Intensive Lab Session (ILS) Hamburg

14th – 17th of October 2013

Intensive Lab Session in the frame of the conference

"Renewable Wilhelmsburg Climate Protection Concept - RETROSPECT | PROSPECT | COMPARISON"

For the „Implementation Plan"- in the framework of the EU-project "Transform" several specific measures have to be developed for the realization of the "Renewable Wilhelmsburg - Climate Protection Concept until 2020 or 2025". For the discussion and development of these measures, an Intensive Lab Session was carried out during the conference named "Renewable Wilhelmsburg Climate Protection Concept - RETROSPECT | PROSPECT |COMPARISON". One of the main strategic fields of the Renewable Wilhelmsburg Climate Protection Concept is the further development of energy standards, as well as concepts for the use of renewable energies and the decentralized energy production and storage. In addition to this question the following tasks were addressed.

- energy supply in the future, by power, gas or district heating?
- Central or de-central?
- Zero and Plus Energy Houses - realistic?
- Relevance and influence of the user?
- Sustainable construction and „Life-Cycle-Concepts"?
- Financing and subsidies?

The PESTLEGS – categories should be used to answer the questions with the focus to achieve the renewable district of Wilhelmsburg. In the following points, the categories are questioned and answered on the base of project ideas of the International Building Exhibition Hamburg 2013 (IBA Hamburg 2013).

The following „PESTLEGS-priorities" are to be answered to the set objectives in the workshop.

- Political
- Economical
- Social
- Technical
- Legal

- Environmental
- Governance
- Space

Time schedule for the ILS Hamburg

Joint program

Monday (14th of October 2013)

13:00	Registration
14:00	Field trip to the project area, presentation of single projects and the new development areas
14:30	in between official unveiling of the IBA plaque and EFRE sign at the „Energy Bunker“
15:15	in between Meeting CLUE Members in front of IBA Info-Point, Neuenfelder Straße / Kurt-Emmerich-Platz 2
	• Wilhelmsburg Central
	• “Energy Hill”
	• Global Neighbourhood (“Weltquartier”)
18:00	Evening Programme: reception at the ”Energy Bunker”

Tuesday (15th of October 2013)

09:00	Conference: the Climate Protection Concept, other district concepts, the “Master plan Climate Protection” and international examples
18:30	Internal Welcome and Presentation of results of ILS in Amsterdam Room 112/113
19:30	Evening Program

Workshop 1

Wednesday (16th of October 2013)

9:00	Welcome
9:30	Presentation of areas areas Veddel, South Kirchdorf and the urban development in Wilhelmsburg Central, discussion of their specific energetic situation. Impuls by • Chiara Derenbach, Hamburg Ministry of Urban Development and the Environment / Project group • Jan Schüleke, MegaWatt
10:45	Coffee Break
11:00	Pecha Kucha about several heating concepts and discussion • Hamburg Energie (heat storage Energy Bunker, decentralized feet-in Integrated Network, „Power-to-Heat“, „Smart Power Hamburg“) • Mrs Hartmann, Hamburg Wasser (Hamburg Water Cycle, waste water heat exchanger) • Matthias Wangelin, MUT Energiesysteme, Kassel and Florian Schlögel, Fraunhofer Institute (combination of heat and power, “Smart Grids”)
12:15	Separation in three „Area Groups“
12:30	Lunch
13:30	Interviews with relevant stakeholders Veddel: • Heinrich Bröhan , copper industrial firm Aurubis Wilhelmsburg Central: • Olaf Albrecht and Peter Arnold, Vocational School G18 – visit on site Dratelnstraße 26, Meeting Point School Office at 13:30
after-wards	Development of heating concepts for the three areas
15:00	Coffee Break
15:30	Development of heating concepts for the three areas
17:00	Internal interim presentation
18:00	Short meeting at the workshop rooms R.112/113
19:30	Evening Program *(tba)*

Thursday 17th of October 2013

9:00	Separation in three „Area Groups“
	Development of heating concepts for the three areas
12:00	Lunch
13:00	Preparing the presentation of the results

Workshop 2

Wednesday 16th of October 2013

09:00	Conference: Presentation and discussion of several examples of „energy efficient and sustainable” IBA projects, first results of the monitoring: • „EfficiencyHousePlus“ VELUX LightActiveHouse • Education Center in Passive House Standard Tor zur Welt • Passive House BIQ with Algae Facade • Massive wooden Construction Woodcube • Energy Storage Energy Bunker • Passive House „Open House“ and the relevance of the user → See separate program
18:00	Short meeting at the workshop rooms R.112/113
19:30	Evening Program *(tba)*

Thursday 17th of October 2013

9:00	• Welcome
	• Collection of impression and aspects of Wednesday by Cards, Post-Its…
	• Discussion of inputs
	• Classification, main questions
	  ○ Future of energy supply, by power, gas or district heating?
	  ○ Central or decentral?
	  ○ Zero and Plus Energy Houses realistic?
	  ○ Relevance of the user?
	  ○ Sustainable construction and „LifeCycleConcepts“ ?
	  ○ Financing and subsidies?

10:00	• Impulses and Interviews: ○ Laurenz Hermann, Berlin Energy Agency, „EfficiencyHousePlus“ Network ○ Dr. Peter Krämer (Building Situation, Subsidies, Sustainable Material) ○ Paul Frank (Frank Group), Association of Independent Housing Companies (BFW) • Discussion and definition of common results and findings
12:00	Lunch
13:30	• Consolidation of results

Joint Program

Thursday 17th of October 2013

15:00	Presentation of the results
17:00	End

![TRANSFORM – Transformation Agenda for Low Carbon Cities]

Program flyer of the conference

HAMBURG INTERNATIONAL BUILDING EXHIBITION | CITIES IN CLIMATE CHANGE - NEW ENERGIES FOR THE CITY

Climate change is on going, and is threatening human civilisation. The necessary reduction in greenhouse gases by at least 80 per cent by 2050 will only be achieved if cities (the main producers of greenhouse gases) significantly cut down their emissions.
In ENERGIEATLAS (2010), the IBA Hamburg devised an excellence scenario showing how CO_2 emissions caused by buildings on the Elbe island of Wilhelmsburg can be reduced by over 90 per cent by 2050, even though the population is set to grow by some 50 per cent. The concept is based on extensive civic involvement and the following four pillars:

- Upgrades on buildings to increase energy efficiency
- Energy efficient new constructions
- Local heating grids based on renewable energies and industrial waste heat
- Renewable energy production in urban areas

Initial milestones in the Renewable Wilhelmsburg Climate Protection Concept have been achieved in over 50 projects since 2007. The EnEffStadt IBA Hamburg monitoring project running until 2015 can track whether or not the planned CO_2 saving will be reached. Over 50 percent of the electricity required by buildings on the island will then be generated on site in a climate friendly manner.

REVIEW | OUTLOOK | COMPARISON

We would love to see you at the IBA'S Renewable Wilhelmsburg Climate Protection Concept conference on the Elbe islands. Register with Konsalt GmbH by post or fax, or online at www.iba-hamburg.de/rwcpc-conference, by Friday 11/10/2013. Participation is free.

The EU Interreg IV C project, CLUE, and the Intensive Lab Session of the EU'S TRANSFORM project, carried out as part of the 7th research activities programme will be held simultaneously with the conference.

Hamburg ahead

INTERNATIONAL CONFERENCE
RENEWABLE WILHELMSBURG
CLIMATE PROTECTION CONCEPT
REVIEW | OUTLOOK | COMPARISON
14 – 16 October 2013
Hamburg, Germany

Sponsored by:
Bundesministerium für Verkehr, Bau und Stadtentwicklung
Bundesinstitut für Bau-, Stadt- und Raumforschung
Zukunft BAU
Hamburg

INTERNATIONAL BUILDING EXHIBITION IBA HAMBURG GMBH
AM ZOLLHAFEN 12, 20539 HAMBURG
WWW.IBA-HAMBURG.DE

IBA_HAMBURG Building the City Anew

Photo: IBA Hamburg GmbH / www.uffo-der.de
Layout: Konsalt GmbH

INTERNATIONAL CONFERENCE ON THE RENEWABLE WILHELMSBURG CLIMATE PROTECTION CONCEPT

After six years of the Renewable Wilhelmsburg Climate Protection Concept, the IBA Hamburg invites you to join it as it reviews, looks ahead at and compares international climate protection projects and those based in Wilhelmsburg.

The event will begin with an excursion to selected IBA projects, after which you can explore the Energy Bunker and enjoy the view of Hamburg at a get together. The first day of the conference will first focus on European and US cities leading the way in climate change, before shifting to the idea of climate protection in urban areas as part of the "Energetischen Stadtsanierung" (Energy efficiency city upgrade) development programme. The final focus of the day will be the Renewable Wilhelmsburg Climate Protection Concept, with a presentation, discussion, and tribute to one of the "Landmarks in the Land of Ideas".

The third day of the conference will see concrete building plans for IBA projects presented in detail, and solutions for combining architecture and renewable energy sources discussed.

Registration for the conference held from 14 to 16 October 2013
Online registration: www.iba-hamburg.de/rwcpc-conference

By email to: iba@konsalt.de
By post or fax to:
Konsalt GmbH, Altonaer Poststrasse 13, 22767 Hamburg, Germany
Fax +49 (0)40 357 527 16

I hereby bindingly register for the Renewable Wilhelmsburg Climate Protection Concept conference

Institution/Association
Last name, First name
Telephone
Email

14 October, bus excursion ☐ Get-together ☐
15 October, conference day 1 ☐
16 October, conference day 2 ☐

Monday | 14 October 2013 | Bus excursion
IBA DOCK | Am Zollhafen 12, 20539 Hamburg

01.00 pm Check in at IBA DOCK
Registration for bus excursion
Visit to IBA at WORK exhibition

02.00 pm Start of bus excursion

02.30 pm Energy Bunker: Official unveiling of the IBA plaque and EFRE sign

06.00 pm Get together in the Energy Bunker
Level 2: Champagne reception at the power station
Level 8: Café vju
Level 10: Visit to the flak tower and collectors

10.00 pm End of first day

Tuesday | 15 October 2013 | International conference
Bürgerhaus Wilhelmsburg | Mengestraße 20, 21107 Hamburg

Host for the day
Stefan Schurig | World Future Council

08.30 am Registration
IBA Hamburg and "Zukunft Bau" exhibition forum

09.00 am Welcome and introduction
Uli Hellweg | CEO of IBA Hamburg

09.15 am Greenovation: How Eco Districts Foster Innovation and Development
Joan Fitzgerald | Boston Northeastern University Law and Public Policy

International role models for urban climate protection

10.00 am Copenhagen
NN | City of Copenhagen (TBC)

10.20 am Vienna
Ina Homeier | City Administration Department for Urban Development and Planning for the City of Vienna

10.40 am Stockholm
Christina Salmhofer | Sustainability manager at the City of Stockholm

11.00 am Break

11.15 am San Francisco
Calla Rose Ostrander | Department of the Environment

11.45 am Hamburg
Hans Gabányi | Authority for Urban Development and the Environment, Free and Hanseatic City of Hamburg

12.15 pm Discussion with speakers

01.00 pm Lunch break

"Energy efficient city upgrade" development programme

01.45 pm Welcome
„Energy efficient city upgrade" development programme
Ministerial head Oda Scheidelhuber |
Federal Ministry of Transport, Building and Urban Development

02.00 pm Heating schemes and the energy efficient city upgrade in Hamburg
Frank Karthaus | Authority for Urban Development and the Environment, Free and Hanseatic City of Hamburg

02.10 pm Bergedorf Süd pilot project: Programmatic objectives and planned implementation
Arne Dornquast | Bergedorf District Office Manager

02.15 pm Hamburg pilot project Bergedorf Süd: Heating grids in existing districts with mixed ownership and usage structures
Henrik Diemann | Metropol Grund
Kay Teckenburg | MegaWATT

02.40 pm Hamburg pilot project Dulsberg: Modifying the district heating grid and making buildings energy efficient
Dr Andreas Hermelink | Ecofys Deutschland
Dr Stephan Richter | GEF Ingenieur AG

03.05 pm Discussion with speakers

03.15 pm Break

Renewable Wilhelmsburg Climate Protection Concept

03.45 pm Interim review
Simona Weisleder | IBA Hamburg
Karsten Wessel | IBA Hamburg

04.30 pm Panel discussion
Is the urban quarter THE driving force behind climate protection?
Outlook for the future of the Renewable Wilhelmsburg Climate Protection Concept
Dr Michael Beckereit | Hamburg Energie
Prof. Peter Droege | University of Liechtenstein
Hans Gabányi | Free and Hanseatic City of Hamburg
Uli Hellweg | IBA Hamburg
Dr Harry Lehmann | Federal Environmental Agency
Christian Maaß | HIC Hamburg Institut Consulting GmbH
Prof. Irene Peters, Ph.D. | HCU Hamburg

Awards ceremony: Germany – Land of Ideas

05.30 pm Awarding of IBA Hamburg for the Renewable Wilhelmsburg Climate Protection Concept
Tribute speech and award presentation
Corinna Pregla | „Deutschland Land der Ideen"
Matthias Grimm | Deutsche Bank

06.00 pm Finish

Wednesday | 16 October 2013 | International conference
Bürgerhaus Wilhelmsburg | Mengestraße 20, 21107 Hamburg

Host for the day
Uwe A. Carstensen | Plans Urban development, urban restructuring, architecture

08.30 am Registration
IBA Hamburg exhibition forum and "Zukunft Bau"

09.00 am Welcome and introduction

Zukunft Bau research initiative
Welcome BMVBS

09.10 am State Secretary Rainer Bomba | Federal Ministry for Transport, Construction and Urban Development

09.20 am Welcome BBSR
Prof. Harald Herrmann | Federal Institute for Structural, Urban and Regional Research

09.30 am Green Buildings State of the Art
Rudolf Trachsel | Bob Gysin + Partner BGP Architekten

Brief discussion with the speakers

Completed IBA projects in detail

10.00 am Calculated values and measured reality
EnEffStadt IBA Hamburg monitoring project
Thomas Wilken | TU Braunschweig

10.15 am VELUX Lichtaktiv Haus (Light active house)
An existing "EffizienzhausPlus" (Efficiency house Plus)
Jan Ostermann | Ostermann Architekten
Thomas Wilken | TU Braunschweig

10.45 am Break

11.00 am "Tor zur Welt" (Gateway to the world) training centre Passive house standard and renewable energies in school construction
Patrick Ostrop | bof Architekten
Jörg Baumgärtner | EGS Plan

11.45 am Algenhaus BIQ Biomass production in the city
Dr Martin Kerner | SCC
Dr Jan Wurm | Arup Deutschland GmbH

Brief discussion with the speakers

12.30 pm Lunch break

01.30 pm WOODCUBE Sustainability and Life Cycle Balance in housing construction
Matthias Korff | Deep Green Development
Joost Hartwig | ina Planungsgesellschaft mbH

02.15 pm Open House The passive house and its users
Heiko Schiller | Schiller Engineering
Dr Stefan Krümmel | HCU Hamburg

Brief discussion with the speakers

03.00 pm Break

03.30 pm Energy bunker from war ruin to the power house of renewable energies
Guido Höfert | HHS Architekten
Axel Dette | ReGE Hamburg
Joel Schrage | Hamburg Energie

04.15 pm Panel discussion: "Prospects for climate friendly architecture"
Prof. Dr Norbert Fisch | TU Braunschweig (TBC)
Jan Gerbitz | IBA Hamburg
Joost Hartwig | ina Planungsgesellschaft mbH
Rudolf Trachsel | Bob Gysin + Partner BGP Architekten
NN | Resident (TBC)

05.00 pm Ceremony to handover the IBA plaque to the building owners of the Prima Klima campaign
Simona Weisleder | IBA Hamburg

05.15 pm Finish

Conclusions Workshop 1 - "District Heating Grids"

Problem Formulation of Workshop 1

One of the main strategic fields of the Renewable Wilhelmsburg Climate Protection Concept is the supply of the densed areas by district heating of renewable sources.

Accordingly, until now the following heating grids have been realized or are in concrete planning phases:

- ➔ The district heating grid of the „Energy Bunker" supplies until now about 1.000 units of the IBA-projects "Global Neighbourhood" ("Weltquartier") and areas close-by. The building of the former WWII bunker is place of the central heat and power station with a heat storage of 2.000 m² which collects or will collect the following energy sources: solar thermal of the "solar shell", a biogas CHP, a woodchip boiler, waste heat of a closed-by industrial firm and peak-load natural gas boiler. An extension of the grid and the supply of about 3.000 units of the 1900s Reiherstieg Area is planned

- ➔ The „Integrated Energy Network Wilhelmsburg Central" supplies right now the new buildings in this central Area (Residential Buildings, Offices, Public Bath). The central energy unit is a biogas CHP. Additionally, decentral producers of renewable heat are allowed to feed into the grid, which is practised right now by three objects. An extension of this grid is planned in the frame of the development of further areas near-by and during bigger urban developments after the transfer of the main road "Wilhelmsburger Reichsstraße". Thereby, the connection of the close-by vocational school has to be verified.

- ➔ The deep geothermal district heating grid in the southern Reiherstieg Area is currently in the planning phase. A realization is planned until the end of 2015. The grip will supply an industrial firm, the local hospital and several residential buildings.

The Renewable Wilhelmsburg Climate Protection Concept envisages an extension and a coupling of the grids above as well as the development of two new grids in the areas of Kirchdorf-Süd and Veddel:

- ➔ The residential area South Kirchdorf was developed in the 1960s 1970s and was built up of mainly high-rise buildings. The Climate Protection Concept envisages for this area a "solar concept" with a supply mainly by solar thermal.

- ➔ The residential area at Veddel was built up in the 1920s as a typical Hamburg red brick area, developed by former cities chief architect Fritz Schumacher. For this area, the Climate Protection Concept envisages a supply by a heat pump with the source of the Elbe River. Close-by are several industrial firms which waste energy is potential useable.

The development of measures during a workshop is reasonable for the areas Veddel, South Kirchdorf and the urban development in Wilhelmsburg Central because of their conceptual openness.

For the workshop the participants of the Intensive Lab Session Hamburg split up into three different teams, with each task force covering a different area of Wilhelmsburg. All three areas feature different building stock, population structure and prospects of development.

All three groups were assigned with the same objective which was to develop strategic plans to reduce the emissions of carbon dioxide (CO_2) associated with heat supply of their area to the necessary minimum until the year of 2050. In order to achieve this objective there are four different scopes that need examination:

- Reduction of the demand for heating energy
- Providing heat energy from renewable sources
- Use of industrial waste heat
- Reduction of the usage of fossil fuel by the application of highly effective cogeneration of heat and electricity

The idea was that each task force would find a set of solutions most suitable for the examined area under consideration of the prevailing conditions. In order to do so the following questions had to be answered:

- What are the characteristics of the area under investigation?
- Who are the stakeholders?
- Are there any sources of renewable energies or industrial waste heat within or nearby the investigation area and if so to what extent do they correlate with the heat demand?

Introductory Presentations

Before the participants of the Intensive Lab Session Hamburg split up into the different workshops the urban development concept "Zukunft Elbinseln 2013+" was outlined to the group.

Urban development

Chiara Derenbach of the Hamburg Department for Urban Development[1] and the Environment presented some of the main projects of the International Building Exhibition and gave a preview on future plans.

The largest urban development project which took place as part of the IBA Hamburg was Wilhelmsburg Central. The area provides solutions to questions about how to reconcile the marked contrasts of the Elbe islands – city and harbor, quiet and noise, greenery and transport hubs – and improve the quality of life for residents. The key specifications of Wilhelmsburg Central are:

[1] Behörde für Stadtentwicklung und Umwelt (BSU)

- Total gross floor area: approx. 115,000 m²
- Gross floor area residential: approx. 30,000 m²
- Gross floor area retail, commerce, services: approx. 75,000 m²

Another major step towards the development of Wilhelmsburg will be taken in the future when Wilhelmsburger Reichsstrasse is diverted to the east, so that it runs alongside the railway track. This key measure will open up a broad corridor of approximately 146 hectares running north from the geographical center of the Elbe islands towards the Spreehafen, allowing for the future development of the district and potential space for several thousands of new homes. This represents a unique opportunity for the district to consolidate itself in a sustainable way.

The second important future development area is the customs area in the North of the island of Veddel (about 11 hectares) with significant potential for the residential district Veddel and its bridgehead on the south side of the Norderelbe vis-à-vis the HafenCity. After the abandonment of the customs area in the district will be able to grow towards the Elbe and connect Wilhelmsburg with the center of the city of Hamburg. This evolution will be another step towards lifting the isolated location between Spreehafen, Georgswerder and Wilhelmsburg North. More detailed Information regarding the urban development concept "Zukunft Elbinseln 2013+" can be found in the presentation in the Annex.

Renewable Wilhelmsburg

Jan Schülecke from MegaWATT presented the Workshop Handouts, introducing the different quarters and development areas of Wilhelmsburg with a special focus on the future energy demand, district heating networks and the associated power plants based on renewable energies.

Hidden under the wide forecourt of the new BSU building beats the heart of the new integrated energy network Wilhelmsburg Central[2]. A bio-methane-powered CHP plant operated by HAMBURG ENERGIE provides the bulk of the heat supply, while feeding renewable power into the electricity grid and also ensures a basic level of service. Additionally a number of interconnected power generation plants located in various buildings form a large "virtual" power station. All nearby residents can feed renewable thermal energy into this thermal grid. Solar heat plants located on suitable roofs for example also feed in energy from renewable sources. The key specifications of the central power plant are:

- 600 kW biogas CHP (space for a second one)
- 2,400 kW natural gas peak load boilers
- Currently delivering 6.5 GWh heating energy per year (approx. 75% produced by the CHP)

In contrast to the hidden integrated energy network Wilhelmsburg Central the "Energy Bunker" is visible from a great distance being landmark and a symbol for the aim towards supplying the Elbe islands with renewable forms of energy. By using, in an intelligent way, a combination of solar

[2] Energieverbund Wilhelmsburg Mitte

energy, biogas, wood chips, and waste heat from a nearby industrial plant, the "Energy Bunker" is set to supply most of the Reiherstieg district with heat, while also feeding renewable power into the electricity grid. The project's most innovative feature is its large-scale buffer storage facility, with an expected total capacity of 2,000 m³ built inside the former air raid bunker. This is fed by the heat from a biogas CHP, a wood combustion system, and a solar thermal unit, as well as the waste heat from an industrial plant. The key specifications of the "Energy Bunker" after completion will be:

- Solar panel façade on the south side: approx. 1,600 m²
- Photovoltaic system on the roof: approx. 1,100 m²
- Heat storage tank of 2,000 m³
- 267 kW industrial waste heat
- 625 kW biogas CHP
- 2,000 kW woodchip boiler
- 4,240natural gas peak load boilers
- Will deliver approximately 22,500 megawatt hours of heat (approx. 78% produced from renewable energies and industrial waste heat) and almost 3,000 megawatt hours of renewable electricity.

Veddel

Context

The Veddel area is located southeast of the city center of Hamburg, and is separated from it by the river Norderelbe. The district includes the eastern part of the island Veddel east of the railway line from Hamburg Central Station to Hamburg-Harburg and the Peute, also an island in the Elbe river basin. A small strip on the northern edge of the island of Wilhelmsburg, with the Emigration Museum BallinStadt, is also part of the Veddel district. West Veddel extends the area of the Port of Hamburg.

The Veddel district covers an area of 4.4 square kilometers. The area of Peute is determined by industry and business, the remaining Veddel by habitation. The population density is 1,100/km².

Except of a small strip in the North of the Veddel Island that still is under supervision of the Hamburg Port Authority most of the Island was build up as residential area in the 1920s. The former Hamburg chief architect Fritz Schumacher provided the guideline of a uniform design of houses with red clinker brick facades and flat roofs. The individual building blocks, grouped around a central plaza with a school, were built according to the plans of various Hamburg architects on behalf of different local nonprofit cooperatives. Today many of the buildings that are inhabited by roughly 5,000 people are under urban heritage conservation and the entire area is considered protected milieu.

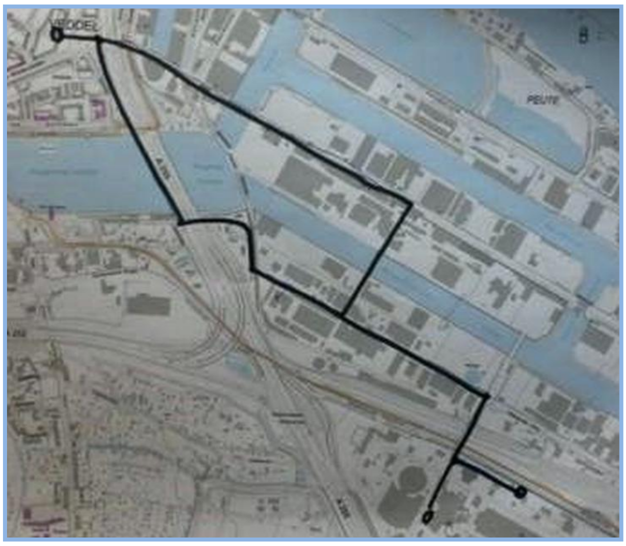
In the actual condition the so called Schumacher buildings have a total floor area of 87,700 m² and a specific heating demand of 165 kWh per square meter and year. The IBA Energy Atlas predicts a total estimated heat demand of 15,000 MWh per year for the area (including municipal buildings) by the year of 2050 (after energetic retrofitting). After the abandonment of the 11 hectares customs area in the north of the district a mixed quarter with building blocks for approximately 270 apartments and approximately 59,000 m² for commercial use will be build.

Building Uzilization	Urban and Landscape Environment Types	Energy Procurement Area (EPA)	Heat Demand
Existing buildings		[m²]	[MWh/a]
Mixed / Commercial	Functional buildings and public facilities	101.346	6.745
Housing	Schumacher buildings 1920s-1930s	87.725	8.772
Planned buildings			
Housing	Multi-storey housing - Passive House Standard	21.600	756
Commercial	Commercial areas - Passive House Standard	59.000	3.363
	Total	**269.671**	**19.636**

One of the biggest industrial plants in the area of Peute belongs to the Aurubis AG (formerly Norddeutsche Affinerie AG) the largest copper producer in Europe.

Findings

The discussion was dominated by the idea of the use of industrial waste heat from Aurubis for future heating systems. Currently the copper plant uses water from the river Elbe for continuous process cooling. Therefore the necessary amount of water is taken from the river, heated up to 35 Degrees Centigrade and pumped back into the river. This permanent thermal output of about 60 MW has to be considered excessive and unused energy as well as an undesirable temperature-impact on the river Elbe.



The team worked out two different routes for potential heating pipelines from the Aurubis plant to the center of the island of Veddel (→ figure).

The necessary length of the pipeline was reckoned with 5,500 meters with estimated costs of 5.5 Million Euros. The total investment costs including heat exchangers in the buildings were valued at roundabout 8.5 Million Euros. To finance this investment as many recipients as possible should become connected to the heating grid.

In order to use the waste heat for heating purposes the heating systems in the connected buildings would have to be adjusted to lower flow temperatures. This could be achieved by installing larger radiators as well as subfloor or panel heating systems.

Without an adjustment of the radiators additional systems to raise the temperature within the buildings e.g. heat pumps would have to be installed. This also applies to the domestic hot water demand where temperatures above 60 °C are at least once a day are mandatory. Alternatively electric instantaneous water heaters could be installed.

According to the Aurubis representative at the workshop Mr. Bröhan (Head of energy management and media supply at Aurubis) the copper plant could also supply hot water at a higher temperature level of approximately 90°C. This scheme would afford new heat exchangers and process modifications with uncharted investment costs at the copper plant.

Conclusions

The amount of waste heat produced by the Aurubis copper plant exceeds the heating demand of the Vettel district by a multiple. Using this waste energy for heating purposes could save up to 90 percent of the emissions of carbon dioxide connected to the heat supply. Nevertheless in order to do so numerous obstacles must be overcome.

Taking into account the funding for estimated investment costs and additional running costs the application of waste heat from the Aurubis copper plant for heating the district of Vettel would cost nearly 100 Euros per megawatt-hour. Based on the assumption that the current heating costs are approximately 65 Euros per megawatt-hour additional funding or an optimization of the system would be necessary.

PESTLEGS

Political/Legal/Governance

- Implementing incentive systems for using waste heat (public funds – like EEG – for renewable heat)
- Development plan: obligatory connection to heating grids, reduction of flow-temperature in heating systems
- Implementing the „EEWärmeG“ for existing buildings
- For the City of Hamburg (grid owner): investing in the development of heating grids as part of the political task

Economical

- Costs for waste-heat nowadays: 100 €/MWh (for connecting pipelines, district heating grid and integration in existing heating systems) Benchmark (Natural gas boilers) <65/MWh→ optimization of the system is necessary
- Uncertainty: equipment-costs for using waste heat at Aurubis

Social

- Need for constant prices for heating

Technical

- There are two options for using waste-heat
  - Option 1: Use of cooling-water (35 °C) in combination with decentralized heat pumps - attention: this would lead to a constant additional electricity demand!
  - Option 2: integration of heat-exchangers (hot water ≈90 °C) Requires new heat exchangers and process modifications with uncharted investment costs at the copper plant
- In general:
  - Decentralized (Option 1) vs. centralized system (Option 2) - both is possible
  - Peak load and redundancy systems (e.g. natural-gas boilers) are necessary and not considered in the costs yet

Environmental

- Reduction of CO_2-Emissions between 50% and 90% (depending on the system-design and the share of waste-heat)
- Reduction of the temperature-impact of the Elbe

Spatial

- Integration of the grid into the infrastructure planning process

Next Steps

- Continue and deepen the dialogue with Aurubis copper plant
- Promote low temperature heating systems for new buildings and energetic retrofitting

Wilhelmsburg-Mitte /-Nord

Context

For a long time, the disjointedness that characterized Wilhelmsburg was nowhere more acutely felt than in the very geographical center of the Elbe islands. Only a few minutes' journey from Hamburg's main station, highways and railway lines essentially tore the district apart, leaving a gaping hole. In a growing city like Hamburg, the major potential for development in this area went unnoticed.

The IBA Hamburg's Metro zones theme features Wilhelmsburg Central as its largest new construction project, taking on the task of bringing this inner-city backwater back to life.

The many construction projects taking place in the new center mark the first major step towards the development of Wilhelmsburg. Another will be taken when Wilhelmsburger Reichsstrasse is relocated to the east, so that it runs alongside the railway track. This key measure will open up a broad corridor running north from the geographical center of the Elbe islands towards the Spreehafen, allowing for the future development of the district and potential space for several thousands of new homes.

Findings

The investigation area consists of the IBA project Wilhelmsburg Central with a total floor area of 94,000 m^2 and the vocational school nearby as well as a land area of 0.45 km^2 in the North that shall be developed into a residential area after the relocation of the Wilhelmsburger Reichsstrasse. The heat density varies between 20 GWh/km^2 and 50 GWh/km^2 whereas the threshold for the economic operation of a district heating network is 20 GWh/km^2.

- Heat density between 20 GWh/km2 and 50 GWh/km2
- 20 GWh/km2 are necessary for the economic operation of a district heating network

For the heat supply of Wilhelmsburg Central a heating grid with a 0.6 MW biogas CHP and two 1.2 MW natural gas peak load boiler have been established to deliver 6.5 GWh heating energy per year. The Vocational school has its own CHP with a total heat capacity of 2.5 MW.

The projected residential area will have a total floor area of 305,000 m^2 with a heating demand of 6.1 GWh per year and an additional demand for domestic hot water of 8.1 GWh per year. This results in the need of a generation capacity of 4.3 MW peak with a base load demand of 1.6 MW for heating and hot water.

- Heat demand of projected buildings:
    - 6.1 GWh per year for Heating
    - 8.1 GWh per year for domestic hot water
- Necessary heat production capacity:
    - 4.3 MW peak load
    - 1.6 MW base load for heating and hot water

The design team has investigated three different scenarios to provide this additional demand.

Scenario 1:

- Use excess capacity from school and Wilhelmsburg Central
- Assume 1.3 MW available from school as peak load supply to other areas.
- Equipment of CHP extension already installed → 0.6 MW new capacity CHP in the IBA project Wilhelmsburg Central when needed (only investment cost of CHP).

- Need for more base load and peak load. One option would be heat pumps using groundwater for each building.

Challenges

- Energy savings at school
- Phasing of the erection of the new buildings
- Heat shall be delivered at two temperatures, low for space heating and higher for hot water

Scenario 2A: Aurubis copper plant low temperature waste heat

- Available heat capacity: 60 MW at 35° C
- Single Pipeline in new road: river water can be discharged at another location
- 35° C can be used for space heating (floor heating / new buildings)
- Otherwise heat pumps or electric instantaneous water heaters will be required to produce drinking water at 60-70° C.
- Maximum investment: 5.000.000 € since value of produced heat is app. 1.000.000 € per year.
- Costs of main pipe: 1.500.000 €
- Other costs: heat pump, distribution
- Look for other industrial waste heat sources in the area.
- Look for other potential heat demand areas

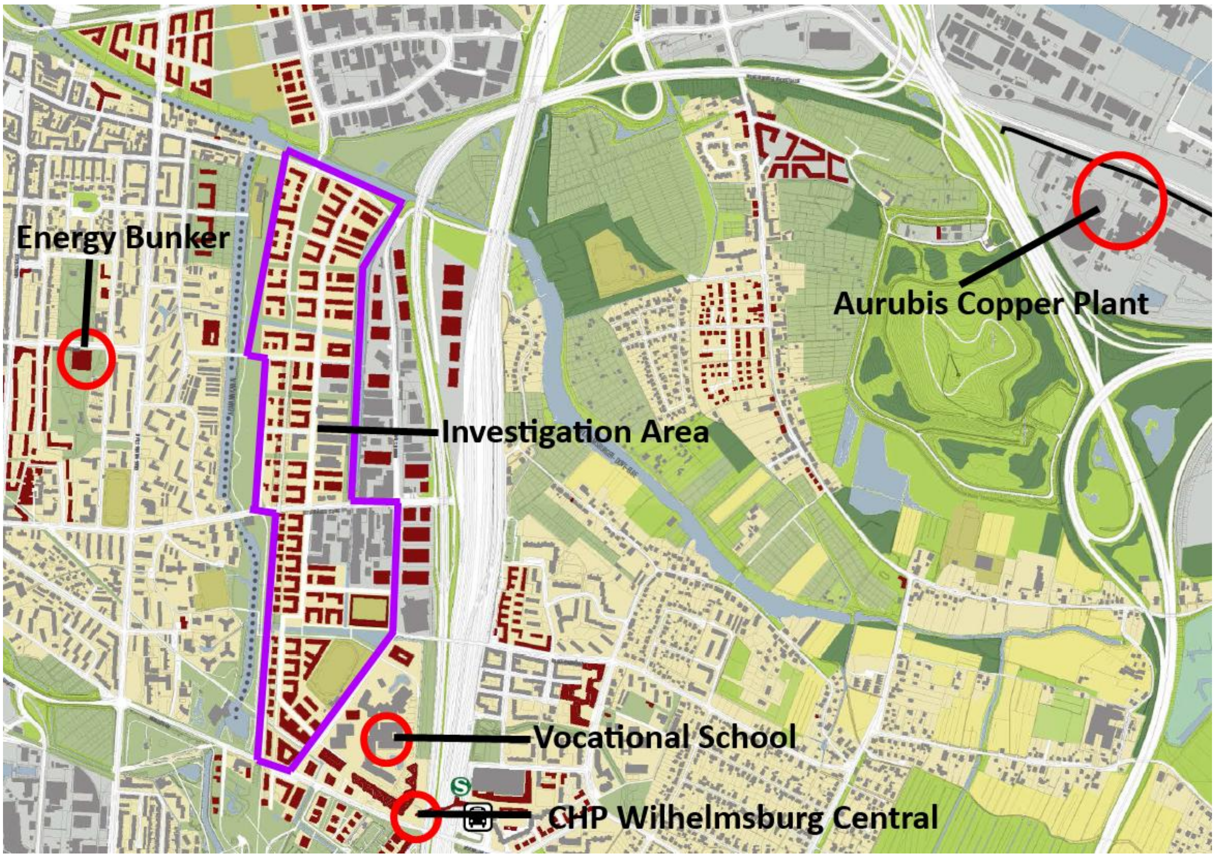
Scenario 2B: Aurubis copper plant high temperature waste heat

- Temperature available: 70-90° C
- Available heat capacity is unknown.
- Two pipes required for closed cycle
- This temperature requires substantial investment at industry, but then other districts may also be supplied by this source
- Costs main pipe: 1.500.000 €

Scenario 3: biomass/biogas

- Extend capacity of biogas CHP (biogas 90-100 €/MWh)
- Local network supplied by heat boiler fired by wood chips or wood pellets (wood chips 25 €/MWh; wood pellets 35 €/MWh)
- maybe also solar heat (roof top): Assuming on average 4 floors per building will make 76.000 m^2 of roof area available (25 % of 305,000 m^2 total floor area)

The investigation area and the described heat producers are shown in the map below.



The “How?” questions

Stakeholders and Tasks:

• City/District/IBA:	legal framework ”Bebauungsplan”
• Copper Factory:	deliver Energy
• Vocational School:	deliver Energy
• HAMBURG ENERGIE:	Design, Build, Contracts, Processing
• Developers, Investors and Clients:	planning the Buildings

Barriers

- Price of district heating: Price <-> Costs
- Plan B (if one of the sources is not delivering) e.g. peak boiler

Conclusions

- There are three suppliers existing near the investigation area
- Urban development leads to new potential customers for renewable heat
- Development is solvable with planning, communication and contracting

PESTLEGS

Political

- Subsidies may discontinue, making long-term planning complicated.

Economic

- Currently there is too little incentive for industry to deliver waste heat.

Social

- Present low-income population may have to leave the area due to increasing rents.

Technical

- Details for the outline for a new heating grid and the possible use of industrial waste heat from Aurubis need further analyses.

Legal

- Connection obligation for district heating might be required.

Environmental

- Local NO_x-emissions from CHP engines have to be considered.

Governance

- Lack of communication between key stakeholders.

Spatial

- The long distance between the copper plant and the supply area increases the economic risk.

Next Steps

- Expansion and densification of the existing district heating grids based on renewable energies and industrial waste heat
- Close coordination with relevant authorities
- Close coordinated with the planning
- Communication with potential heat producers who could feed into the grid (Aurubis, Vocational School)

Kirchdorf Süd

Context

Kirchdorf Süd is a 0.4 km² high-rise estate with 2,300 apartments and about 6,000 inhabitants on the island of Wilhelmsburg in the South-East of the Wilhelmsburg district. With a population density of more than 17,000/km² Kirchdorf-Süd is one of the most densely populated quarters in Germany. The residential buildings have an overall gross floor area of approximately 105,000 m^2. The settlement was established in the years 1974 to 1976 with correspondingly low energetic standards. The owners of the buildings are six different cooperative building companies that rent out the apartments as social housing. Nearly 19 percent of the population is unemployed and about 40 percent of the tenants receive social welfare benefits.

The heat supply in all buildings is based on natural gas used for central boilers in each building or boilers within the apartments. The area has no existing district heating grid.

In the actual condition the residential buildings in Kirchdorf Süd have a specific heating demand of 180 kWh per square meter and year. The IBA Energy Atlas predicts a total estimated heat demand of 12 GWh per year for the area (including municipal buildings) by the year of 2050.

Findings

The analyses started with the assumption, that the residents would not be capable to pay appreciable higher overall rents including heating.

As first ideas options for energetic retrofitting of the buildings were discussed. The team worked out that there would be a conflict of interests between the tenants and the building companies as owners. If landlords are interested in energetic retrofitting, they are confronted with the situation that the benefits of their investments will firstly go to the tenants who save a certain amount of heating costs as a function of the quality of the measures taken.

According to the German tenancy law 11 % of the costs for energetic retrofitting can be allocated on the rent. This would most likely lead to an increase of the overall rents since the resulting financial benefits for the tenants resulting from lower heating demand are smaller than the increase of the rent. With this initial situation there is presumably low interest in investments by the owners as well as by the tenants who fear the costs of any changes.

Renewable energy sources of a noteworthy amount could not be detected in the area. Since all buildings have six or more floors the available roofage for potential production of solar heat or electricity is very small compared to the gross floor area that has to be heated. Due to the small area of Kirchdorf-Süd the use of other surfaces for solar energy or the growing of energetic crops are out of the question.

On the other hand the density of the district seems to comply with the requirements to economically establish and operate a district heating system with low CO_2-emissions by CHPs.

Conclusions

In order to keep the extra costs as low as possible energetic retrofitting of the building envelopes should wait until cosmetic repairs of the frontage of the buildings become necessary anyway.

Especially buildings that currently do not have a central boiler will need extra investments for heat distribution within the building. The necessary construction work will also lead to noise and dirt exposure for the tenants.

A district heating system with low CO_2-emissions could be installed by using highly efficient CHPs. Nevertheless this would most likely result in rising costs for heating.

The main reason for this is the low price for electricity produced in the CHPs that is by law connected to the market price of the European Energy Exchange (EEX). On the other hand the electricity price for production, transportation and profits (excluding taxes and allocations) paid by the residents is much higher. Thus, revenues from the sale of electricity from CHP-production to residents could lower the heat price and additional earnings from electricity sales could be used to finance and operate the CHPs. Citizen companionships for renewable electricity could allow the tenants to participate in the plants for the production of renewable energies and purchase electricity directly from the CHP.

PESTLEGS

Political

- Additional subsidies for energetic retrofitting of building envelopes could push investments and attenuate the financial liability for socially deprived tenants.

Economic

- Due to cheap prices for natural gas and without financial inducement for the replacement of old natural gas boilers the erection of district heating systems with low CO_2-emissions results in rising heating costs.

Social

- How could preferably all residents of the area be to purchase electricity produced by CHPs?
- How to raise attractiveness of new heat supply?
- How to raise acceptance for new heat supply?

Technical

- The model could be improved by the use of large buffer storages for heat energy and the implementation of renewable energy sources such as: Photovoltaics, Solar Thermals and / or the use of biogas.

Legal

- The legal bases for the sales of electricity out of the CHPs to the residents are complicated.

Environmental

- District heating with highly efficient CHPs will considerably reduce CO_2-emissions.

Governance

- There is no existing impulsion for the stakeholders in the area to take any steps towards the reduction of CO_2-emissions.

Spatial

- The best location for a single CHP generation plant has to be identified. It could potentially be advantageous to place several smaller CHPs within the buildings cellars replacing the existing central heaters.

Next Steps

- Communication with the stakeholders to promote energetic retrofitting and district heating based on renewable energies

General outcome and policy recommendations

In dealing with the questions of ILS, all three groups worked out similar impediments for the reduction of the emissions of CO_2 associated with heat supply. One of the most important prerequisite for the establishment of a reasonably priced, low emission heat supply is the highest possible number of participating households in the area.

This can be achieved by the implementation of following recommendations:

- Official commitment by “Senat” and “Bezirk” to realize concrete actions and to implement the Masterplan Climate Protection (“Masterplan Klimaschutz”)
- Promoting motivation for connection to local heating networks
- Compulsory use of district heating for the development areas north of Wilhelmsburg Central and in the new areas of the Veddel district by regulations in the Land Use Plans (“Festsetzungen in Bebauungsplänen”)
- Clauses for use of district heating in future land tenders and purchase agreements for single premises in existing residential areas if the land is owned by the city of Hamburg (“Vergabebedingungen für städtische Grundstücke”)

- Active support of the development and the establishment of district heating networks based on renewable energies, decentralized CHPs and industrial waste heat in existing residential areas
- Integration of district heating concepts in future projects of energetic retrofitting if necessary supported by a corresponding expert

Additionally, since low temperature floor and panel heating systems lead to higher energy efficiency, a system of promotion and sponsorship for the adjustment of building heating systems for operation on low temperature level would help to reduce CO_2-emissions and make renewable heat supply systems more effective.

Workshop participants:

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Uwe Gährs	Tilia Umwelt GmbH
Torsten Ebeling	Vattenfall Europe New Energy Services GmbH
Mrs. Hartmann	HAMBURG Wasser
Detlef Moldmann	Ministry of Urban Development and the Environment
Dr. Maja Berghausen	District Hamburg-Harburg

Conclusions Workshop 2 - "Buildings / architecture"

Day 1: Presentations of several IBA-projects (2nd conference day)

The International Building Exhibition (IBA) Hamburg took place from 2007 to 2013 in Wilhelmsburg and the adjacent islands on the „Elbinseln Wilhelmsburg und Veddel", „Kleiner Grasbrook", the „Harburger Schlossinsel" and the harbor of Hamburg. Global climate change is an important issue due to the flood of 1962, to the population of Hamburg. In reference to this event, the themes of the IBA Hamburg "Cities and Climate Change" and "Climate Concept - Renewable Wilhelmsburg" were developed as a current and future-oriented project. The IBA has been developed in rural areas concepts of a complete renewable energy supply and these concepts are to be transferred into a new dimension within the urban area. Energy efficiency in urban areas comprises the basis of the integration of the residents, as well as the process of optimizing the energy efficiency of existing buildings and the consistent implementation of more stringent energy targets for new buildings.

Furthermore, the implementation of a sustainable energy supply based on renewable energy for the entire district is one of the main goals of the IBA Hamburg. In addition to the general climate protection program the IBA Hamburg contains a variety of individual projects with different energy concepts and aims. In the description of the excellence scenario the path of self-sufficiency of the district with heat and electricity as well as the reduction of CO_2-emissions are described in spite of increasing population.

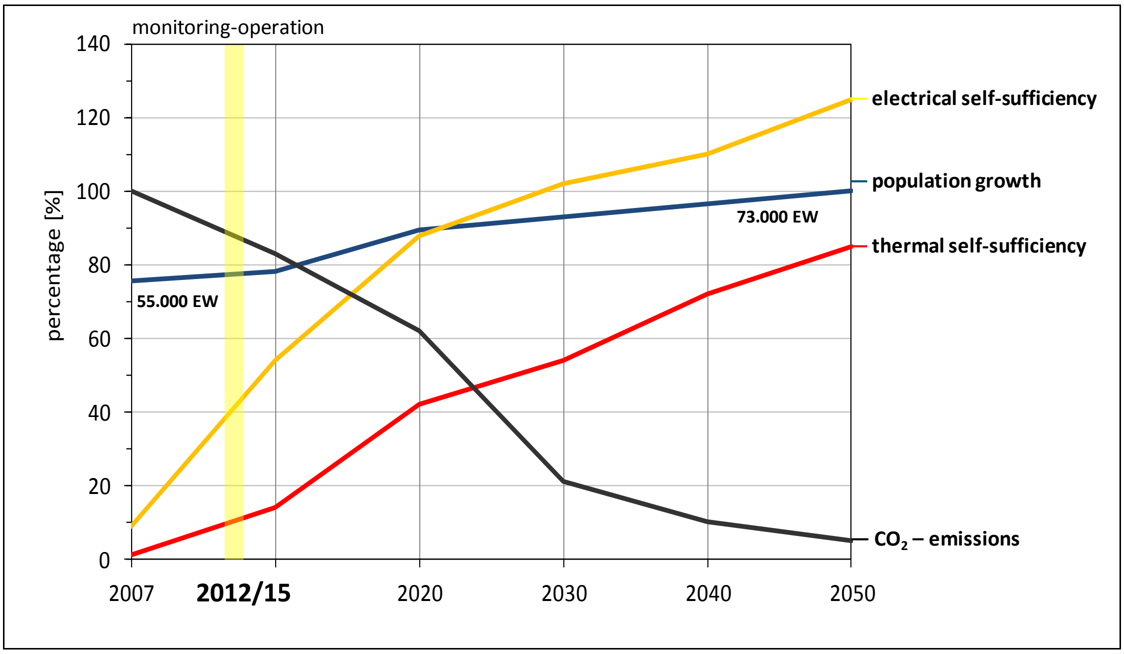

figure 1: excellence scenario for the path to climate-neutral supply (source: IBA GmbH)

Calculated values and measured reality – Monitoring of "EnEff Stadt – IBA Hamburg"

In the processing of the energy monitoring the selected IBA-projects are divided into different categories. The evaluation is carried out in two stages.

10 of these selected projects, which are innovative and trend-setting buildings are explored in a high-level-monitoring. Accordingly the data of energy consumption and energy production is recorded in a 15-minutes-period and transferred daily, weekly or monthly.

In addition, 40 of these selected projects are considered in a so-called low-level-monitoring with a monthly or an annual recording and transfer period.

The aim of this monitoring is to check the "milestones" to achieve the state of "zero-emission" for the district. The concepts of energy supply of the buildings that are in the high-level-monitoring are also investigated. To calculate and represent the emissions of the building operation the recording data of energy consumption, energy supply and energy balance are required.

In order to make these statements following probes are necessary:

- total current consumption
- electricity reference from the public grid
- Electricity generation by type of production (photovoltaik, CHP, etc.)
- Total heat consumption
- Heat reference from the heating network
- Heat generation by type of production (solar thermal, CHP, etc.)
- Consumed amount of energy to generate electricity / heat (gas, wood pellets, etc.)

The building, whose consumption is recorded in the extended (high level) monitoring, are also considered in subcategories if the necessary sensors are technically feasible:

- electricity: ventilation, household electricity, lighting
- heat: hot water, heating
- heat storage: thermal stratification
- Memory Power: Battery charging status

To verify compliance with the milestones, monthly and annual energy balances are created. These are used to determine the current state of carbon-neutral power supply of the building and the district. For this purpose, data on energy consumption and energy production in monthly or annual resolution are needed. This data can be read manually by the operator, buildings and used for further processing.

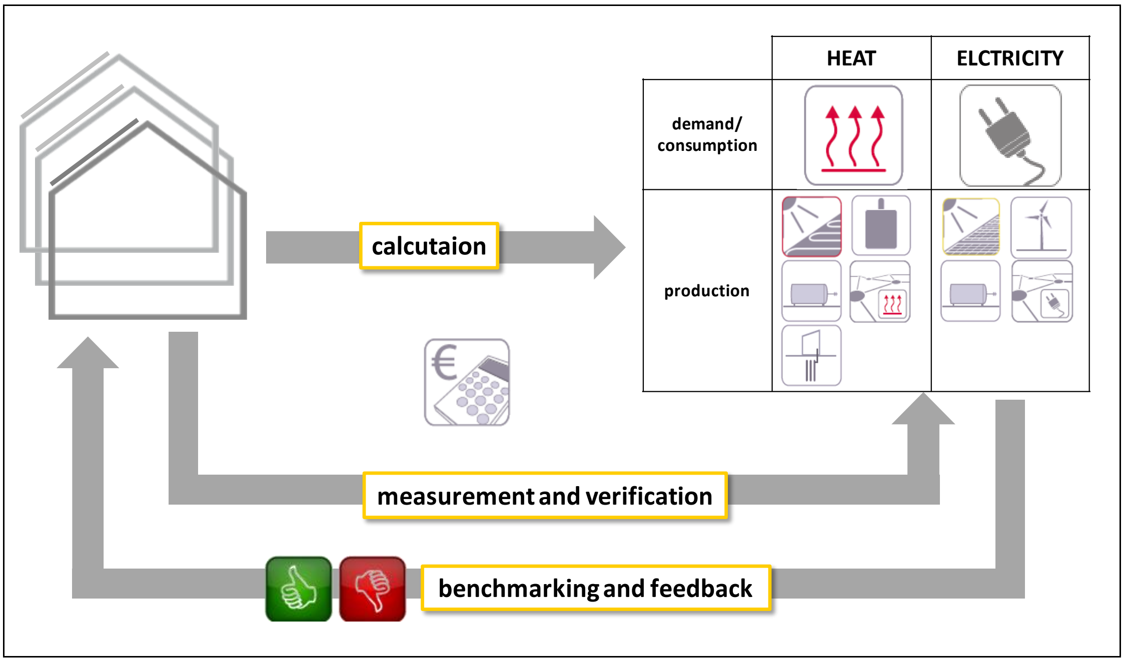

figure 2: “Energy monitoring an benchmarking”

For the high-level monitoring the consumption and production data are recorded and analyzed for generating daily profiles. To reduce the amount of data to a compatible level and at the same time a sufficient profile resolution, the energy consumption and energy production are automatically recorded in a resolution of 15 minutes. To assess the respective energy balances of heat and electricity, the consumption of raw materials for the production of heat and electricity as the amount of biomass can also be considered (figure 4).

In addition, in the following buildings a comfortable monitoring is carried out with the aim to investigate the quality of the interior (indoor environment quality) and to assess on the basis of surveys of user behavior:

- Open House
- IBA Dock
- Tor zur Welt
- Smart ist Grün

The comfort measurements of air temperature, humidity and CO_2 content in the living areas are not held for the entire duration of the project. Depending on the projects, the measurements last for a period of 2 to 12 months. These data are also recorded with a resolution of 15 minutes.

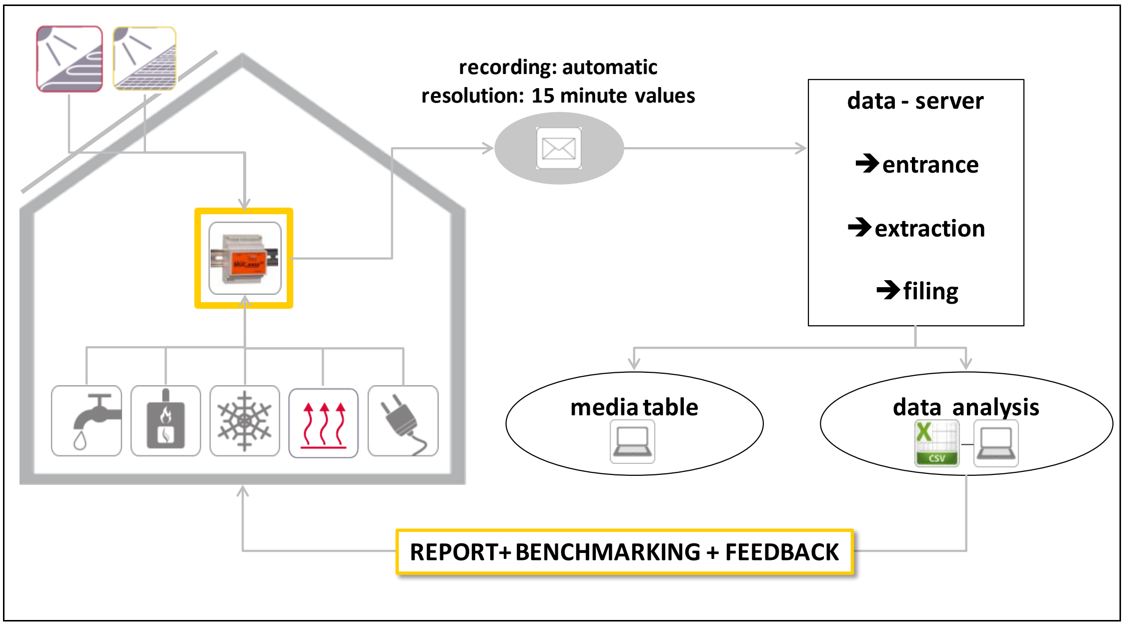

figure 3: “High Level Monitoring”

Against the background of the creation of an overall energy balance in the area of the Hamburg International Building Exhibition (IBA) in 2013, the priority of the Energy Research Centre of Lower Saxony (Energieforschungszentrum EFZN) is on the development of a monitoring network for the detection of relevant monitoring data. The task is to lead the individual projects in a total together.

It is important to point out, that the implemented measures like the new buildings, the retrofitted buildings, the creation of a new district heating network and the promotion of measures in private energy conservation reached the project savings effect.

Furthermore, the trend should be examined, whether the implemented and planned measures will achieve the climate goals and a CO_2-neutrality by 2050. Essentially a balance of needs and coverage is established for electricity and heat. (EFZN)

As a multimedia platform to show the central informations and to represent the energetic components and aspects of the energy monitoring a “media desk” was designed.

This desk shows the individual projects as well as the energy balance of the entire area during the presentation period and beyond (figure 5).

The "media desk" is used to display the following parameters:

- the strategies and scenarios of "climate protection concept Renewable Wilhelmsburg"
- the temporal change of the total area in the time slices 2007, 2013, 2020 and 2050 with the localization of the planned measures
- the energy consumption characteristics and the monitoring of all individual projects

- the current energy situation and the detailed presentation of the monitoring results of individual projects
- the current energy situation and the presentation of the monitoring values of the total territory

figure 4: “media desk ”

Efficiency House Plus: “Licht Aktiv Haus” / Light Active House”

The “LichtAktiv Haus” in Hamburg-Wilhelmsburg is a refurbished settler house from the 1950th. The living space was enlarged by an annex. The heat insulation was improved, and large, modern windows as well as systems for energy generation from renewable sources were installed. In modernising the house, several objectives were pursued. On the one hand, the aim was to meet the power and heating requirements of the house using renewable solutions such as geothermal and solar energy, thus creating a CO_2-neutral house over the period of use (figure 6).

The house is heated by an air-water heat pump. This is in addition to the supply of heating and providing hot water safely. The annex contains the solar thermal system (19.8 m²) and photovoltaic system (8,8kWp). The solar thermal system supports the supply of the building with heat.

Furthermore, the house should offer a high level of living comfort. This is to be ensured via automatic window opening control, activated using indoor climate sensors. The goal of the project is to show that systems for CO_2-neutral operation can be retrofitted in an existing home. Furthermore, it should show how well automatic natural ventilation can work.

figure 5: "Licht Aktiv Haus"(source: IBA Hamburg)

The building performance is evaluated and the energy is monitored by using numerous measuring devices which compile performance data, energy consumption and energy production. Furthermore, volume energy measurements are taken at relative locations. As the project continues, meter readings of the heating quantities and power meter will be used as a basis for evaluation.

Several factors influence the level of comfort in a room. One of these is the daylight supply through transparent construction elements (windows), incl. the resulting level of lighting from natural sources. Decisive parameters for comfort include room air temperature in conjunction with relative humidity and the CO_2 content as indicators of air quality. Furthermore, the VOC content is described to determine volatile organic compounds. Both values (CO_2-concentration and VOC content) are reported in parallel for mutual validation.

Education Center in Passive House Standard: "Tor zur Welt" / "Gateway to the World"

The education center "Gateway to the World" is divided into six body buildings, built to passive house standards. The new building complex of the education center draws on the urban structure of the west directly adjacent "railway area". In the ground floor four of the six buildings are spatially related to each other. In addition to classrooms of different teaching institutions a sports hall is integrated into the overall complex on the terrain. In a solitaire, the energy center of the building is housed.

The heat supply to the building is ensured by the use of two wood pellet boilers with a rated capacity of 240 kW. In support, two solar thermal systems, installed on the roof (40 m² tube collectors) and on the facade (80 m² flat panels) are integrated in the heat supply concept. On the roof of two buildings photovoltaic systems have been installed with a total installed capacity of 17.1 kWp for the regenerative electricity supply. The photovoltaic system was designed with the performance, that 10% of the electricity needs for lighting are sourced from renewable energy.

figure 6: “Gateway to the World“(source: IBA Hamburg)

In addition to a good building performance and a high renewable solar coverage of total energy consumption of the school buildings, a good thermal and hygienic indoor environment quality (IEQ) is a prerequisite for successful learning and teaching. With decreasing comfort (high or low temperature and humidity, high concentration of CO_2) in the classrooms the performance of students and teachers will decrease. To the interior high expectations and requirements with regard to temperature, air humidity, CO_2-concentration in the ambient air and good acoustics are laid. These parameters are examined and evaluated in addition to the energy monitoring.

Passive House with Algae Façade: “BIQ”

The five-story residential building with 15 units has been implemented in the Passive house standard. On the south and west of the building side, a biogas generating façade is prefixed as a second outer shell. With the help of sunlight Microalgae are cultivated in glass elements, which are used to produce heat and supply the building with its own energy in form of a solar thermal generator. The second front is implemented for the lighting control, shades the building, generates biomass and supports the heating system. In the water-filled panels microalgae grow up and will harvested at regular intervals. The biomass thus will obtain in further processes. Besides the cultivation of algae, the collectors of solar thermal serve heat supply of the building. The additional heating demand will be ensured through the total system with a technical concept consisting of an electrically driven heat pump with deep drilling. There is also a connection to the district heating supply and cover the peak load by a gas boiler.

figure 7: "BIQ" (source: IBA Hamburg)

Massive wooden Construction: "Woodcube"

The 5-storey residential building "Woodcube" consists almost entirely of the renewable material wood. All building materials of the building are checked for their CO_2-potential and building biological compatibility. Only the core of the building is made of reinforced concrete. The use of protective coatings and impregnations was omitted. The goal of the construction is to build the first residential building in a way of a storey housing which emits no greenhouse gases and is biologically recyclable. Electricity and thermal energy are also based on renewable CO_2-neutral sources. The Woodcube is due to the selection of sustainable materials a nearly balanced CO_2-footprint through the production and building operation. It shows the potential of massive wooden structures in the area of climate-neutral construction and energy supply from renewable sources (source: IBA Hamburg).

figure 8: "Woodcube" (source: IBA Hamburg)

Energy Storage: "Energy Bunker"

The ruin of the "Flakbunker" in Hamburg Wilhelmsburg was renovated and expanded in 2012 to energy plant for decentralized heat and power supply to the adjacent residential neighborhood. As a memorial and cityscape formative monument that stands in the middle of a residential area, the bunker has been made available through a new development and the establishment of a café at 30 m height to the public. The energy concept promises over conventional concepts and producers with a savings of about 95% carbon dioxide.

Above the roof of the building envelope and the south facade photovoltaic and solar thermal systems are installed. The thermal performance of the collector is 750 kW, the power of the PV system on the south side is about 100 kW peak. In the core of the energy bunker is a large buffer storage installed, which has already been reduced the thermal generation capacity. The buffer storage, which is located in the central interior of the bunker, is containing a total of 2,000,000 gallons of water. The storage is fed by the heat of the solar thermal plant, industrial waste heat, bio methane gas, CHP and wood combustion (source: HHS Archtiekten).

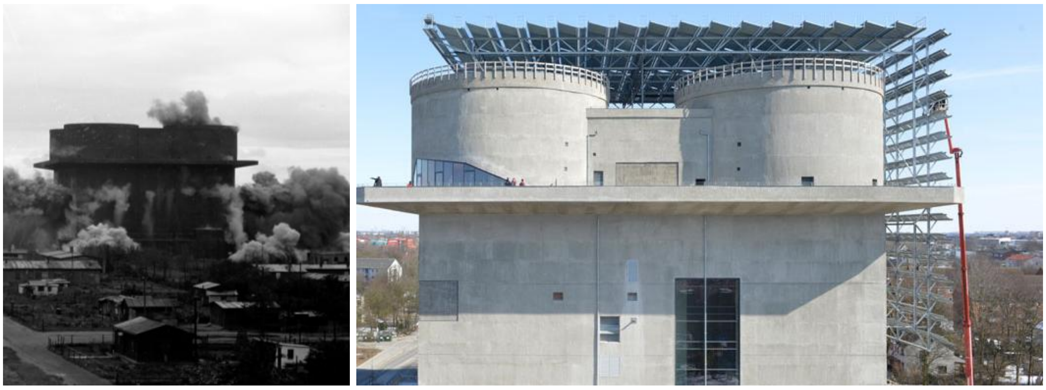

figure 9: "Energy Bunker" (source: HHS Architekten; IBA GmbH)

Passive House „Open House" and the relevance of the user

The "Open House" is built as a "Passive House" with the number of 44 apartment units in different types of housing. For this project, several investors have joined together in order to realize the project. The building is powered by two gas-fired combined CHPs. One CHP is supplied with biogas. To cover the peak load, a gas condensing boiler can be switched on. A cover of biogas utilization of 40% should be achieved this way. The generated electricity by the CHP can be used inside the building partly. In addition to the power generated by the operation of the CHP, solar electric power is generated by the PV system installed on the roof (72 kWp). This allows the CO_2-emissions reduced by the operation of the building and the share of renewable energy to be increased. The building achieved in the annual balance sheet total energy consumption compared to the over-production of energy, and therefore corresponds to the IBA standard "Passive House Plus".

figure 10: “Open House“ (source: IBA GmbH)

As a part of the research project “EnEff Stadt – IBA Hamburg” the use and acceptance of the building is investigated by the HCU (Hafen City University). The task is addressed to combine the analysis of the political, economic, social and media parameters. The influencing factors, evaluation of user behavior, user satisfaction and acceptance will be studied. Dealing with energy-efficient constructions and innovative technical equipment is questioned from the perspective of the inhabitants and builders of the IBA project "Open House". Target of the investigation is the function of the interaction in the passive house as a socio-technical system of human and non-human actors. In addition, the integration of these systems with different types of users and the integration and normative acceptance of this technology in everyday life is to investigate.

Users influence

The residential buildings of the GEWOFAG in Munich/ Riem are an example to show the influence of different technical concepts and the installation of various heating and ventilation components to the user and the energy consumption. On the basis of six identical buildings with eight units the heating energy consumption is compared and contrasted. Various heating and ventilation components in the respective buildings can be compared that way. The result shows that a higher standard has a negative impact on the consumption of heating energy compared to the normal standard of insulation of the building envelope caused by a rebound effect concerning the user. The installation of pretext heating elements has the result of a reduction of energy consumption by 7%. The installation of temperature controlled thermostatic valves, computerized central heating controls and operation of controlled ventilation systems with heat recovery lead to the highest reduction of the heating energy consumption (figure 16).

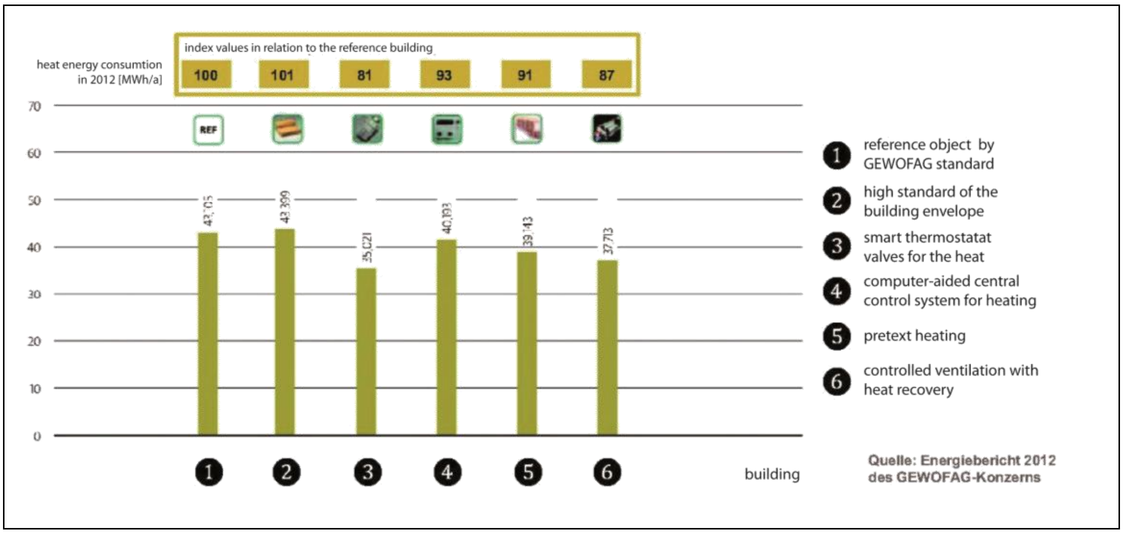

figure 11: influence to the heat consumption because of different technical systems

Day 2: Workshop and Discussion

These issues are addressed and deepened discussed on the second day of the conference and as part of a workshop.

Lecture: "Efficiency House Plus"

The development and the political background of energy efficient buildings in Germany are based on the climate change and the mitigation and the formulation of the Kyoto protocol. The development to reach the aim of energy-efficient buildings will also be pursued with the aim of ensuring the energy supply. The topic of energy-efficient building is regulated by the European Directive of Building Performance (EDBP) and the German energy saving ordinance (EnEV). The goal of these regulations is the transformation of energy supply system of Germany. With the entry of the respective heat protection regulations since 1977 and their detachment of the EnEV the requirements are increased in energy-efficient building and efficient technical operation (figure 12).

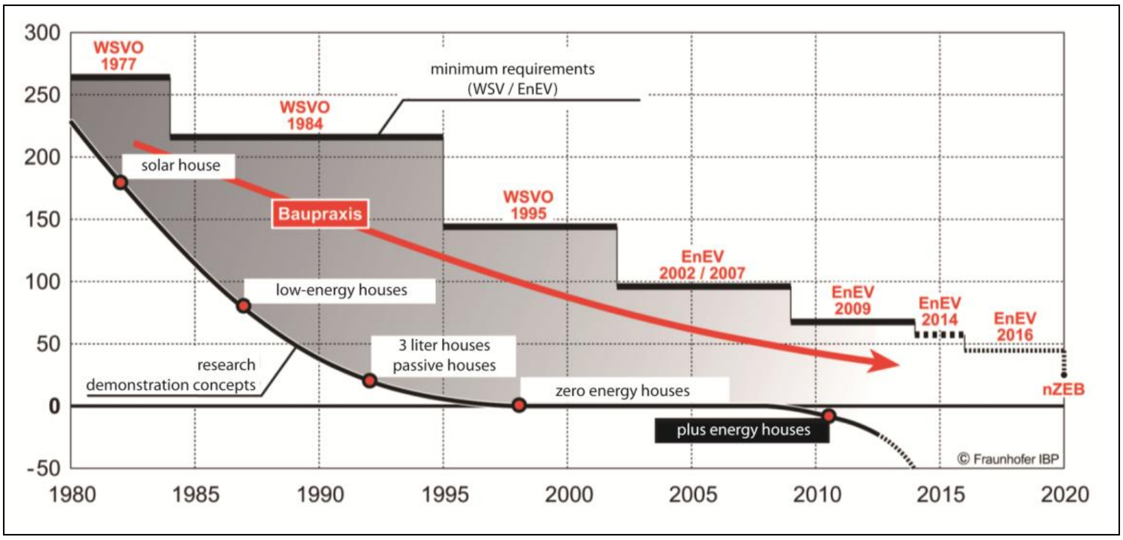

figure 12: Requirements of energy efficient building in Germany (source: Fraunhofer IBP)

The EDBP requires to reach the nearly zero-emission standard for public buildings until 2019. The "Efficiency House Plus" is defined as a building with a negative annual of primary and final energy demand including lighting and appliance. The balance of the energy demand of these buildings includes the renewable generated electricity and also the fed-in to the power grid. The aim on the main focus is a high level of self-use renewable energy. An autarchy of this building by 100 % is not sought.

32 projects within the network are affiliated. Nine of these projects with innovative technologies have been realized and implemented. The energy consumption and production of heating and electricity are recorded and evaluated to verify the "EHP standard". To reduce the thermal energy losses an air-tightness, an avoiding of heat bridges and the installation of windows with triple-glazing is necessary. To create a good indoor air quality, while reducing the heat ventilation losses, a mechanical ventilation system with a high efficient heat recovery is to install.

figure 13: "Efficiency Houses Plus" (source: Elbehaus GmbH; Berliner Energie Agentur)

Within the network, there are buildings of different types and technical concepts. The average heating demand is about 25 kWh/m²a. In most of the concepts in the buildings underfloor heating or wall heating are combined with a heat pump. Usually, the renewable electricity generation is achieved with photovoltaic systems. The average installed area is 0.5 m2 per m² living space. To increase the use of self-produced electricity several projects are using battery systems and/or electro mobility. All monitored buildings reached the standard of an annual energy plus. However the tendency of a higher energy demand than a projected one is detected.

Lecture: “Die Energiewende und die Wohnungswirtschaft” (The turnaround in energy policy and the residential trade)

The existing buildings and the residential units have due to their edification year and use different building structures and properties of the construction and building envelope. The energetic neighborhood redevelopment and the formation of district heating systems for decentralized heat supply require a basic inventory. To implement the decentralized supply crucial parameters are important. Besides the compactness (shape of the building) and age structure of buildings in urban neighborhoods, the quality of the building envelope (insulation standard, state of the building envelope) and the acquisition of consumption of the buildings are an integral part of the investigation.

The consideration at the building level has as well as the inventory of the nearby surroundings and the neighborhood influence in the implementation of the energetic neighborhood redevelopment. Different distributions use (residential, commercial, industrial, recreational, special items, etc.) and the possible shift to other uses which justify increasing or dwindling due to space requirements, these factors have an influence on the redevelopment of the neighborhoods. In consideration of the site and the integration of renewable energy in the supply concept the integration of mobility is being questioned and exploited potentials. As a decisive parameter here, the question of ownership arises again.

Based on the observation "cluster" can be created, which will develop the action priority, the efficiency savings potentials and the prospect of realization.

figure 14: "housing development – Hamburg Bramfeld" (source: left: Klimapakt Schleswig Holstein; LH Kiel/ right: Gesellschaft für Bauen und Umwelt mbH; plan zwei)

The settlement of Bramfeld comprises a total of 200 accommodation units, which are powered and heated by four heating circuits of the district heating network. 30 townhouses are supplied via a "virtual power plant" with heat and electricity. The idea of the "virtual power plant" is in a demand-led operation. Although this dependency is not released to a central power supply but an optimized supply of the existing structures is assured. The "virtual power plant" consists of three CHP, a gas boiler and a heat pump together. The electricity generated by the CHP is used in direct spatial context for the operation of the heat pump. The used outdoor air is preheated via the waste heat of the operating CHPs in the equipment room and serves as a source of the heat pump. The exhaust air of the heat pump is directed to outward. The arrangement and interaction of decentralized heat and power generators forms a typical composite of a "virtual power plant" (figure 15).

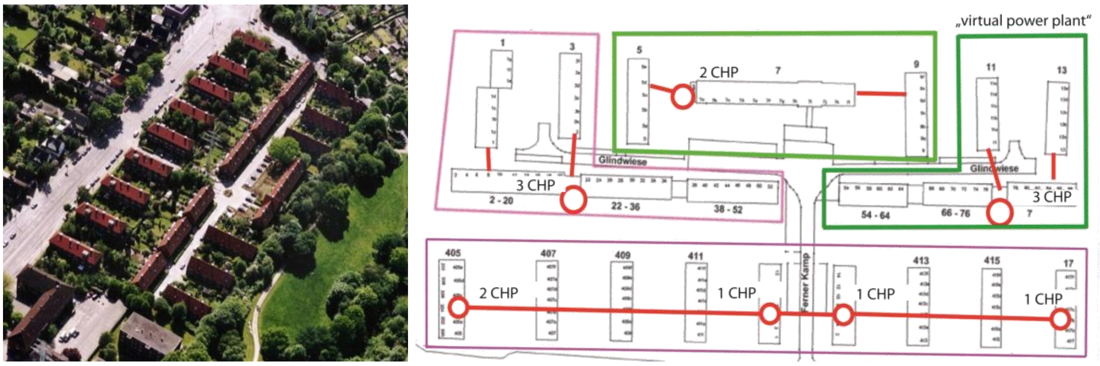

figure 15: "housing development – Hamburg Bramfeld" (source: BFW: P.-G. Frank)

Final discussion and findings

The topic of the final discussion involves the questions asked at the beginning of the workshop of a forward-looking supply of the districts on the basis of renewable energies. Especially the new buildings are appropriate to achieve the requirements of the Energy Plus standards. The feasibility of the implementation of energy-plus houses show the results of the "Efficiency House Plus" - network. It is necessary to develop and implement a monitoring plan for each new and also for the retrofitted buildings to check the building operation and to determine the achievement of this standard. The results of the monitoring also offer the possibility to optimize the building performance. Therefore, the inclusion of a monitoring plan should be integrated into the planning process of the building.

To give an answer to the question of unique energy standards, a consideration of the district and the city level is required. Due to the temporary excess energy resulting from the operation of energy-plus buildings and the question of the distribution and storage of energy, the implementation of zero-energy-and CO_2-neutral city district constitutes the main target.

The challenge for the development of city districts in the future is to combine the new built energy-plus buildings with retrofitted buildings. The retrofitting therefore has to be planned and arranged in a commercially reasonable framework. Through the interaction a balance sheet of energy and CO_2-neutrality occurs within the district.

The development of a decentralized energy supply with the use of self-generated energy in the immediate vicinity of the building and in the context of the neighborhood seems to be a forward-looking solution. For the integration of renewable electricity and heat generation in the existing supply systems, a combination of operators, producers and consumers on the respective viewpoints (building, district, city) is required.

In addition, a variety of factors are important for the integration of renewable energy into the existing system. The climatic, geographical and geological conditions and the incidence of renewable resources, development and distribution of electricity and heat are crucial for the realization of supply concepts.

Due to an increase in electricity consumption, caused by the enlargement of technologies in the buildings, the electricity generation has to be based on renewable energy supply. This is the main factor to achieve the target of a zero-energy district or loe-energy-neighborhood (Figure 17).

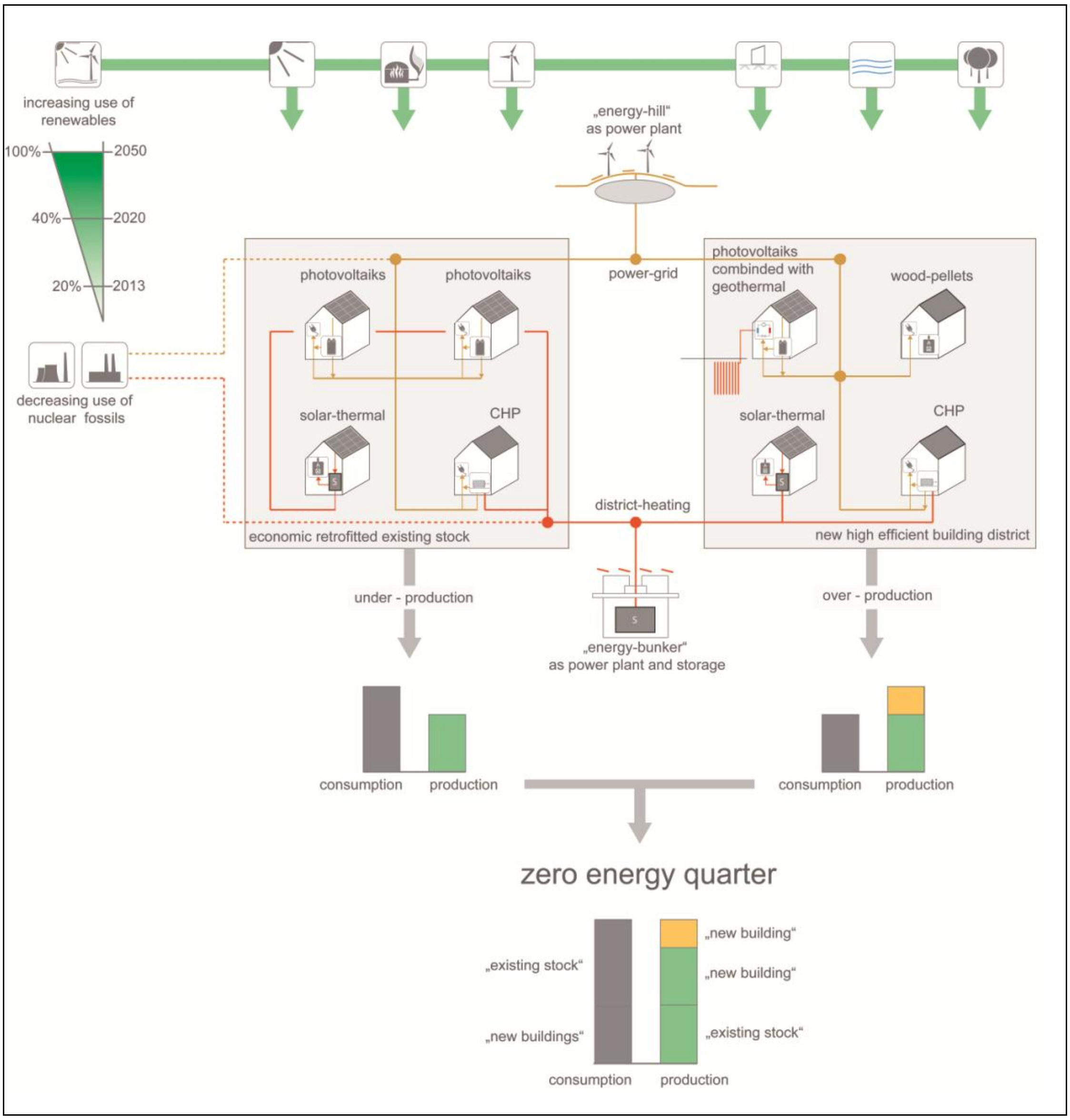

figure 16: "zero energy quarter"

By regulatory and legal conditions in the social and spatial context, the implementation of energy supply concepts of neighborhoods will be crucial. Through the establishment of private companies and individuals Communities (neighborhoods) that are necessary for the sale of electricity and heat from renewable sources. The foundation allows the implementation of "neighborhood concepts" and a decentralized production and use of energy in the urban context. To implement this scenario the user acceptance and integration of these into the respective individual concepts (like Open House) and should include in the overall concept.

A willingness of the users to realize the implementation is absolutely required. In addition to the use of renewable resources for the building operation, also the choice of building materials represents a significant influencing factor. The use of resources is considered on the basis of the environmental effects (Wood Cube) during the construction, building, operating and decommissioning. Moreover, the choice depends on materials of different useful life and replacement frequency. This always has to be considered in the planning an the constructing, as well as during the whole lifetime of a building.

Summary

In the summary, the main findings of the architectural workshops and the exciting discussion are tried to be merged by means of the PESTLEGS.

Political

- ➔ Compulsory use of district heating for new development areas by regulations in the Land Use Plans ("Festsetzungen in Bebauungsplänen")
- ➔ Clauses for use of district heating and for minimum energy standards in future land tenders and purchase agreements for single premises in existing residential areas if the land is owned by the city of Hamburg ("Vergabebedingungen für städtische Grundstücke")
- ➔ There is no political support for a city district or neighborhood heating or electricity system yet. It is due to become part of the climate and energy policy.
- ➔ In the current situation there is no political involvement concerning heating or electricity grid where neighborhoods supply themselves.

Economical

- ➔ It is necessary to reduce the energy demand of the existing buildings in terms of retrofitting concepts.
- ➔ Concerning zero- or low-energy-neighborhoods new buildings should supply the retrofitted buildings by giving the overproduction of heat and electricity directly without serving the public grid.

Social

- ➔ The user acceptance of the building and technical concept becomes increasingly important, because a good user behavior and an adequate user knowledge mostly influences the building operation positively.

- In contrast, an uninformed user doesn't accept the technical devices and therefore it often causes a rebound effect.

Technological

- It is required to consider and to implement monitoring concept in every case of architecture, new buildings as well as retrofited buildings.
- The building operation of residential buildings normally requires to be checked and optimized in the first year of startup procedure.

Legal

- Actually there is no law in Germany to sell the overproduced of energy (heat and electricity) directly in the neighborhood. Though, it is possible for house owners to establish a BGB company to sell the produced electricity of a photovoltaic-system to the tenants.
- There is a need to change legislation and existing agreements to make it easier to establish neighborhood energy supply. The combination of local energy production, energy storage and energy usage demands a new regulatory framework with new legal conditions.

Environmental

- Every city district and neighborhood needs an advanced implementation of renewable energy in the existing energy supply, both heating as well as electricity supply, as long as the reduction of CO_2-Emisssionen remains the ultimate goal.

Governance

- To manage the transformation process from public grids into low-energy-neighborhoods, leadership is needed. Since there is not a particular party responsible for smaller energy grids yet, this has to be organized in the future.

Spatial

- Early integration of energy planning in spatial planning and Land Use Plans ("Bebauungspläne")
- In most of the spatial implementation there is no issue, because there usually is enough space in existing neighborhoods. Attention is needed if the density of a new buildings is

very high, so that the energy demand can no longer be self-supplied.

➔ The potential of the use of renewable energy and technical infrastructure and devices always have to match and to be coordinated. The planning and the development of any type of energy systems in relation with spatial and programmatic planning needs to be researched accurately.

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