtet man die Weitläufigkeit der internationalen Teilnehmer der summer school so zeigt sich, dass das anfänglich angestrebte Projektziel umfänglich erreicht wurde.

In der summer school Veranstaltung des Jahres 2013 durfte der Fachbereich Architektur der TU Darmstadt Teilnehmer der American University in Cairo, des Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico Campus Querétaro, der Woodbury University in San Diego sowie der TU München begrüßen.

Im Jahr 2014 setzte sich die Veranstaltung zusammen aus teilnehmenden Universitäten aus den Ländern China (Tonji University, Shanghai), Österreich (TU Wien), New Sealand (University of Auckland), sowie Einzelteilnahmen aus den Ländern Moldavien, Kanada, Iran, Spanien und weiteren Teilnehmern aus Deutschland.

Die letzte summer school der beantragten Serie durfte als Teilnehmer Gruppen der Univeristas Trisakti, Jakarta, des Instituto Universitário de Lisboa, des Institut National des Sciences Appliquées des Strasbourg und der Escola da Cidade, Sao Paulo begrüßen. Zudem nahmen 2015 eigeninitiativ Bewerber der Länder Italien, China, Pakistan und Deutschland teil.

Gemeinsam mit Studierenden der TU Darmstadt wurde in den Jahren TU Darmstadt intern aber auch über die universitären Grenzen hinaus das internationale Profil des Fachbereichs Architektur der TU Darmstadt gestärkt und die besondere Bedeutung des Energieeffizienten und nachhaltigen Bauens des Fachbereichs grenzübergreifend vermittelt.

fig. 1:
attending universities of summer school 2013-2015

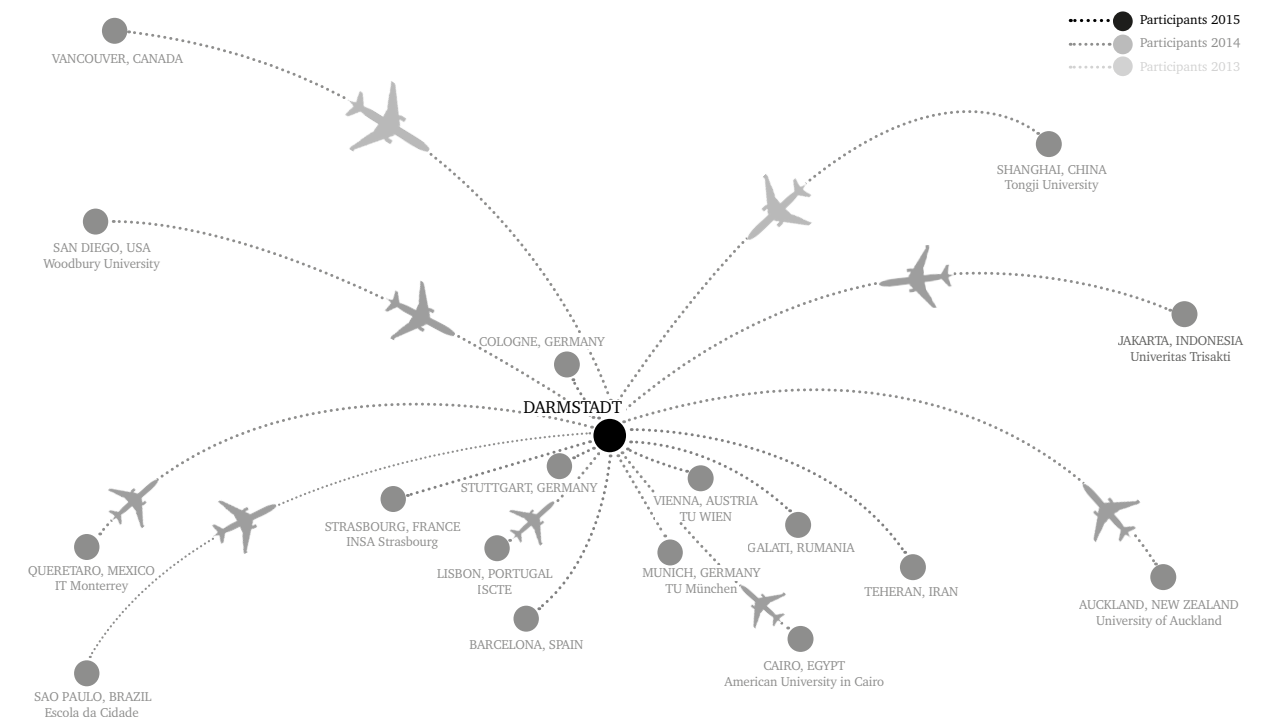


fig. 2:
the world meeting in Darmstadt,
international summer school network

2. Internationaler Diskus zur Transformation der Versorgungsstrukturen baulicher Strukturen

In den letzten Jahren hat eine Diskussion auf internationaler Ebene zur Zukunft der gebauten Umwelt begonnen. Diese wird vor allem vor dem Hintergrund begrenzter Reserven fossiler Brennstoffe und der Notwendigkeit von Adaption- und Mitigationsmaßnahmen im Hinblick auf den Klimawandel geführt. Dabei stehen Themen der Transformation energetischer und infrastruktureller Versorgungssysteme und die Optimierung vorhandener baulicher Strukturen im Fokus, ohne den städtebaulichen und architektonischen Wert der gebauten Umwelt zu schmälern

Die summer school adressierte daher durch konkrete Projektarbeiten gezielte Fragestellungen und konnte durch intensive Wissensvermittlung und Wissensaustausch Grundkonzepte nachhaltigen Bauens fixieren die über die Veranstaltung hinaus international Anwendung finden werden. Dabei konnten auch insbesondere Studierende des Fachbereichs Architektur der TU Darmstadt im unmittelbaren Austausch mit ihren internationalen Kommilitonen wertvolle Erfahrungen des internationalen Bauens für ihr zukünftiges berufliches Leben sammeln.

Ressourcenknappheit und Klimawandel setzen gerade im Bauwesen und in der Stadtentwicklung ein Umdenken in Gang, Gehen doch allein von diesem Sektor ca. 40% des Energieverbrauchs und der Emissionen aus. Ressourcen- und Energieeffizientes Bauen ist ein Gebot der Zeit; es wird durch rechtliche Instrumente wie auch durch Städte, Kommunen, Bauherren, Architekten und die Industrie vorangetrieben. Noch weniger vorangekommen ist die Entwicklung regionaler und quartiersweiter Energiekonzepte, die viele ergänzende Möglichkeiten zur Energieeffizienzsteigerung bieten. Gebäude können hierbei nicht nur die Rolle des Energieverbrauchers, sondern auch des Energieproduzenten und -speichers in einem quartiersweiten Versorgungsnetzwerk übernehmen. Dazu tragen nicht nur bauliche und technische Möglichkeiten zur regenerativen Energieerzeugung bei, sondern auch erhöhte Gebäudestandards und ein angepasstes Lastmanagement. Des Weiteren sind neben ökologischen Aspekten und der damit einhergehenden Verbesserung der Umweltmerkmale die Anhebung des Nutzerkomforts, die Verringerung der Betriebs- bzw. Nebenkosten Bestandteile nachhaltiger Energiekonzepte.

Die umfassend formulierten Aufgabenstellungen der summer schools die von der städtebaulichen Grundidee über konkrete hochbauliche Konzepte bis zur Bewertung der energetischen und komfortbezogenen Parameter gewählter Konzepte ein großes Tätigkeitsfeld boten, ermöglichten es den Teilnehmern sich den eigenen Zielvorstellungen entsprechende thematische Schwerpunkte zu wählen und gezielt zu vertiefen.

Durch die jährlich erstellte und veröffentlichte Dokumentation der workshop Ergebnisse wurde den Teilnehmern in komprimierter Form der inhaltliche Extrakt der summer school bereitgestellt und bot den folgenden

Veranstaltungen wesentliche Informationsgrundlagen zur weiteren Vertiefung des Gesamtthemas einer nachhaltigen Entwicklung baulicher und freiräumlicher Strukturen.

Als Download verfügbar werden diese Publikationen über die Internetseite der TU Darmstadt der interessierten Öffentlichkeit als weiterführende Grundlagen zur Verfügung gestellt.

Unter folgendem Link finden sie die Ergebnisse der summer school serie:

https://www.architektur.tu-darmstadt.de/international/international_courses/summer_school_1/intro.de.jsp

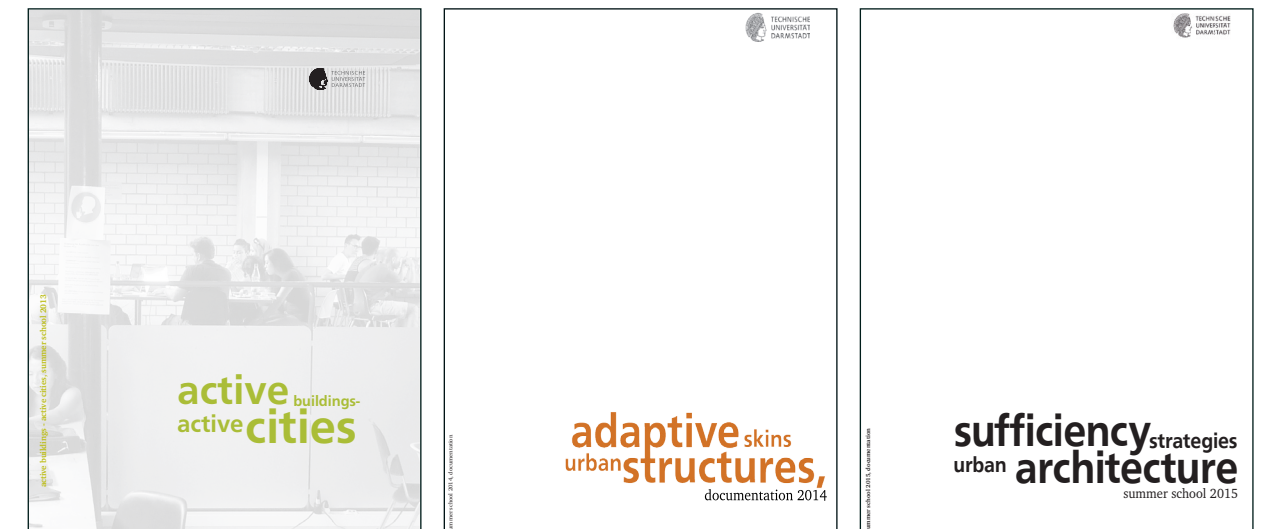


fig. 3: documentary of the three years summer school at the TU Darmstadt, available at the unit for sustainable design, TU Darmstadt

CHAP. II

Inhaltliche Ausrichtung der Internationalen summer schools des Fachbereichs Architektur der TU Darmstadt, 2013-2015

Die nachfolgenden Beschreibungen zum strukturellen Grundkonzept der Veranstaltungen sowie der Inhalts- und Ergebnisdarstellungen der einzelnen Veranstaltungen erfolgen in englischer Sprache. Dies beruht auf der internationalen Ausrichtung des Formates.

1. Background

Architecture and urban design portrays its society and reflects their cultural, social, and technological achievements. With this in mind, the façade of an individual building and urban space represents and describes the residents of a given area. Although the content and form of architectural expression has changed from one era to the next, the role as the representative “face” of a society, even during the radical façade reduction in classic modern times, has not changed. In accordance with energy transition and the increased change from using fossil fuels to renewable energy sources, building surfaces and urban spaces need to fulfill new demands.

Since the middle of 1977 architectural and urban surfaces meet increasing energy requirements in addition to their representative and constructive tasks. This is due to the enormous energy demands of buildings and cities worldwide. Therefore a supply of renewable energy needs to be decentrally organised and locally produced. In the temperate climate of Germany, ever since the first German thermal Insulation Ordinance in 1977, these energy requisites are dealt with particularly in terms of heating. Aside from minimizing heat loss through the building envelope, passive strategies that use solar power and sufficient openings make the interior rooms livable. Residential buildings have developed, through the progressive reinforcement of energy requirements, from a purely structural-physical principle to a passive house standard. This sets particularly high demands on the quality of the building envelope by strict limits on the transmission heat loss and high passive gains, regulated through building openings. Further demands for passive gains require a certain amount of window surface area depending on the buildings compass direction and a minimum distance between buildings. An energetic optimum in Germany is achieved through maximizing building openings to the south and, at the same time, minimizing openings on the other sides of the building.

In recent times active strategies for buildings and urban spaces have been in the focus of research and planning. With the progressive development of technical systems such as solar panels or photovoltaic systems, more and more building surfaces are producing the buildings own required energy. In the past years, a growing number of buildings with “zero-energy” or “plus-energyhouse” standard have been constructed. The buildings remaining energy demand is reduced through passive measures and profits from its own production of energy; electricity form Photovoltaic for example. In many cases, a building can produce more energy than needed and thus has a surplus of energy. In order to maximize energy production, specific buildings shapes and surface designs have been developed. Plus-energy houses require, just like passive houses, a minimum distance to surrounding buildings to avoid shade. In addition, an energetic optimum is achieved by making use of south oriented roofs and façades. Passive and active strategies require both south façades which can lead to conflicts. In addition, more conflicts arise in terms of the supply of daylight in interior rooms, ventilation, and design.

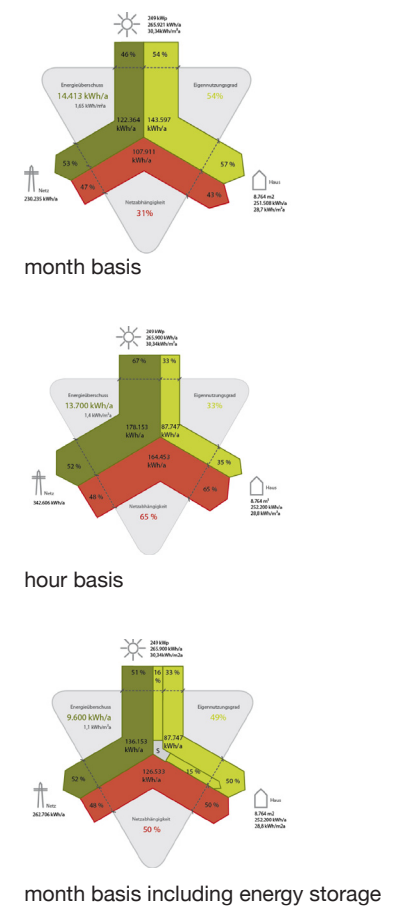


fig. 4: Potentials for Self-supply of buildings in context of different considered time frames

This shows that the requisites on the surface of buildings and urban spaces have become very complex. It is the planners and architects job to balance out and fulfill these complex requirements in order to have a holistic overall design. Adaptive can mean a changing system that automatically reacts to the surrounding circumstances; passive or active matters through solar yield or sun and heat protection for example. Another form of adaptation however can also be seen in terms of flexibility or multifunctional building structures that adapt to the ever changing building requirements; a structure with a curtain wall that can easily be dismantled and replaced to comply with changing building envelope demands.

2. Overall project, summer school 2013-2015

summer school 2013, active buildings – active cities

In the beginning, the many facets of sustainable architecture and urban planning are discussed. The previously described limits of coverage and balance all the way to establishing its potential on the scale level of the district. The expertise gained by the field of Design and Energy Efficient Building through the “SolarDecathlon” 2007/2009 (zero plus houses– new buildings) and “Efficiency Plus in Old Buildings, Neu-Ulm” (zero plus energy houses in old buildings) as well as the work in urban projects “UrbanReNet”, “Plus-energy-district Oberursel” and “Energy strategy Heilbronn” are integrated into the teaching program.

summer school 2014, adaptive skins in urban structures

The second summer school in 2014 engage into a deeper view into the necessary synergy for training and networking opportunities and the needs of active energy systems. The lectures focus on the integration of the surfaces of physical structures and urban spaces. The transformation of existing energy systems requires the systematic use of local energy sources – it will become necessary to energetically use the surfaces of buildings and spaces.

summer school 2015, sufficiency strategies in urban architecture

Sufficiency is one of the three columns of sustainability. Nevertheless, until now little attention has been paid to it in the architecture and urban planning. Research topics about sustainable architecture currently focus on improvements in energy efficiency, the integration of active systems into buildings or creating synergies by interconnecting urban spaces. Increasing demands of the society have currently halted all efforts. Energy demands have been lowered in Germany from approx. 210 kWh/ sq. m a (1949) to 150 kWh/sq. m a (2012). But all these savings have been “equalized” by the increasing surface demand per person from 19 sq.m (1949) to 43 sq.m (2012). Therefore all measures remain ineffective until sufficiency strategies are developed and practiced.

3. structural program concept of the summer school 2013-2015

welcome module

Upon arrival of the participants in Darmstadt, they introduced themselves and their home universities to each other. Subsequently, the quest, workshops, and organization of the summer school were presented and teams for each subject were created. Important in the constitution of the teams, besides a mix of expertise, was the intercultural exchange.

workshop module

Basic module within the summer school curriculum was the workshop day. Combined with ‘expert lectures’ by renowned representatives of the sustainable, energy-efficient building and planning sector, students gained comprehensive knowledge of the current state of research and development within the summer school’s subject area.

presentation module

In ‘intermediate presentations’, for which students prepared the current state of their work, they presented to and discussed with a forum of professors, docents and experts their works. Based on the results, comments and critique, students continued to develop their projects over the second week. The summer school was concluded with ‘final presentations’: In 15 minute lectures process and design results were presented again to a panel of professors, docents, external experts, supporters and sponsors.

exercise module

Part of the summer school program were excursions to several locations to see projects exemplifying the subject of the specific summer school. Different sites and buildings were visited in order to offer a large variety of insights to the participants.

informal module

Despite the intensive program of the summer school with all its lectures, exercises and the studio project, there was the occasional time for ‘informal’ events, underlining the importance of creating team spirit and to perform the intercultural exchange. Students were visiting an ‘äppler-garden’ in Frankfurt, there was a ‘Bergfest’ (half-way party) on the Lichtwiese, and besides the different barbecue or cooking events the nightlife was explored.

expert lectures

In the course of the events, speakers who had been awarded in specific areas concerning the summer school topic were invited to talk about the topic related questions. Their speeches were offering substantial contributions in terms of content to the holistic treatment of the events topic.

active buildings-
active cities,
summer school 2013

adaptive skins
urban structures
summer school 2014

sufficiency strategies
urban architecture
summer school 2015

fig. 5:
Series of summer schools in the years
2013 until 2015



fig. 6:
Photography of the welcome event of
summer school 2013

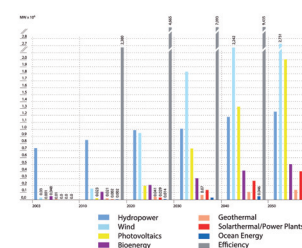
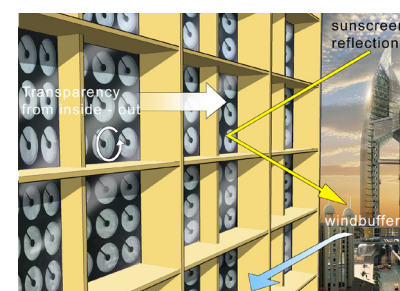
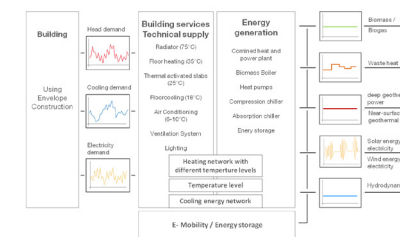
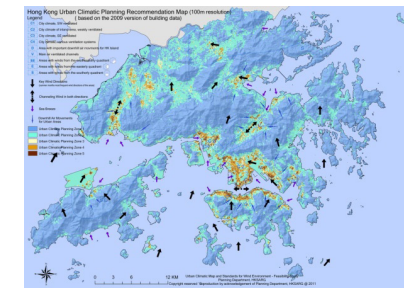
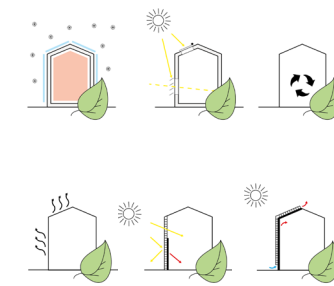


fig. 7: Exemplary impressions of different summer school lecture topics

CHAP. III **summer school 2013: active buildings - active cities**

21st July - 05th August 2013

Abstract of the summer school event 2013 with exemplary work results. For complete informations about the workshop see the attached summer school documentation 2013 „active buildings - active cities“ or follow the link:

https://www.architektur.tu-darmstadt.de/international/international_courses/summer_school_1/summerschool_2013_1/2013.de.jsp

1. exercise

In light of dwindling and finite fossil energy resources and of global climate change, strategies for an intelligent handling of energy in building design and urban planning are becoming increasingly important. Only through a holistic design process, starting with the analysis of use, location, and climate factors, continuing with the floor plan and building envelope design, leading up to detailed planning of space conditioning systems and building services, urban structures and buildings can emerge providing a maximum amount of comfort while demanding a minimal amount of energy. Hereby, the integrated use of renewable energy sources plays an important role.

The summer school at TU Darmstadt, which had been hosted in cooperation with the Unit of Building Climate and Building Systems of TU Munich, connected the experiences of holistic urban and neighborhood planning on a national level with the experiences of international colleagues in the field – in 2013 from the United States, Mexico and Egypt. Students worked jointly on a concrete assignment, a master plan concept for an urban area. The selected area is a city quarter in Frankfurt/Main, which is the major development area in the coming years.

The work on the assignment was divided in two steps: a joint analysis and a design phase. Analysis included researching local climate conditions and site potentials. Subsequently, participants depending on their interests and expertise, could choose either an urban or architectural design assignment.

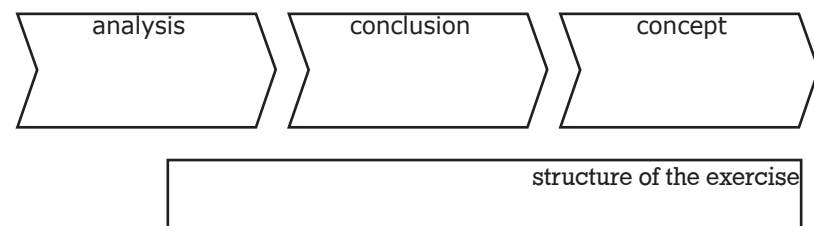


fig. 8:
structure of the exercise

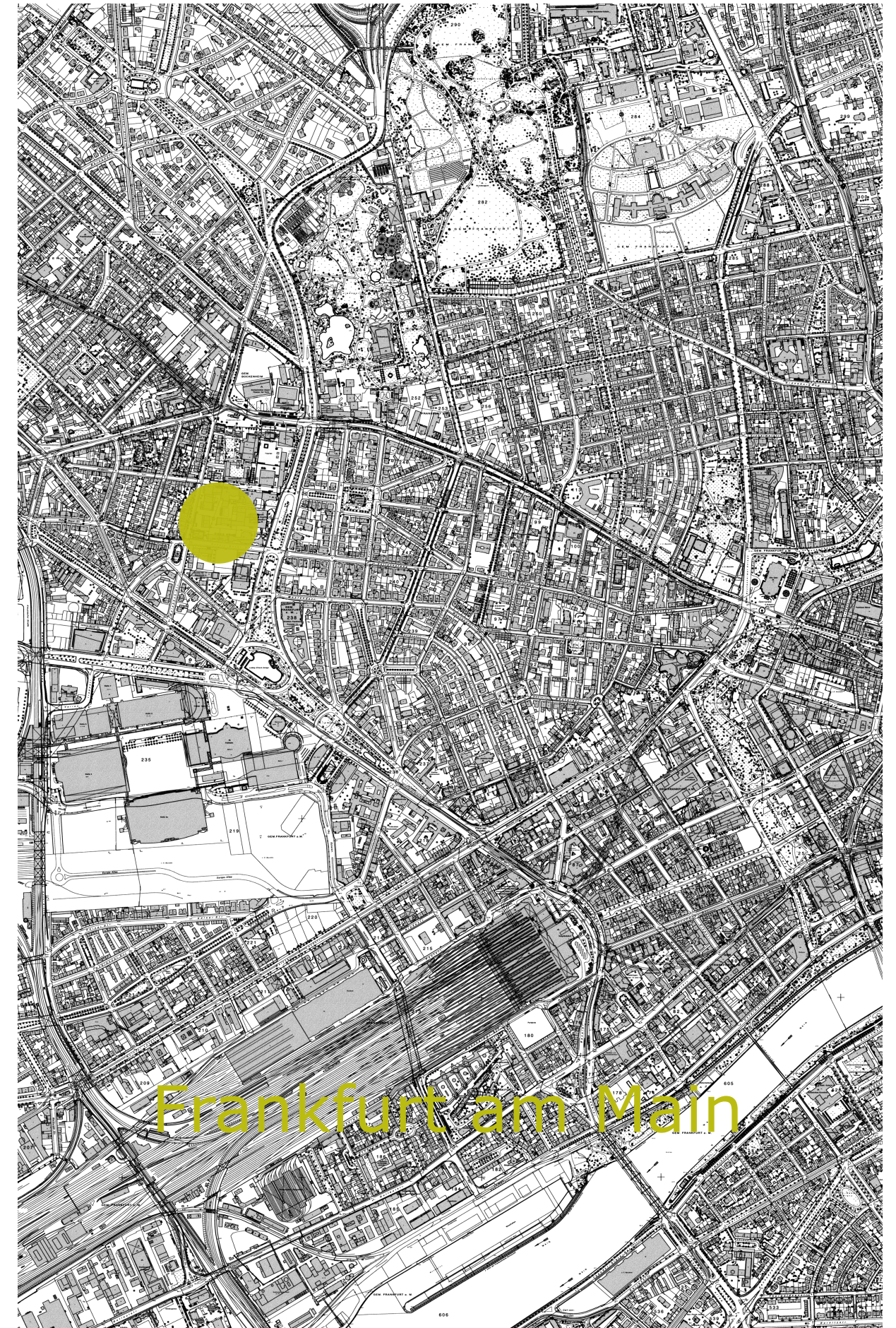


fig. 9:

2. analysis of potential

Within the assignment of the 2013 summer school a new future viable city quarter for the site in Bockenheimer had to be designed. The urban site was on the former core campus of the Goethe University Frankfurt. Formative in this area was the perimeter block development. This typical urban design element from the past had to be transported and transformed into today's and future urban design.

The first analysis of potential builded the basis for the two levels of consideration. Interdependencies of urban planning and building had to be analyzed and identified. The architectural design should result in a holistic building concept of architecture, building services and energy systems. Thereby the integration of energy systems and technical building services had to be designed as much as the facades as the face of the city, expression of individuality of its users, but also as climatic and energetically effective envelope. It was expected that through the concurrent design work from both urban and architectural design perspectives, a fruitful exchange between both disciplines happens, which, as a result will achieve a holistic picture of the development potential of the area of consideration.

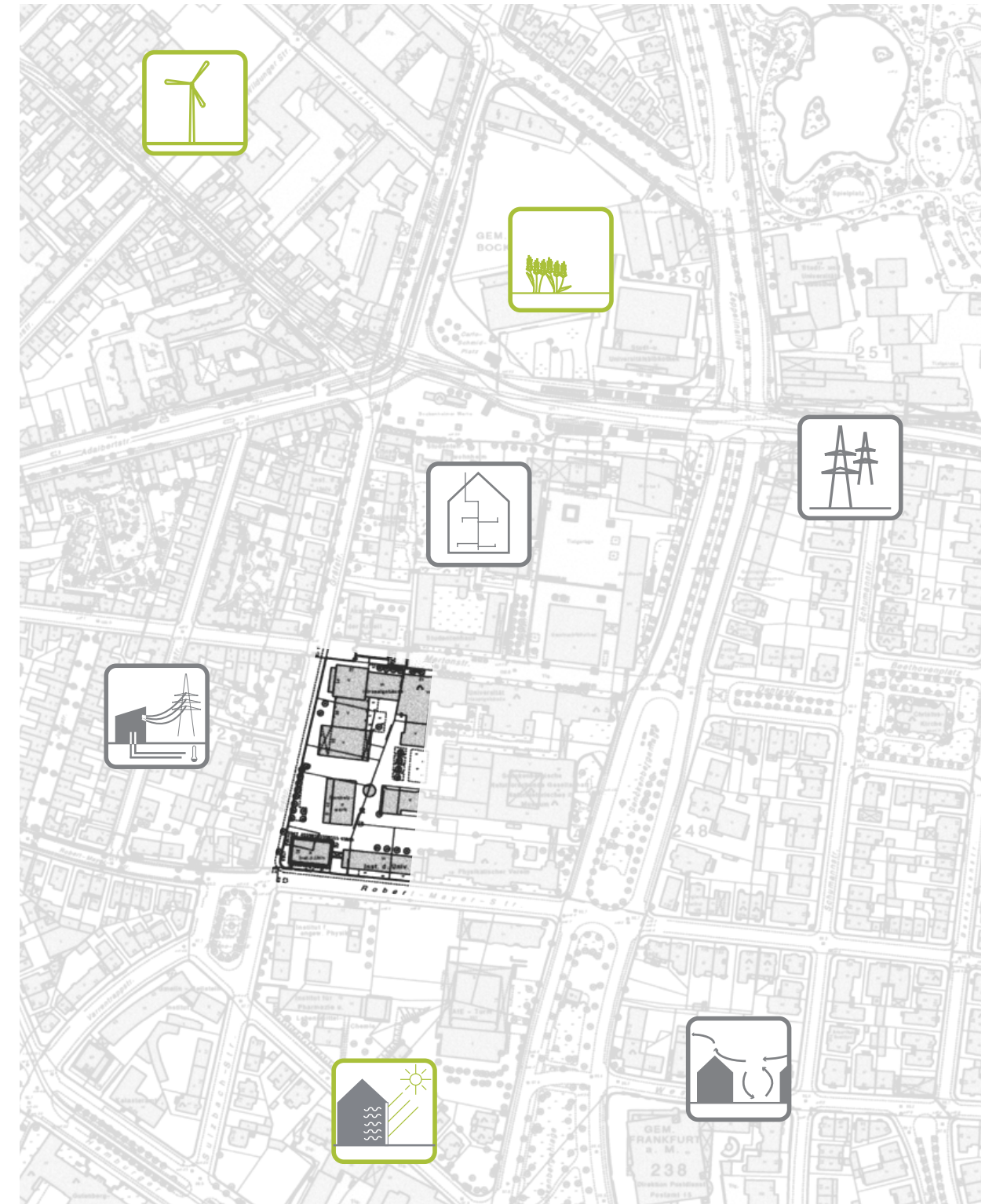


fig. 10:
Analysis of urban potentials for an urban design strategy and a building solution

3. exemplary design solutions

urban design site

At the site, a future-oriented city quarter with determinations on the subject of regenerative energy supply and distribution as well as adjusted specifications of demands, from the envisioned uses and selected building energy standards, were designed. Questions in the focus of urban design, among others were: What is a future viable city quarter? Which challenges for urban design occur due to the dwindling of fossil energy sources? How are energy-efficiency and urban structure connected? How does spatially optimized housing structures look like? Which flexibility offers the neighborhood of the future, e.g. for multi-generational dwelling? How much urban live does a quarter need, how much space for private retreat?

building design sites

For a location within the city quarter, an exemplary building had to be developed, under consideration and integration of existing buildings. Three sites were open for selection. Dependencies of the singular building with the urban design had to be analyzed and findings applied in the design concept. The architectural design should result in a holistic building concept, which integrates aspects of architecture, building services, energy supply through active generation and passive gains. Thereby, the integration of energy systems and technical building services had to be designed as well as the façade forming the climatic and urban envelope.



fig. 11:
Site for the urban design strategy and building solutions

urban design – group 2, summer school 2013

The interaction and social activities in urban spaces had been seen as a mayor target for developing the inner city area between the main station the city quater Bockenheim and the adjacent area of Frankfurt Westend. There for differnt approaches dealt with open public spaces who could protect their users from weather differences.

- an interactive social gathering place
- the design proposal consists of a linear park
- a tent structure stretches from the north to the south of the park

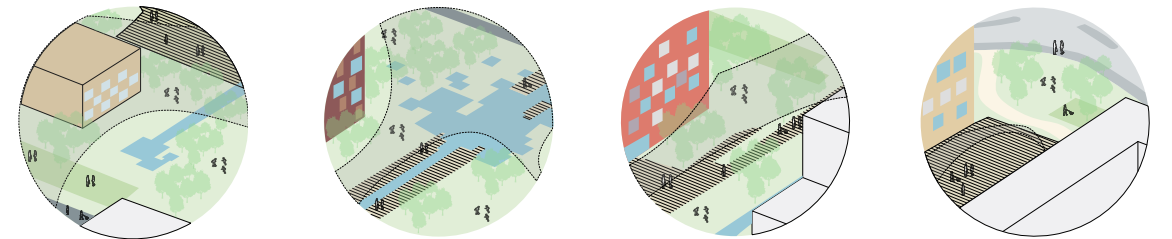
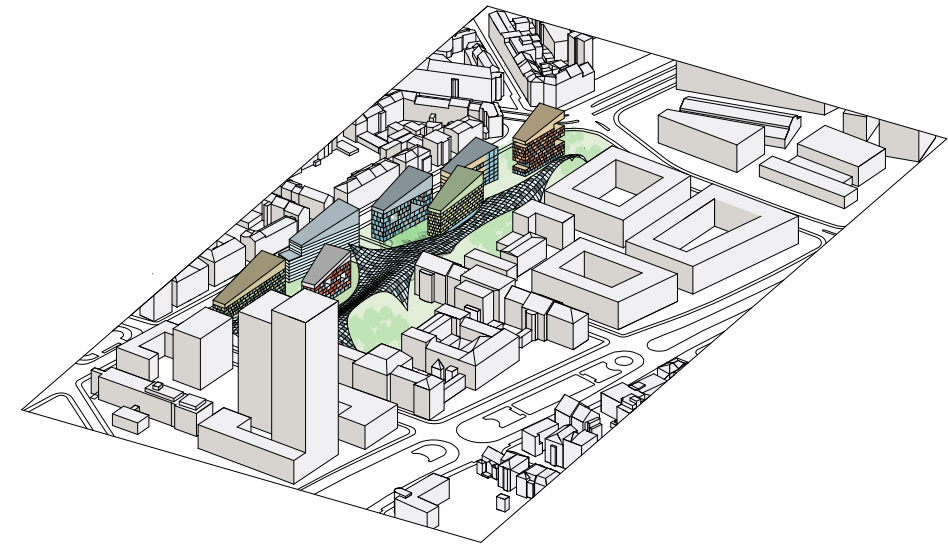


fig. 12:
summer school 13,
examplary urban design study,
Concept of a linear park with a tent
structure

urban design – group 4, summer school 2013

In intensive analyses of the building site and the adjacent surroundings potentials were located to active urban spaces for different usages.

- create an energy efficient urban environment by activating the potential possibilities of existing spaces
- enlarging green structures including shared spaces and large walkways
- working with the existing structures is sustainable
- respecting the history and social background of the existing blocks in an appropriate way

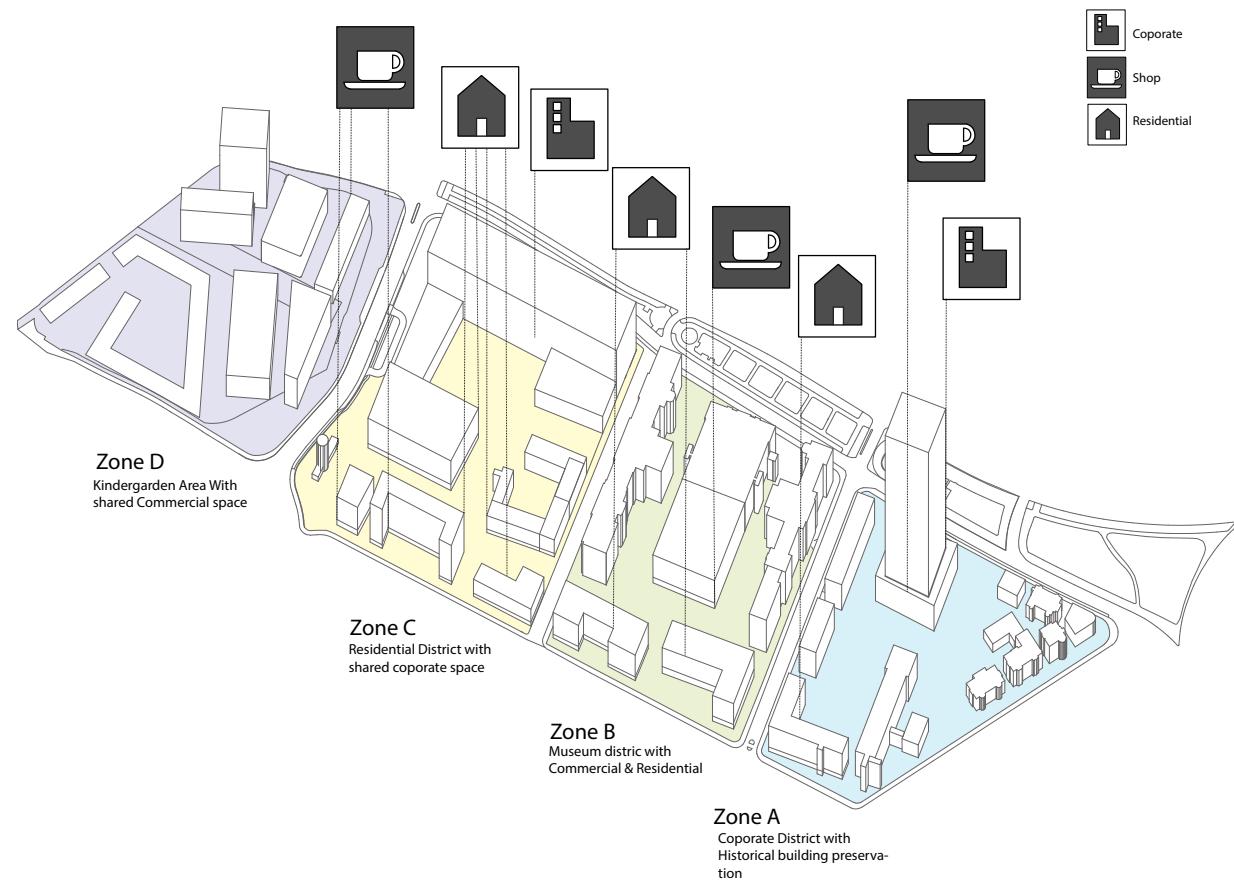


fig. 13: summer school 13, exemplary urban design study, „revitalize and activate“ energy efficient urban environment with green connection

building design – group 5, summer school 2013

The building studies dealt with the inner city situations reacting to the given surroundings by shaping the cubatures of the building. The buildings had been organised consurning to the specific daylight and energy gaining potentials.

- shaping the building form for optimizing the solar impact
- integrating greenery to the building
- organizing ground floors in condition to given daylight situations

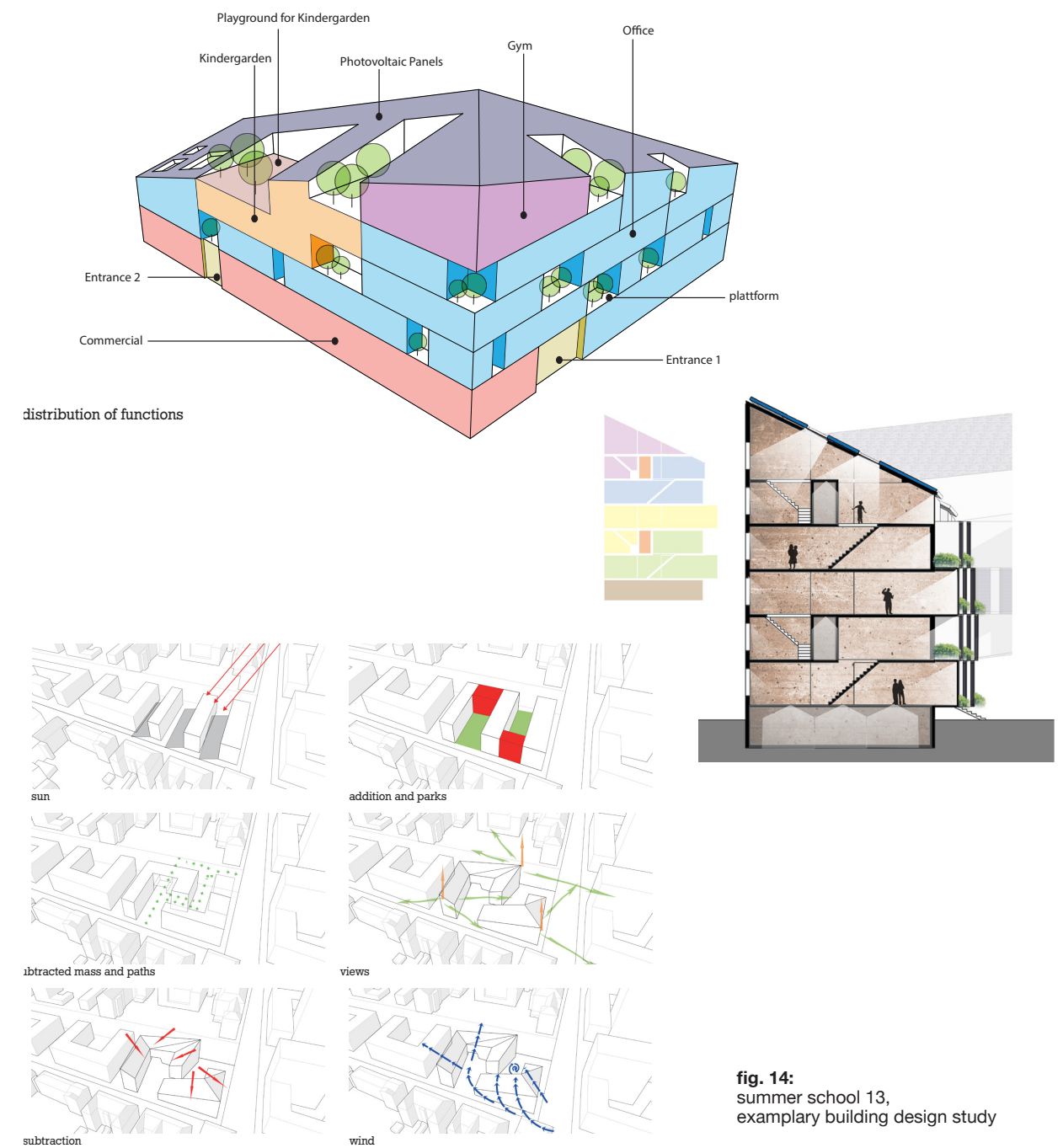


fig. 14: summer school 13, exemplary building design study

4. day program modules

welcome day & get together



workshop & crits



lectures



informal events

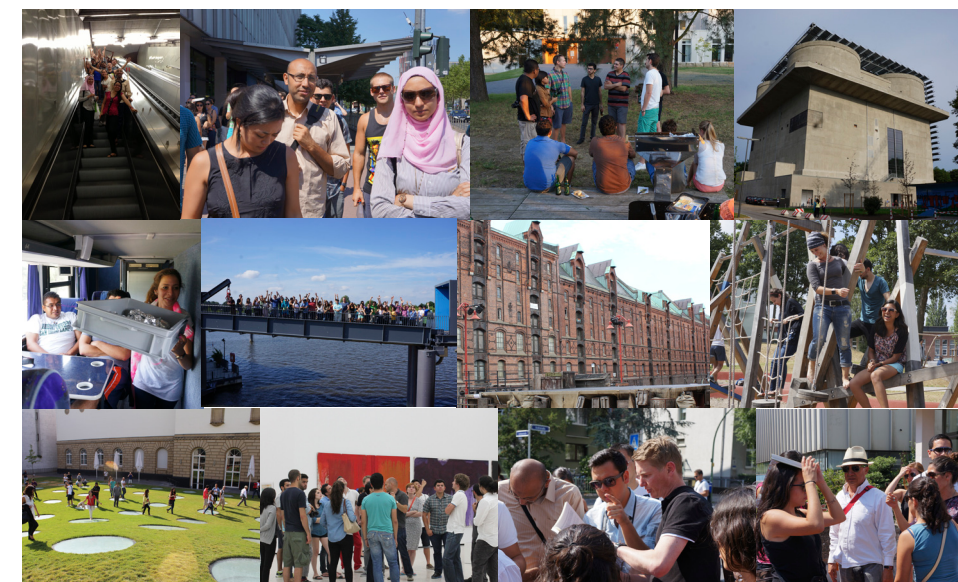


fig. 15:
summer school 13,
day program modules

CHAP. IV summer school 2014: adaptive skins in urban structures

27th July - 09th August 2014

Abstract of the summer school event 2014 with exemplary work results. For complete informations about the workshop see the attached summer school documentation 2014 „adaptive skins in urban structures“ or follow the link:

https://www.architektur.tu-darmstadt.de/international/international_courses/summer_school_1/summerschool_1/2014.de.jsp

1. exercise

This year's summer school design workshop „adaptive skins in urban structures“ focuses on the sustainable development of the Lichtwiese Campus of the Technical University of Darmstadt (TUD) and its structural and spatial setup.

The goal is to incorporate knowledge gathered from expert lectures and exercises into the design. It is important to develop a conclusive method of working within international and interdisciplinary teams in which the complex demands of the design are met and collated to form a homogeneous concept. Challenges due to barriers such as language, architectural approach and cultural differences are expected and are to be handled accordingly.

Architectural and urban spatial concepts must, aside from the creative core task of creating spatial quality, take issues in terms of CO2 production, improving micro-climatic effects and the use of natural resources into consideration. New methods and frameworks of sustainable building should not be viewed as an inhabitant of the existing architectural design process but as creative potential that enriches it.

The Assignment requires the participants to develop a new „face“ of the Faculty of Architecture Building and the overall TUD Lichtwiese Campus. It is composed of an architecture and urban planning section that each group will work on. The two parts must correlate with one another into a homogenous concept.

subtask A:

Subtask A concerns itself with the design of the facade and a spatial extension of the Faculty of Architecture Building. It is important to identify necessary design strategies through an intensive analysis of the current situation and incorporate them into the design process. Possible approaches can range from a small-scale energy-efficient renovation with the aim of preserving the buildings original condition and creating a new building complex to reinterpreting the original design concept through combining the old and the new. The chosen approach must meet modern requirements of energy efficiency and comfort. A precise and understandable justification in the various aspects required in the assignment must be delivered.

subtask B:

Subtask B deals with the design of a sustainable urban concept for the TUD Lichtwiese Campus. The conceptual expansion and redevelopment in Subtask A is to be transferred into a larger scale of the Lichtwiese Campus in order to create a coherent overall concept. It is thereby necessary to include the other existing buildings of the Campus. Emphasis is put on creating an individual characteristic for the given area. In addition, other urban issues such as the design of open spaces, improving and adjusting transport infrastructure, and creating a CO2 neutral energy supply must be incorporated into the design.

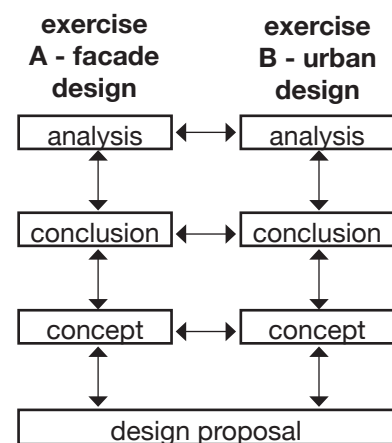


fig. 16:
Design workshop



fig. 17:
Department of Architecture



fig. 18:
Campus TU- Lichtwiese

design subtask a/b – group A, summer school 2014

In a design plot with listed buildings the students had to deal with a situation to reactivate existing building structures without transforming the character of the heritage. There for concepts from „plugin“-rooms until adaptive facades restoring the given structures had been developed.

- increasing the energetic performance of the building and add flexible working spaces to the building
- removing all the interior walls and inserting cubes into the remaining concrete shell structure
- a solar chimney will be inserted into the redesigned roof which also has photovoltaic panels and areas for water collection



fig. 19:
summer school 14,
Intercube

design subtask a/b – group B, summer school 2014

By combining energetic matters with usage and keeping the buildings character various solutions occurred. Therefor often the chimney potential of the inner patio of the architectural building had become part of the energetic concept.

- there were two main goals: to increase the energetic performance and to add flexible working spaces to the building
- by coating a glass roof with a venturi shape above the atrium negative air pressure had been created for support the inner ventilation
- additional insulation layers will minimize the general heat loss
- a buffer zone with a glass house effect is integrated

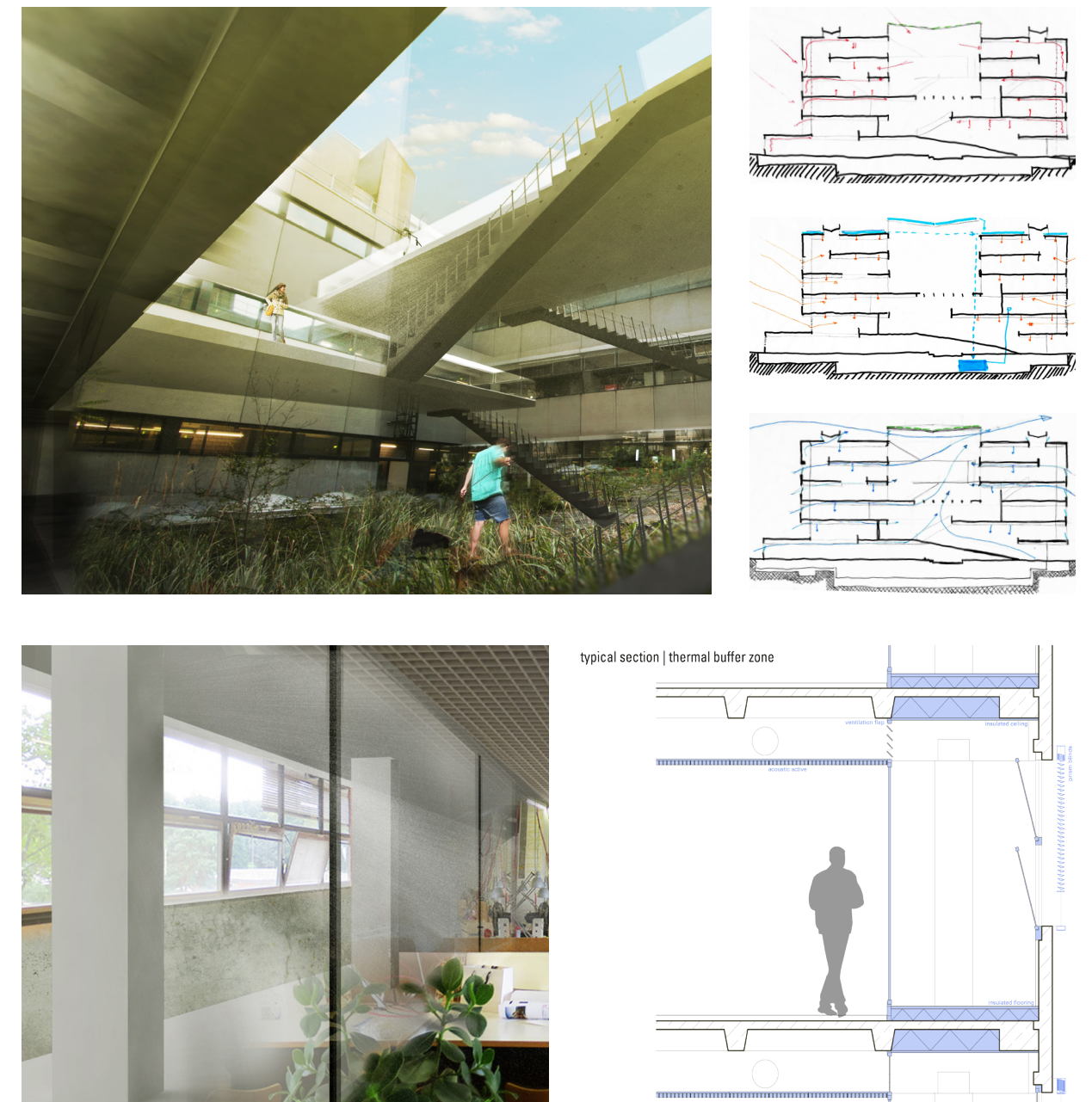


fig. 20:
summer school 14,
Glass house

design subtask a/b – group C, summer school 2014

All concepts followed the approach to develop these concepts beginning from the urban scale and ending up at a building solution. Different attempts interpreted it in the way to combine urban and building potentials by creating structures which serve the inner and outer space.

- “the new center” is an interdisciplinary working place where people of all faculties of the Lichtwiese meet, work, produce and relax together
- we located it in the campus center
- the idea is that the different faculties can think of different methods to use sun, wind, water or other natural sources in the roof to gain energy and to make the Lichtwiese a green and maybe someday autonomous campus

 **THE NEW CENTER**

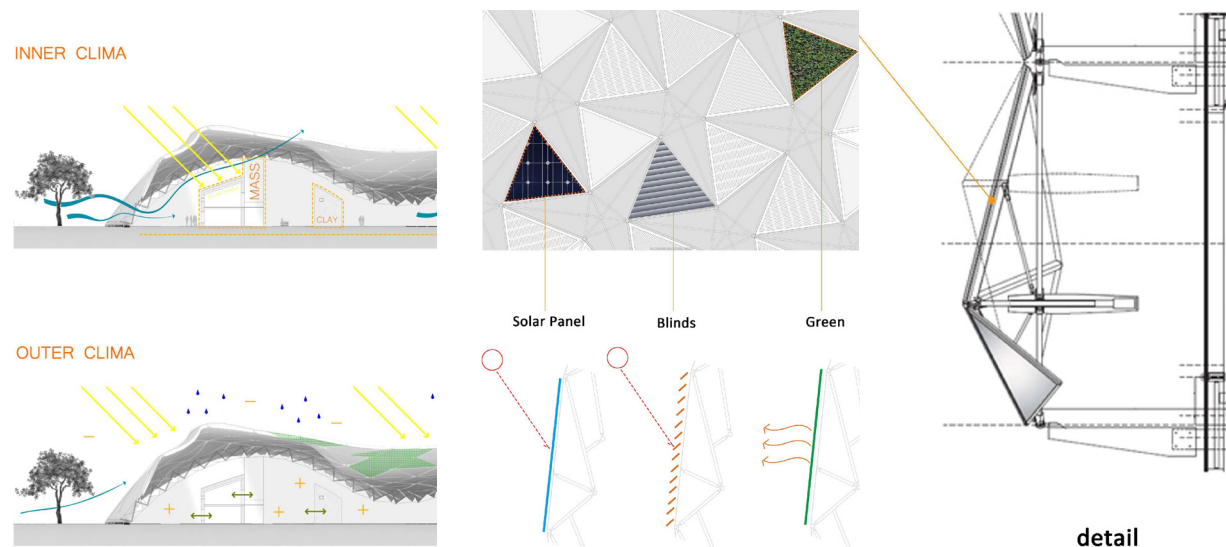
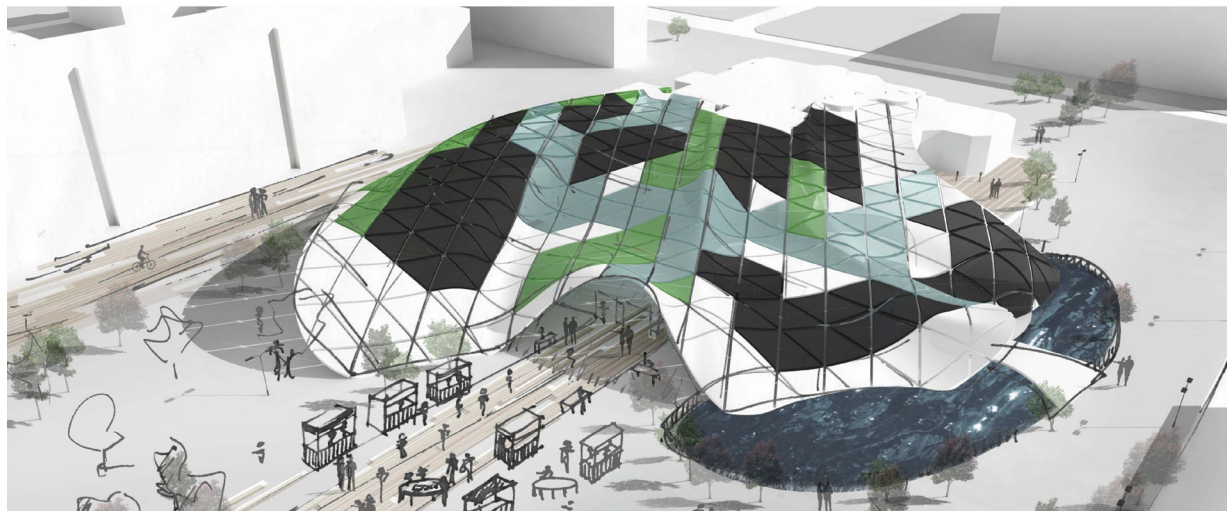


fig. 21:
summer school 14,
The new center

design subtask a/b – group G, summer school 2014

The complexity of the specific tasks coped with the urban scale of a campus site together with different ideas for mobility concepts of the suburban plot as well as the functional building matters and energetic and facade related issues.

- the main urban idea was to define the center of the campus more precisely as a green garden
- structuring the campus by defining private and urban areas
- removing traffic from the center by designing a ring road and decentralizing the existing parking lots

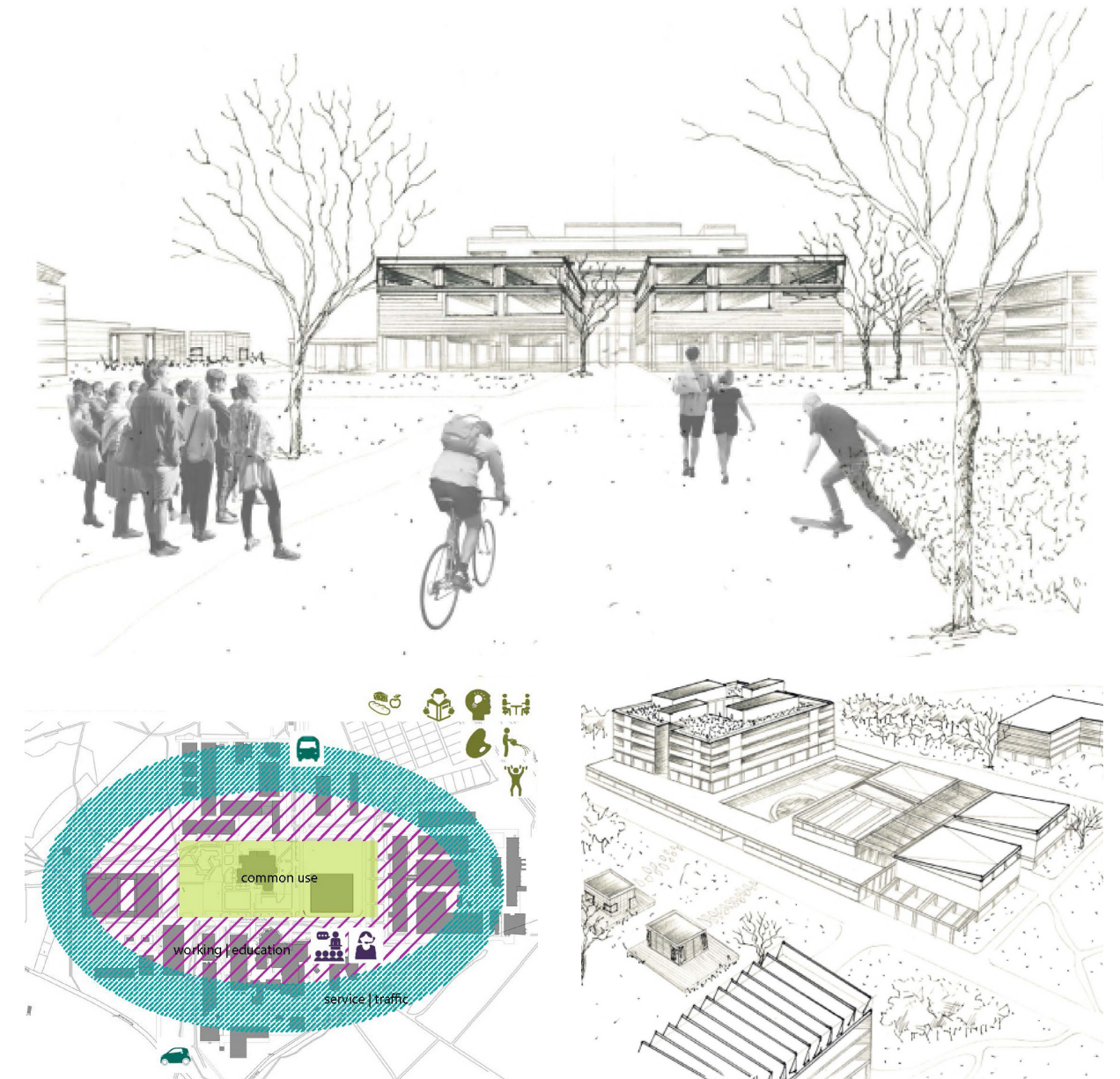


fig. 22:
summer school 14,
The green anchor

2. day program modules

welcome day & excursion to Frankfurt



lectures



workshop & crits



informal events



CHAP. V

summer school 2015: sufficiency strategies in urban architecture

20th July - 31st July 2015

Abstract of the summer school event 2015 with exemplary work results. For complete informations about the workshop see the attached summer school documentation 2015 „sufficiency strategies in urban architecture“ or follow the link:

https://www.architektur.tu-darmstadt.de/international/international_courses/summer_school_1/summerschool_2015/summer_school_2015_intro.de.jsp

1. exercise

The summer school 2015 design workshop „sufficiency strategies in urban architecture“ focused on a sustainable densification of a typical „European City“ Block in Frankfurt. The building site was part of an existing „Gründerzeit“ structure which was built at the End of 19th century. The block itself is situated at the border between a living and an industrial area. Within this tension a strong model for future urban living had to be designed.

The design proposal should conceptually and spatially integrate sufficiency strategies into architecture. Housing hereby was an essential program. This utility was to be combined with another public function needed at that specific plot.

The goal was to incorporate knowledge gathered from expert lectures and exercises into the design. It had been important to develop a conclusive method of working within international and interdisciplinary teams in which the complex demands of the design were met and collated to form a homogeneous concept. Challenges due to barriers such as language, architectural approach and cultural differences were expected and to be handled accordingly.

The design task was structured in four steps. Each step was related to the others and had to be developed carefully. In order to the short time frame of the two week summer school it was necessary to success each step in time.

Step A (site analysis) should be finished within the first two days of the design workshop. Step B (urban concept) and step C (programmatic concept) had to be built on the results of the analysis (step A). The urban and programmatic concept were the basis for the following architectural design. Therefore these two steps should be completed until the third day of the design workshop. They were developed with an overlapping of step A.

Both Subtasks A and B are tackled within a group. Each group must organize itself accordingly in order to have a goal-oriented focus and to make efficient use of time.

In both Subtasks, an intensive analysis had to be made in order to improve the understanding of the task and the area context. This should be the basis to work with during the design. The concept and design outcome were to be portrayed in appropriate methods of presentation (floor plans, sections, views, sketches, diagrams, etc.).

It was essential that the development of all parts of the urban and architectural concept correlated with the results of the analysis and the followed sufficiency strategies.

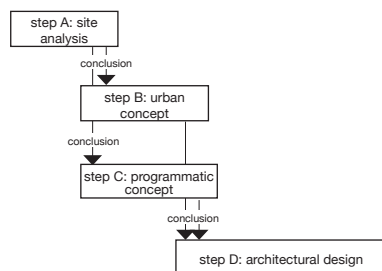


fig. 24:
Design workshop, time table



fig. 25:
Design workshop, Aerial view of the development area



fig. 26:
Design workshop, development area

2. urban and building site analysis

step A: site analysis

The first step was to perform a systematic analysis of the site and its surrounding. Designers should identify specific characters of the situation and its individual „logic“. A solid analysis had to be the basis of the following design task.

The analysis was vital in order to understand the original design concept and to identify programmatic, spatial and energy development potential (lack of use, new programs, etc.)

Hereby, all aspects of the site from its urban environment to programmatic aspects and building details were to be taken into consideration.



fig. 27:
site, Sonnemannstraße Frankfurt

step B: urban design concept

The second step was to create an urban design concept using the knowledge gathered during the analysis. Here, possible solutions in terms of integrating a new building structure by increasing the programmatic qualities of the quarter and „finishing“ the block had to be found.

The amount of structural densification should be planned according to each individual analysis. Also the position and evaluation of a new volume had to be designed carefully and should show its compatibility with the existing area through a model. The proposed new buildings must cohere with the overall logic of the context.

The Design of step B had to be continuously developed parallel to step C to check and ensure a homogeneous overall concept.

The new proposed building was to be shown in the model and in the site plan (view). They had to however have typological diversity between existing and new structures. As design method the production of a series of mass models were strongly recommended. Therefore we propose to develop variations within a volume study. The concept should lead to a sufficiency strategy for cities that follow an interior instead of exterior development. This must determine the unique and strong characteristic of the typical „Gründerzeit“ Block.

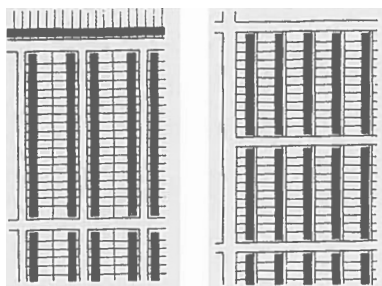
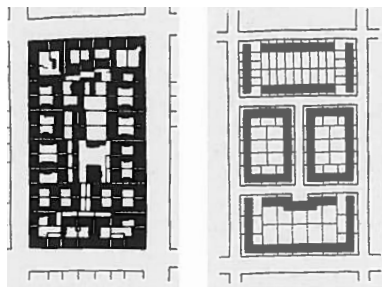


fig. 28:
different city types:
mega block, back-to-back line
structure, equal line structure

step C: programmatic concept

A programmatic concept was to be developed in addition to perceptions of the site analysis. Program and Volume directly interact and influence themselves. Therefore both steps had to be solved simultaneously.

The main program of the design task was innovative housing. In addition to that a second program had to be integrated. Type and size of the additional program was to be argued from the results of the site analysis (step A). This „public“ utility should create a benefit for the surrounding quarter. The housing typology was to be designed in connection to sufficiency strategies told during the daily expert lectures.

step D: architectural design

The last and main step was the development of an architectural design proposal based on the previously defined urban and programmatic concepts. Hereby all essential parts of the building needed to be designed and shown in plans, sections and elevations.

One representative Housing Unit was to be further developed. The main aspects of chosen sufficiency strategies should be integrated in this spatial translation.

Despite to the design of the building structure a second focus concentrates on the facade. This element defines the transition between inside and outside as well as a climatic zones. In addition to a visual character main functions (construction, insulation, ventilation, daylight, solar energy gains, etc.) should be qualitatively described.

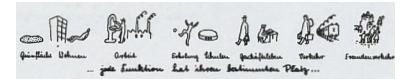


fig. 29:
main programs within a city - ideal of
separating functions after 1945



fig. 30:
flexibility in space

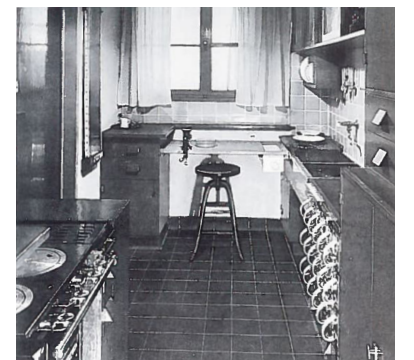


fig. 31:
„Frankfurt Kitchen“ from Ernst May
(1926) as first example of space
efficient design

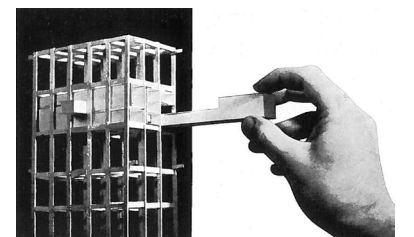


fig. 32:
Le Corbusier

design project – group 1, summer school 2015

Throughout intensive functional and climatic urban analysis the design groups developed ideas about missing functionalities of that specific area.

- public levels in the basement and mostly first floor were organized with private levels up until the 6th floor
- interaction between public and private spaces were combined in the minimized building plot

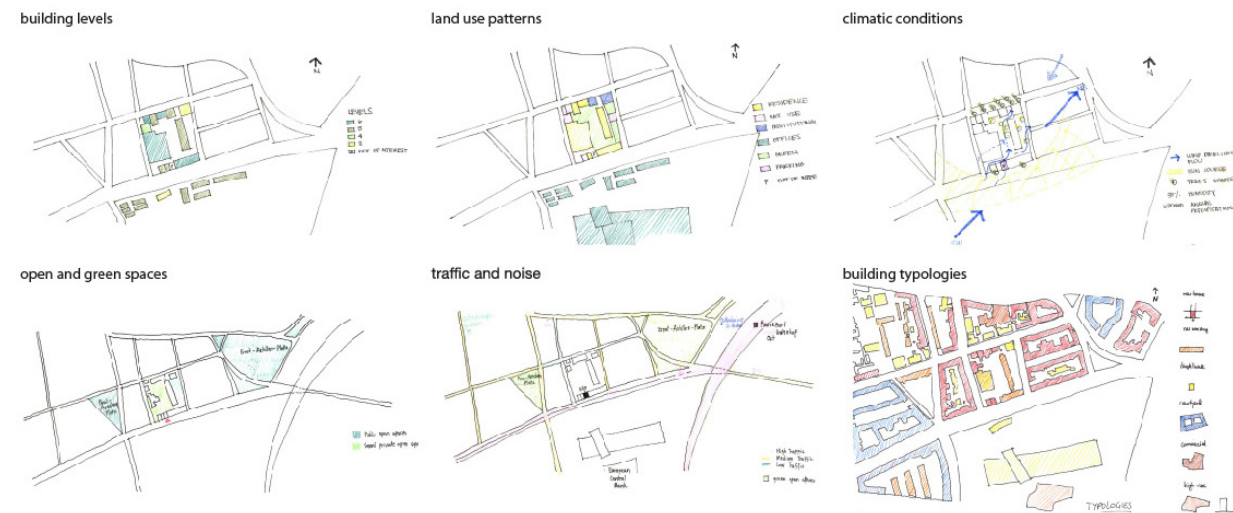
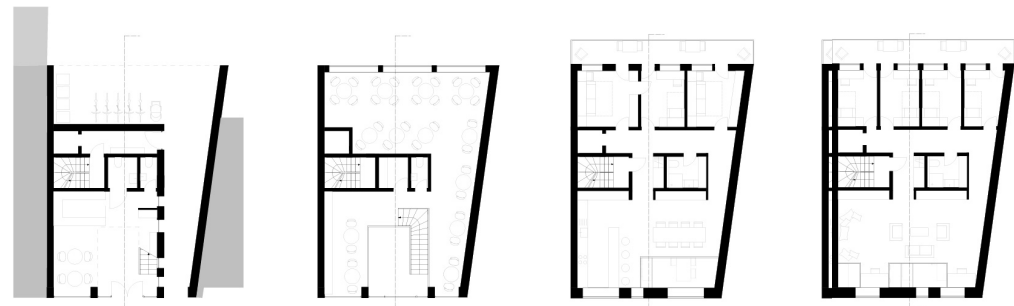
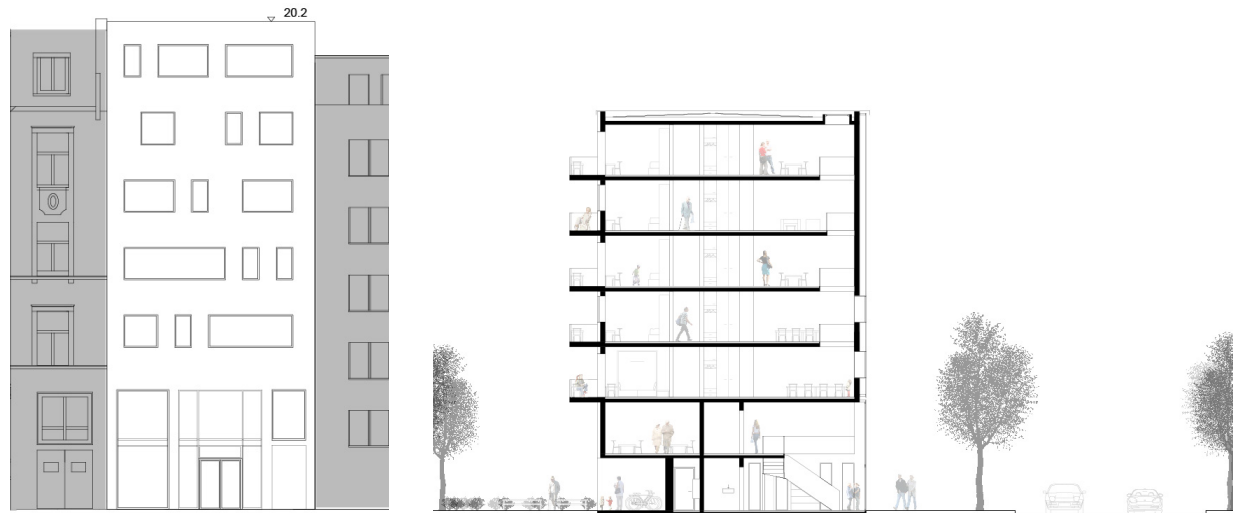


fig. 33:
summer school 15,
design project, group 1

design project – group 3, summer school 2015

Next to usage related approaches few design groups focused on an integrated connection between usage and energetic matters. The solutions ranged from structural to comfort-based answers.

- using circulation levels for supporting building ventilation
- creating different climate zones throughout technical solutions

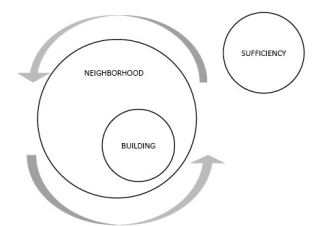
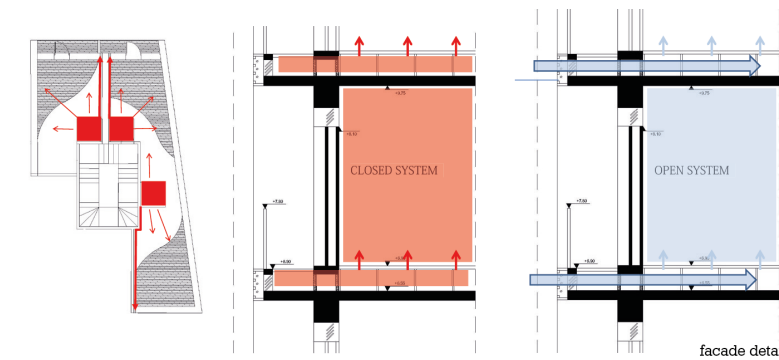
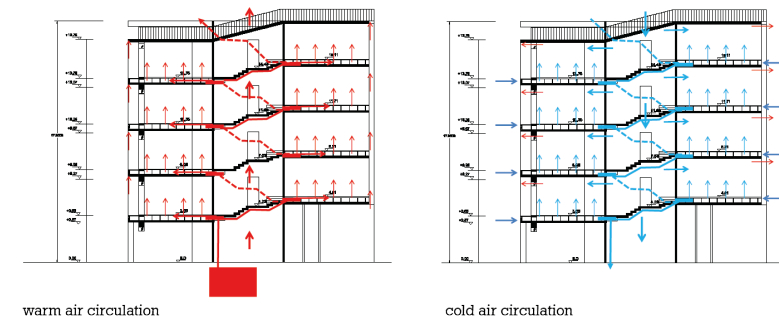
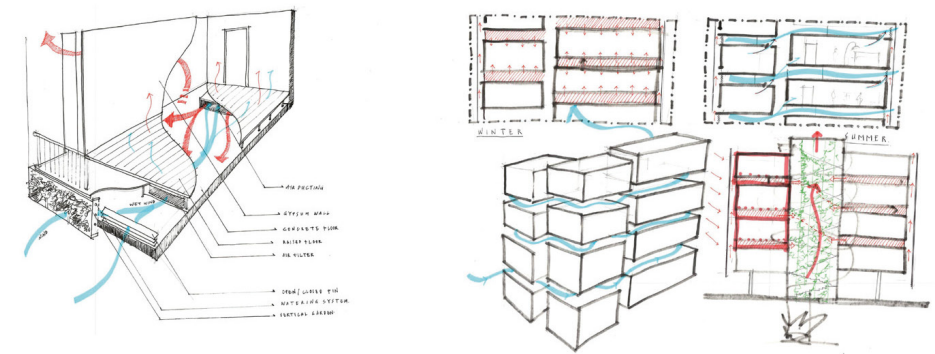


fig. 34:
summer school 15,
design project, group 3

design project – group 10, summer school 2015

Added by the specific idea to create sufficient living spaces in climate changing areas, concepts had been developed which change during the year to offer spacial and energetic optimized living and public structures during the different seasonal conditions.

- breathing building structures gaining user appended spaces
- inner and outer spaces changing during the year

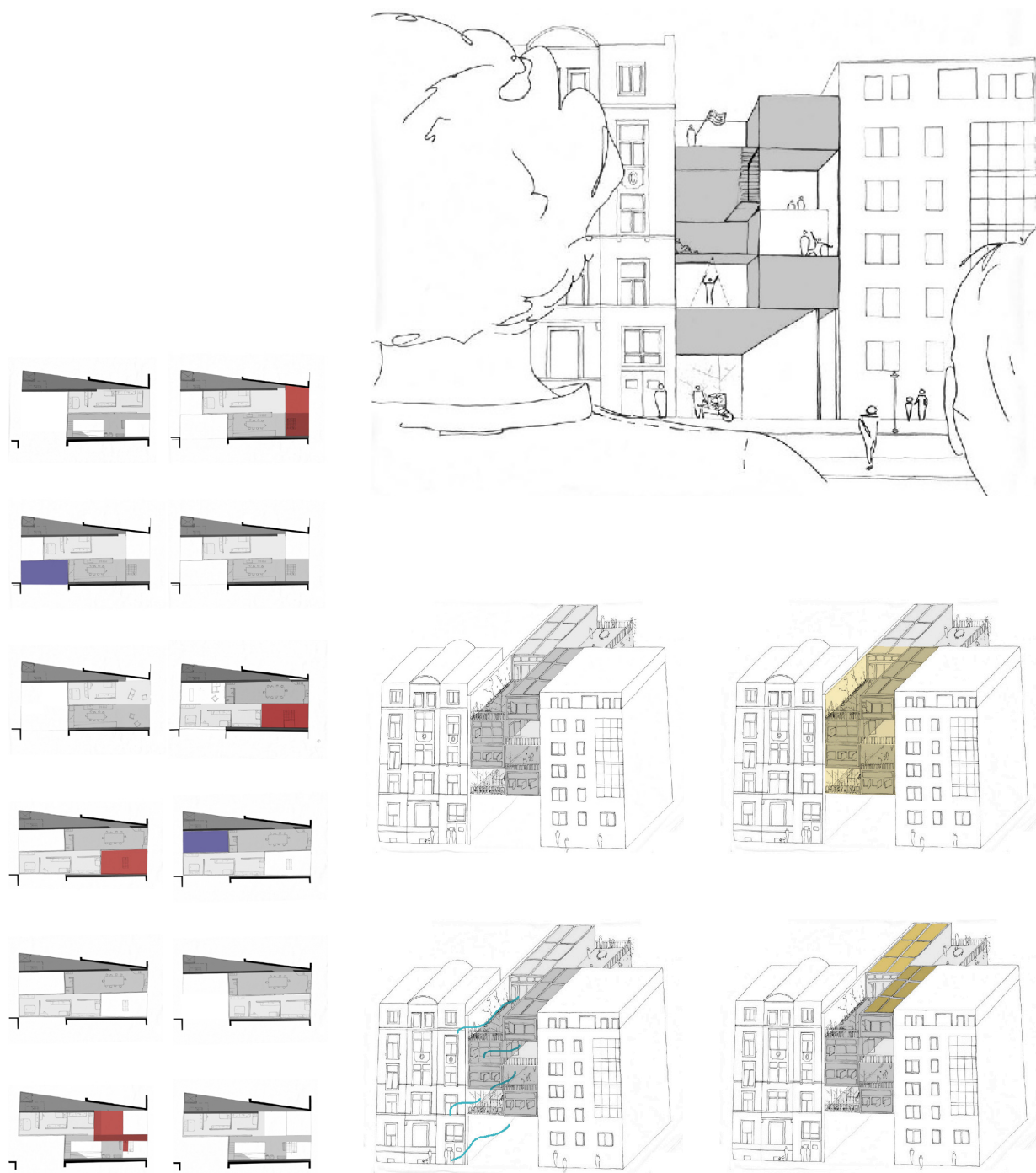


fig. 35:
summer school 15,
design project, group 10

design project – group 11, summer school 2015

In appendency to the multifunctional usage of the design task in a minimized building plot design groups of summer school 2015 often came to the conclusion to achieve interaction of private, semi private and public spaces in the vertical organized building.

- interaction spaces on the different levels of the building
- privacy places oriented to the courtyard, semi-private placed being oriented to the street
- creating vertical communication

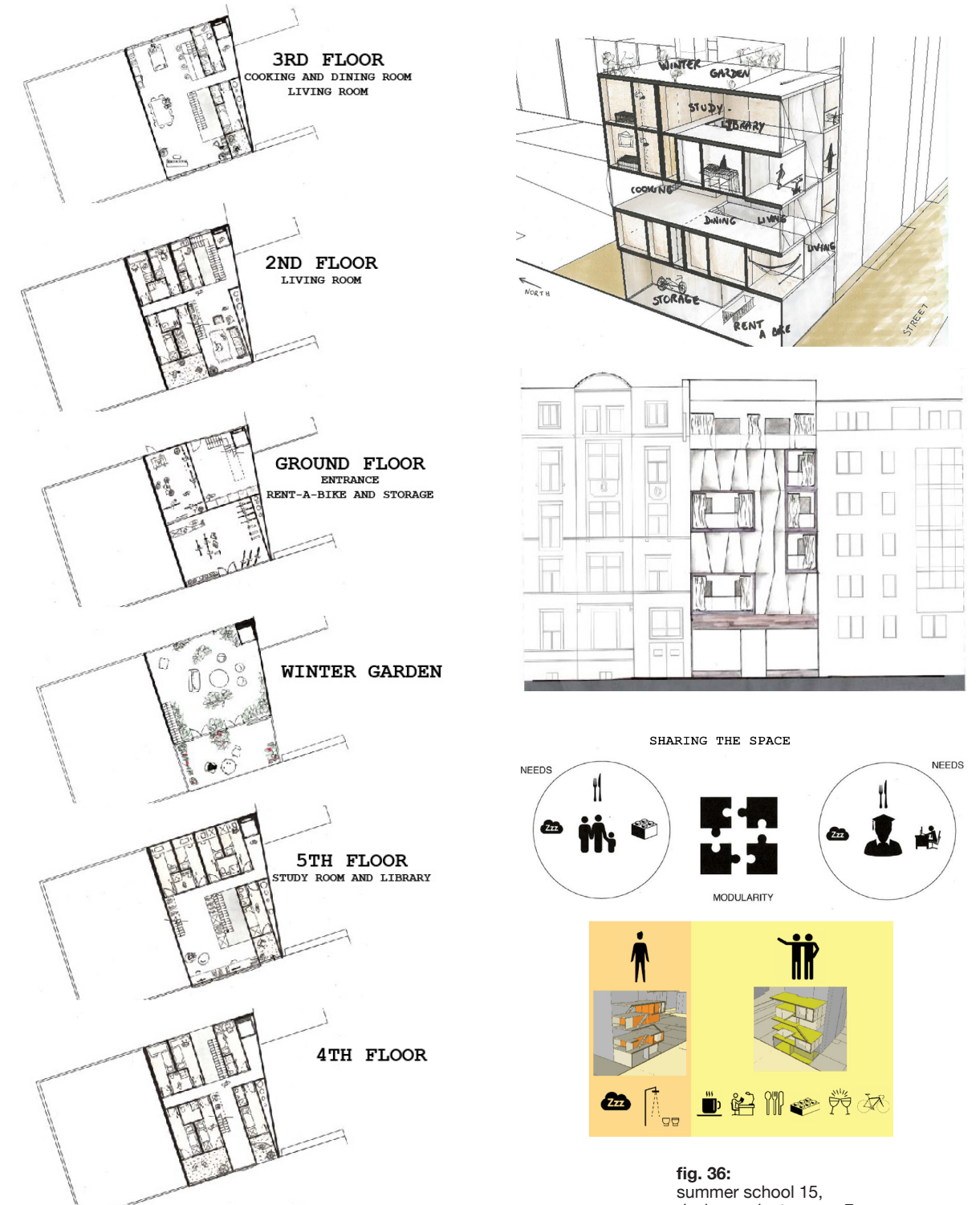


fig. 36:
summer school 15,
design project, group 7

3. day program modules

welcome day



workshop & crits



lectures



informal events



CHAP. VI **Fazit**

Inhalte

Die durch die Teilnehmer erarbeiteten Entwurfskonzepte erfüllen insgesamt vollständig die Erwartungen. Die Ergebnisse sind höchst unterschiedlich und zeigen alle innovative, zukunftsorientierte Konzepte für urbanes Wohnen und Arbeiten. Sie stellen somit einen eigenständigen Beitrag zu neuen nachhaltigen räumlichen Konzepten im städtebaulichen Kontext und im Sinne der Suffizienz dar. Das entwickelte Lehrkonzept der summer school sieht die Verknüpfung von Forschung und Lehre vor. Diese Verknüpfung wurde aus Sicht des Fachgebiets Entwerfen und Nachhaltiges Bauen auch im Rahmen der summer school 2015 erfolgreich angewendet.

Vernetzung & Wissenstransfer

Durch die durchgeführten Expertenvorträge mit anschließenden Diskussionsrunden konnten neue Kontakte zwischen den teilnehmenden internationalen Universitäten ausgebaut und gemeinsame Forschungsinteressen ausgelotet werden. Auch die neu eingeführte Vortragsveranstaltung der „Young Researcher“ hat dies noch mehr vertieft. Darüber hinaus konnten auch auf der übergeordneten Ebene des Fachbereiches Architektur internationale Kooperationen neu angestoßen und bereits vorhandene weiter etabliert werden. Die summer school kann demnach als erfolgreicher Beitrag zur Streuung von Wissen auf dem Gebiet des nachhaltigen Bauens gewertet werden.

Nebenergebnisse

Die internationale Vernetzung und erlangene Bekanntheit im Zuge der durchgeführten Veranstaltungen führten neben der Erhöhung des Bekanntheitsgrades der TU Darmstadt bis zum aktuellen Zeitpunkt zu weiteren erfolgreichen internationalen Verknüpfungen.

Im Wintersemester 2015/2016 wurde Frau Professor Cuisong Qu im Rahmen des TU Darmstadt - Tongji Austauschprogramms als visiting chair geladen und begleitete während des Semesters aktiv die Lehrbausteine des Lehrstuhls Entwerfen und Nachhaltiges Bauen.

Gemeinsam nahm zudem der Fachbereich Architektur der TU Darmstadt in Kooperation mit der Tongji Universität in Shanghai mit insgesamt sieben Studierenden beider Universitäten an dem internationalen Wettbewerb des Solar Decathlon China 2018 teil.

Ausblick auf kommende Teilprojekte

Derzeit werden Verhandlungen mit dem Fachbereich und der Universität geführt, die summer school weiter zu etablieren und auszubauen. Die aus den drei Veranstaltungen 2013-2015 gemachten Erfahrungen in Bezug auf das Lehrkonzept, aber auch die gesamte Organisationsstruktur sollen in dieses neue Konzept einfließen.

CHAP. VII attachment

1. expert lectures and lecture topics during the periode of summer schools

Während der drei Jahre summer school das Organisationsteam und die Teilnehmer der Veranstaltungen wären erfreut eine Vielzahl an Experten des nachhaltigen und energie-effizienten Bauens begrüßen zu dürfen.

Im Rahmen der Veranstaltungen wurden Referenten, die sich in bestimmten Bereichen zum Thema ausgezeichnet haben eingeladen, über themenbezogene Fragen zu sprechen. Ihre Vorträge lieferten inhaltlich substantielle Beiträge zur ganzheitlichen Behandlung des Veranstaltungsthemas.

Vor allem die fachlichen Kompetenzen der Dozenten haben einen nachhaltigen Eindruck bei den Teilnehmern hinterlassen, der sich in den bearbeiteten Projekten der summer school äußerten.

In den Vorträgen und oft auch in anschließenden Gruppenkorrekturen wurden die Inhalte der Experten durch oft lebhaft geführte Diskussion verarbeitet und von den Teilnehmern für ihre weiteren Studien und entwickelten Konzepte adaptiert.

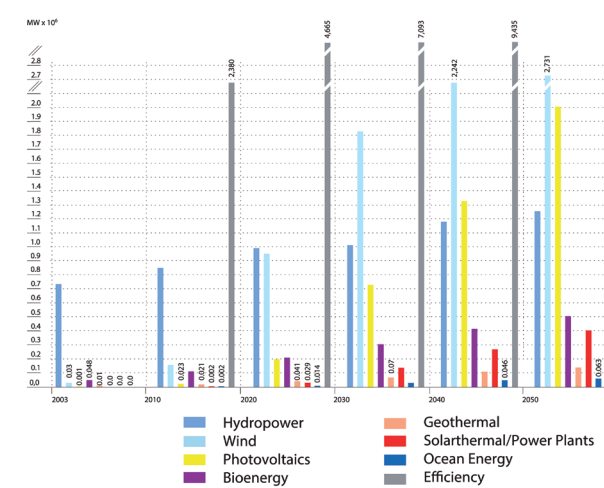


fig. 38:
summer school 2013
Prof. Klaus Daniels
„architecture and the change in energy“

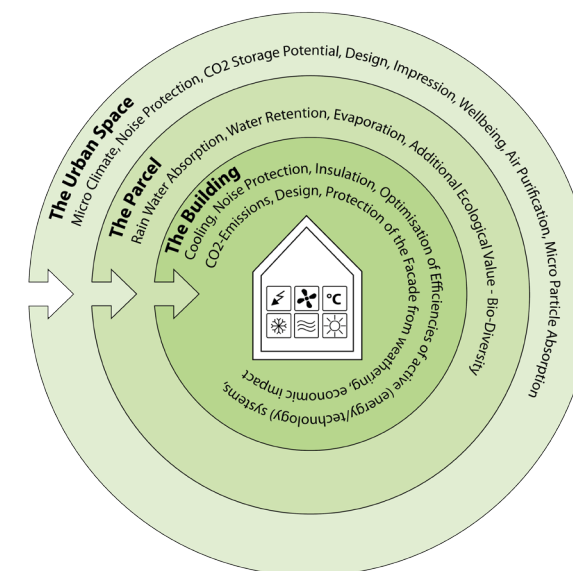


fig. 39:
summer school 2013
Prof. Dr. Jörg Dettmar
„Potential of urban green in the context of energy optimization of urban structures“,
impact potential of greening of buildings and urban space



fig. 40:
summer school 2013
Prof. Dr. Manfred Norbert Fisch
„Smart Buildings for Smart Grids“
House in EnergyPlus Standard

fig. 41:
summer school 2013
Prof. Dr.-Ing. Dr. h.c. Gerhard Hausladen
„climadesign, strategies for an integrated planning and building process“
Energetic Dependencies

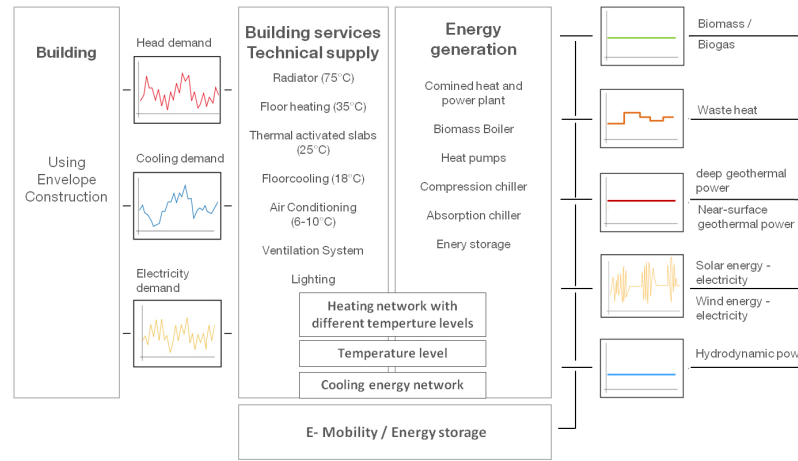


fig. 42:
summer school 2013
Prof. Anett-Maud Joppien
„Active und passive Strategies“,
Solar Decathlon



fig. 43:
summer school 2013
Prf. Dr. Lutz Katzschner
„Urban climate maps: A tool for architecture and planning“
Kassel GIS calculations



fig. 45:
summer school 2014
Prof. Thomas Auer
„Climate-Responsive Building Design“
Manitoba Hydro Place Energetic concept in Winnipeg

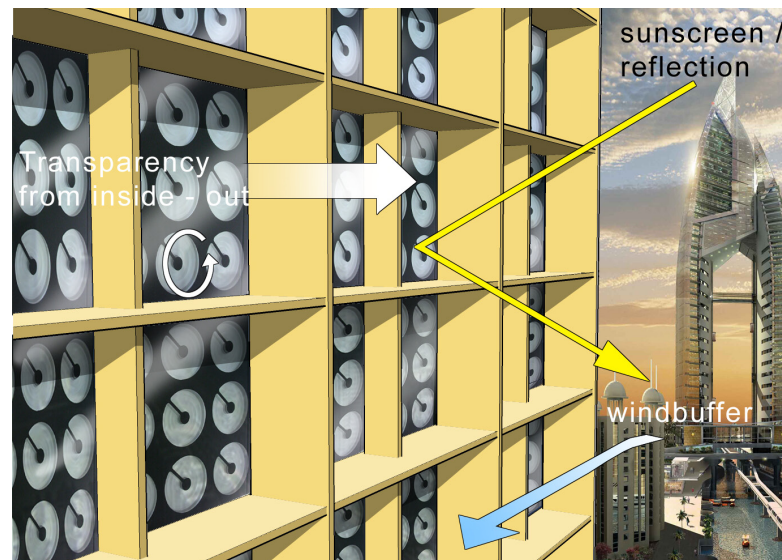


fig. 46:
summer school 2014
Marcel Bilow
„Croft - climate related optimized facade technologies“
Croft Dubai



fig. 44:
summer school 2014
Sabine Djahanschah
„Exemplary Model Projects of the „Architecture and building“ devison of the DBU“
various projects

fig. 49:
summer school 2014
Sebastian Hermann
„Playing City!“
urbanism as schematic structure

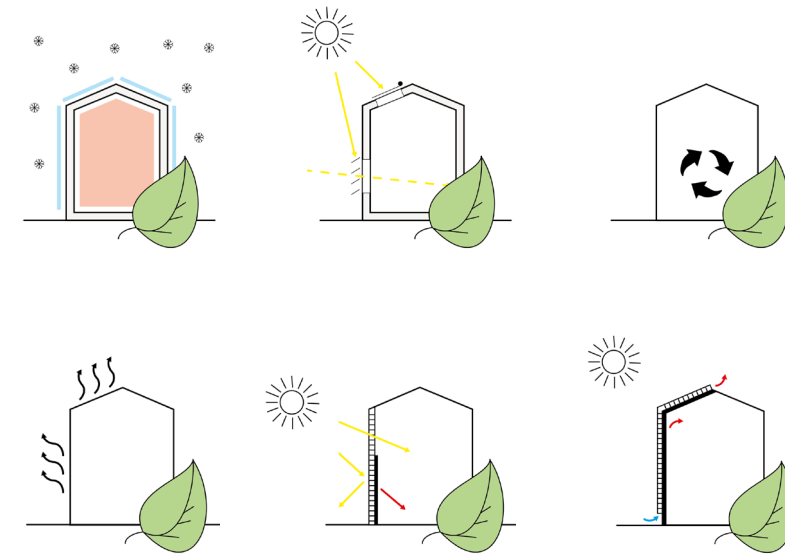
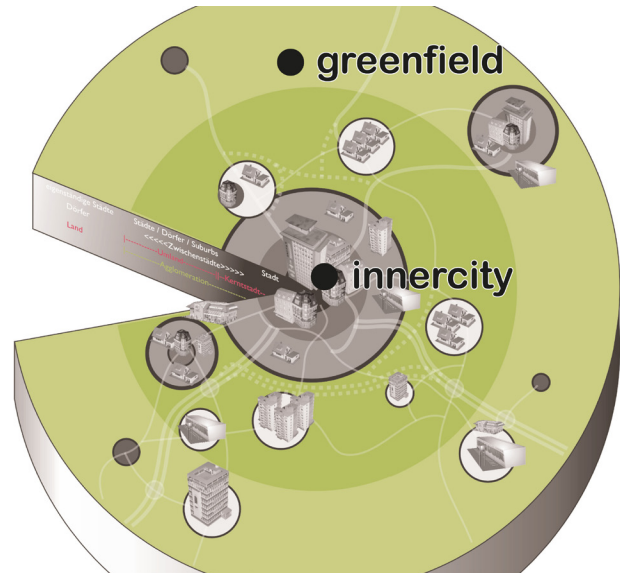


fig. 50:
summer school 2014
Nicole Pfoser
„Green Structures and Energy-Efficient Building“
Influences of greenery in buildings

fig. 47:
summer school 2014
Prof. Françoise-Hélène Jourda
„Urgent!“
Réhabilitation de la halle pajol

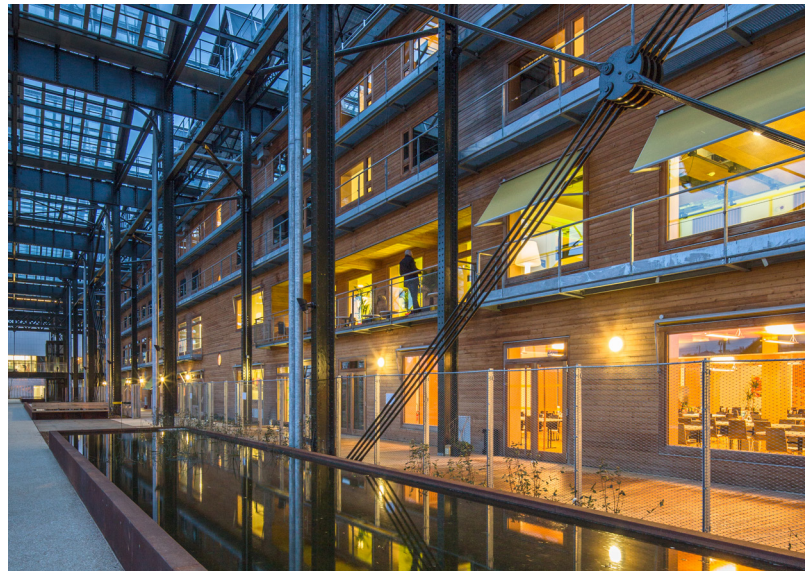


fig. 51:
summer school 2014
Prof. Dr.-Ing. Annette Rudolph-Cleff
„Urban districts and area-based approaches“
Punkthaus der GBG Mannheim

fig. 48:
summer school 2014
Prof. Christoph Kuhn
„History and Typology of Sustainability“
Joseph Beuys - Multiple Capri-Batterie



fig. 52:
summer school 2014
Prof. Antje Stokman
„Designing Water-Sensitive Landscapes“
current chance of creating urban water

fig. 53:
 summer school 2015
 Prof. Sebastian Fiedler
 „Solar Decathlon - from technical to socioeconomic innovation“
 solar decathlon home+



fig. 58:
 summer school 2015
 Prof. Dr.-Ing. Martin Knoell
 „Active Design - Promoting healthy behaviors with urban design“
 urban user behaviors

fig. 54:
 summer school 2015
 Prof. Dr. Peter Gotsch
 „The Idean Project. Concepts for sustainable and resilient neighbourhoods“
 A world within

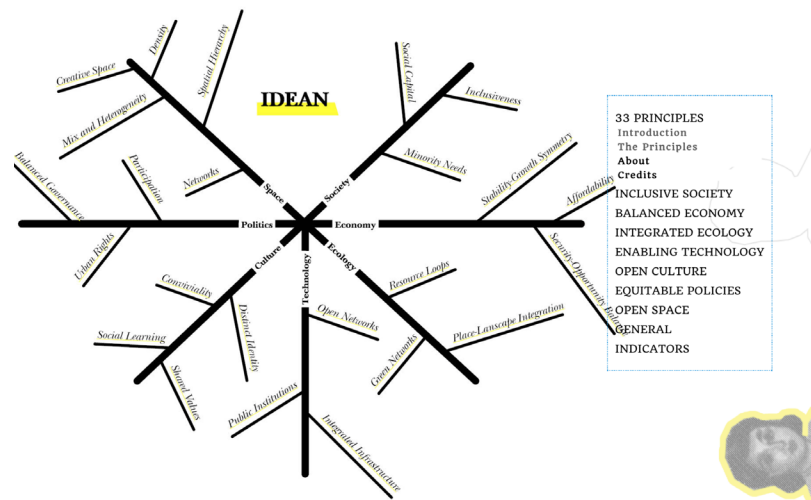


fig. 57:
 summer school 2015
 Arne Steffen
 „Less is less. And Different“
 concept living Hub

fig. 55:
 summer school 2014
 Prof. Manfred Hegger
 „Usage adaptive structures“
 Aktiv-Stadthaus



fig. 56:
 summer school 2015
 Samuel Thoma
 „True love“
 settlement Frohheim

2. Dokumentation der Serie an summer schools 2013-2015

Während der Jahre der Durchführung der einzelnen Veranstaltungen wurden jährlich die Forschungs- und Designergebnisse in veranstaltungseigenen Dokumentationen zusammengefasst. Für die Teilnehmer bestand die Möglichkeit die jeweilige Dokumentation als Druckexemplar zu erhalten. Zudem wurden diese als digitale Version den Teilnehmern sowie der interessierten Öffentlichkeit zur Verfügung gestellt.

Die digitalen und gedruckten Versionen der drei Dokumentationen finden Sie dem Schlußbericht des Forschungsprojektes beigelegt. Zudem besteht die Möglichkeit über folgenden Link die Dokumentation des gesamten Programmablaufs und der erarbeiteten Ergebnisse einzusehen:

https://www.architektur.tu-darmstadt.de/international/international_courses/summer_school_1/intro.de.jsp

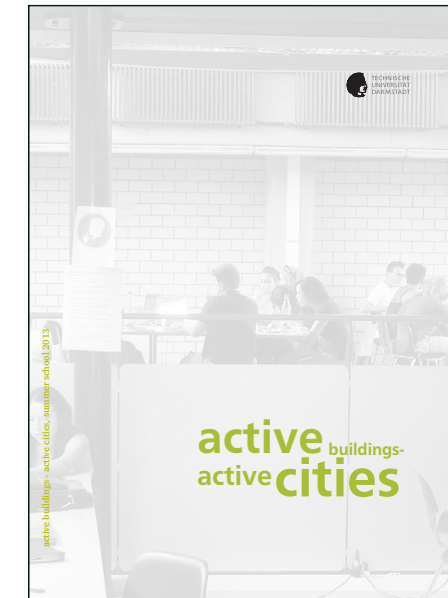


fig. 59: documentary of the three years summer school at the TU Darmstadt, available at the unit for sustainable design, TU Darmstadt