Energy efficient planning and architecture in Wilhelmsburg – Good practice and experiences from IBA Hamburg

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Project Coordinator, IBA Hamburg GmbH

SPECIAL Final Conference
26th January 2016, Gothenburg
International Building Exhibitions
Driving architectural visions and urban development

IBA Berlin 1984/87 and IBA Emscher Park 1999

Urban Development Concept „Leap across River Elbe“ 2001

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IBA HAMBURG – Climate Protection Concept "Renewable Wilhelmsburg"

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Storm surge: 16th February 1962

Bilder: Staatsarchiv Hamburg

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Migration background

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Building the City Anew

Three key themes:

1. Cities and Climate Change
   • Use local sources of energy.
   • Build in climate neutral manner.
   • Rethink urban development by and with the water.

2. Cosmopolis
   • Make globalization a productive process.
   • Create an international urban community.
   • Greater power to education, knowledge and culture.

3. Metrozones
   • Create quality urban neighbourhoods.
   • Give shape to inner peripheries.
   • Promote urban compatibilities.
2006-2013 IBA Hamburg: 70 Projects

420,000 Visitors in 2013 - Exhibitions

420,000 Visitors in 2013 - Guided Tours

420,000 Visitors in 2013 - Conferences
IBA HAMBURG – Climate Protection Concept "Renewable Wilhelmsburg"

420,000 Visitors in 2013 - International Delegations

Future Concept Renewable Wilhelmsburg
Pathways to Climate Neutral and Post-fossil Elbinsel
The Goal:
100 % renewable and in the district produced energy for the Sectors
Housing and commerce/trade/service providers

Urban space and building typologies in Wilhelmsburg
Urban space and building typologies in Wilhelmsburg

- current energy demand
- current energy supply
- potentials to reduce the energy demand → future energy demand
- potentials to use renewable energy (solarthermal, photovoltaics, biomass, geothermal, ...)
- biomass potentials in green areas
- scenarios for
  - increase of inhabitants
  - rate of anual retrofitting
  - increase of energy costs
  - rate of use of renewable energies

→ excellence-scenario

Future Concept Renewable Wilhelmsburg

Strategic Operational Fields of the Future Concept

- Refurbishing into New Building Standard
- Energetically Excellent New Buildings
- Regenerative Heating Network
- Renewable Energies
Energy Efficient Construction

- Minimum 30% better than National Standard EnEV 2009
- 40% of the buildings in Passive House Standard

Architects: Han Slawik Architects, Hannover (design)
BOF Architects, Hamburg (implementation)

Investor: IBA Hamburg

Construction Period: 2009-2010

Standard: EnEV 2007 minus 50%

Energy Concept: Geo-thermal Heatpump; Solarthermal Heating and DHW; PV

IBA Dock Exhibition and office centre
### WATER HOUSES

<table>
<thead>
<tr>
<th>Architect</th>
<th>Schenk + Waiblinger, Hamburg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor</td>
<td>HOCHTIEF Solutions AG, formart Hamburg</td>
</tr>
<tr>
<td>Construction Period</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Size</td>
<td>34 units – gross space: 4,640 m²</td>
</tr>
<tr>
<td>Standard</td>
<td>Passive House</td>
</tr>
<tr>
<td>Energy Concept</td>
<td>Vacuum Tube Solarthermal in Facade for Heating and DHW Geothermal Heatpump Infeed to Open District Heating Network</td>
</tr>
</tbody>
</table>

### Smart-Material-Houses SMART IST GRÜN

<table>
<thead>
<tr>
<th>Architect</th>
<th>zilerplus Architekten und Stadtplaner, München</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor</td>
<td>Behrendt Wohnungsbaub KG (GmbH Co.)</td>
</tr>
<tr>
<td>Construction Period</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Size</td>
<td>15 units – gross space: 1,740 m², floor space: ca. 1,340 m²</td>
</tr>
<tr>
<td>Standard</td>
<td>Passive House</td>
</tr>
<tr>
<td>Energy Concept</td>
<td>Solarthermal Heating and DHW Thin Layer Photovoltaic PCM-Storage Infeed to Open District Heating Network</td>
</tr>
</tbody>
</table>

### Smart-Material-Houses SOFT HOUSE

<table>
<thead>
<tr>
<th>Architect</th>
<th>Kennedy &amp; Violich Architecture, Boston</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investor</td>
<td>Patrizia Immobilien AG</td>
</tr>
<tr>
<td>Construction Period</td>
<td>2011-2013</td>
</tr>
<tr>
<td>Size</td>
<td>4 units – gross space: 790 m², floor space: ca. 520 m²</td>
</tr>
<tr>
<td>Standard</td>
<td>Passive House</td>
</tr>
<tr>
<td>Energy Concept</td>
<td>Integrated PV-Modules in Membrane on Roof and at Facade Geothermal Heating and DHW</td>
</tr>
</tbody>
</table>

### Smart-Material-Houses SOFT HOUSE
### Smart-Material-Houses BIQ

**Architect**
- Splitterwerk, Graz

**Investor**
- Fa. Otto Wulff Bauunternehmung GmbH & Co. KG and Strategic Science Consult SSC GmbH

**Construction Period**
- 2011-2013

**Size**
- 10 units – gross space: approx. 1,800 m²

**Standard**
- Passive House

**Energy Concept**
- Algae-Facade to produce biomass and solarthermal heat
- Geothermal Heat; Micro Biogas Boiler; Infeed to Open District Heating Network

### Smart-Material-Houses Woodcube

**Architect**
- Design: IfuH, Institut für urbanen Holzbau, Berlin/Darmstadt
  Realisation: Architekturagentur, Stuttgart

**Investor**
- Woodcube Hamburg GmbH

**Construction Period**
- 2012-2013

**Size**
- 8 units – gross space: approx. 1,480 m²

**Standard**
- KfW-Effizienzhaus 40

**Energy Concept**
- Massive wooden construction without any screws or glue
- Air tightness without any foils or membranes
- Renewable insulation material (soft wood fibreboard)
»Weltquartier« (Global neighbourhood)

- It is one of the culturally most varied neighbourhoods of the Elbe Island Wilhelmsburg
- More than 1,700 inhabitants from 31 countries live here
- 45% of the residents have an immigrant background:
  Most of them come from Turkey, Africa and East Europe

Participants Workshop in 2007

- Six “Scouts” (“Heimatforscher”) aroused the residents’ interest
- Adults and children designed their dream flats and made proposals for the improvement of their housing estate

820 apartments will be modernized, reformed and adapted to current needs.
Planned Apartments in the Global Neighbourhood:

- New building: 206 Ap
- Modernization: 77 Ap
- Conversion: 440 Ap
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“Prima Klima-Anlage”

Energetically Excellent New Buildings
Refurbishing Into New Building Standard
Regenerative Heating Network
Renewable Energies

IBA HAMBURG – Climate Protection Concept “Renewable Wilhelmsburg”

“Prima Klima-Anlage”

IBA HAMBURG – Climate Protection Concept “Renewable Wilhelmsburg”

Strategic Operational Fields of the Future Concept

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Strategic Operational Fields of the Future Concept

Regenerative Heating Network

„Regenerative“ heating networks

until 2013/2014:
- Energy bunker (3)
- Integrated Energy Network Wilhelmsburg Central (4)
- Deep geothermal energy Wilhelmsburg (5)
- New Hamburg Terraces (6)

after 2013:
- Extension and optional coupling of networks
- opening new areas (1, 7)

General Legislation

Heating Grids can be anchored in Zoning (Land Use Plan)

Hamburg’s Climate Protection Law / § 4 Connection and Use Requirement

„(1) The Senate is entitled ... to prescribe ... though administrative ordinances ... the usage of specified types and technologies of meeting heat demand, in particular the connection to a district heating grid. This applies to grids fed by heat produced by CHP, from industrial waste heat, or from renewables."

This clause has been applied in Hamburg in more than 50 cases.

„For heating and domestic hot water, new buildings are to be connected to a district heating grid, which is predominantly supplied by renewable energies."

Land Use Plan WB 90 Wilhelmsburg Central
Integrated Energy Network Wilhelmsburg Central

„Regenerative“ heating networks

until 2013/2014:
- Energy bunker (3)
- Integrated Energy Network Wilhelmsburg Central (4)
- Deep geothermal energy Wilhelmsburg (5)
- New Hamburg Terraces (6)

2013/2015
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Energy Bunker

Denkmalschutzamt Hamburg

25.000 t

IBA Hamburg / Timo Schiel

IBA Hamburg / bloomimages

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Energy Bunker

Biogas CHP

Waste Heat

Biomass Boiler

Solarthermal

Storage Tank

Natural Gas Boilers

Grid
Daily Load Profile using a Buffer Storage

Energy Source

GHG Calculation: 95 % Reduction

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Strategic Operational Fields of the Future Concept

- Refurbishing into New Building Standard
- Energetically Excellent New Buildings
- Regenerative Heating Network
- Renewable Energies

Energy Hill Georgswerder

Renewable Energies
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Barriers

- slowed extension of district heating grid
- changed tenancy laws
- reduced feed-in tariff for photovoltaic or CHP electricity
- less refurbishment rate
- KISS – Keep it simple and stupid

Since 2013

IBA Hamburg company as city owned urban development agency

- Coordination of urban development plans
- Development of land use plans (in cooperation with local municipality)
- Development of technical infrastructure
- Bidding of public owned building sites (on behalf of financial department)
Vogelkamp Neugraben – Start of marketing in April 2014

Fischbeker Heidbrook – former Röttiger Barrack Area

Wilhelmsburg – 4,000 to 5,000 Residential units

Instruments in New Build Areas
- Bidding of Building Sites
- Concept Tenders
- Connection Obligation in Land Use Plans
- Heat Concept
- Tender of Consessions
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Bidding of Building Sites

→ Highest bid / maximum prize
→ Linked with conditions, e.g.
  → 1/3 social housing
  → Minimum Energy standard
→ Concept Competitions / Tenders
  → Design and Social Quality
  → Advanced Energy standard
  → Photovoltaic
  → Sustainable Building Material / LCA
→ Rated by Point System

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Energy Research and Definition of District Heating Zones

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Tender of District Heating Concession

Kriterium Wichtung

a) Wärmepreise (statischer Wärmepreis sowie dynamisch anhand des Barwerts der Wärmevergünstigungskosten)
   (intern: 50% statisch, 50% dynamisch) 40%

b) CO₂-Emissionen und örtliche Belastung
   (intern: 87% CO₂, 13% sonstige Emissionen) 30%

c) Ein individuelles technisch ausgereiftes und zuverlässiges Konzept
   20%

d) Flächenverbrauch/Einbindungsfähigkeit der technischen Anlagen
   10%

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Instruments in Existing Areas

- National Programme for Retrofitting Concepts and Management
- 65% of Funding from National Subsidy Bank KfW
- 1 year Development of Concept:
  - Research
  - Building Typologies / Real Data
  - Scenarios
  - Action Plan
- 3 years Management

Retrofitting Concepts and Management

- Survey
Thank you for your attention!

Abstract of Energy Atlas and
White Paper of Roadmap available online!

www.iba-hamburg.de

ENERGY ATLAS and WORKING REPORT 1
English versions available as E-Books
Thank you for your attention!

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www.iba-hamburg.de

“Island Electricity Survey”

→ Dynamic simulation of the electricity demand and production of the urban typologies in 2050
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„Insel-Strom-Studie” / „Island Electricity Survey”

→ Dynamic simulation of the electricity demand and production of the urban typologies in 2050

→ Temporary import of 25 MW

→ Temporary over production of 158 MW

→ Temporary over production incl. Storage 132 MW

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SmartPowerHamburg

Funding Program „Energy Efficient Heat“ / „EnEff:Wärme“


Project Partner:

• HAMBURG ENERGIE GmbH (Lead)
• University for Applied Sciences Hamburg (HAW)
• RWTH University Aachen

→ Need to balance flexible Power Production like Wind Power and PV
→ Development of Energy System Services

Sub-Project CHP Interconnection / „Virtual Power Plants”

Sub-Project Storage Concepts
Systematic Development of Heat Storage Potentials of city owned Infrastructure:

• Energy Bunker
• District Heating Grids
• Public Swimming Pools

Sub-Project Demand Side Management
Development and Control of flexible Energy Demands:

• Cold Storage Houses

IBA HAMBURG GMBH
Transient.EE

Funded by National Ministry for Economy and Energy


Project Partner

- Technical University Hamburg-Harburg (TUHH)
- Lichtblick
- Germanischer Lloyd
- ArcelorMittal
- Dow Deutschland
- Stromnetz Hamburg
- Vattenfall Wärme Hamburg
- E.ON Gas Storage

→ Need to balance flexible Power Production like Wind Power and PV

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Simulation by Modelica / Dymola

Storage Potentials and Demand Side Management

- Steel, Copper and Aluminium Factories
- Pumped Storage Hydro Power Station
- Balance Fly Wheel Storage
- Battery Storage
- Air Pressure Storage

- Power2Gas → Gas Grid and Gas Caverne Storage

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Thank you for your attention!

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