Case Study Berlin

Summary

WP 4 Energy Efficiency and CO₂ Emission Reduction

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Situation 1991/1992 - Kaskelkiez (KAS)

- Total living / usable area: 187,450 m²
- Industry / business in the west of the area (Knorr Co.)
- Buildings mainly masonry structure - construction period 1875 - 1920
- Block development with war-related gaps
- Condition of the buildings:
  - 12 % poor / desolate, 59 % moderate damage, 29 % normally usable
- High individual renovation effort required
- Primarily decentralised heat supply
  - 76 % stove heating
  - 14 % gas individual room heaters (GAMAT)
  - 2 % Gas storey heating
  - 8 % central heating (coal)
- Hot water: (estimated ¹, no data available)
  - 45 % coal stoves
  - 30 % electrical storage heaters
  - 25 % gas instantaneous water heaters
- Natural gas network in good condition, no district heating service

<table>
<thead>
<tr>
<th>Spec. Heating Energy Demand</th>
<th>Spec. Final Energy Demand</th>
<th>Spec. Primary Energy Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>203 kWh/m²a</td>
<td>319 kWh/m²a</td>
<td>383 kWh/m²a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective Energy Demand</th>
<th>Input Factor</th>
<th>Final Energy Demand</th>
<th>Primary Energy Demand</th>
<th>CO₂ - Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh/m²*a</td>
<td>MWh/a</td>
<td>kWh/m²*a</td>
<td>MWh/a</td>
<td>kWh/m²*a</td>
</tr>
<tr>
<td>housing, MW-GZ, approx. 115.100 m²</td>
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<td></td>
<td></td>
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<tr>
<td>heating</td>
<td>205</td>
<td>23.536</td>
<td>1,55</td>
<td></td>
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<td>hot water</td>
<td>15</td>
<td>1.726</td>
<td>1,32</td>
<td>20</td>
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<td>housing / trade, approx. 63.500 m²</td>
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<tr>
<td>heating</td>
<td>192</td>
<td>12.226</td>
<td>1,36</td>
<td>262</td>
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<td>hot water</td>
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<td>573</td>
<td>1,30</td>
<td>12</td>
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<td>social institutions, approx. 9.300 m²</td>
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<tr>
<td>heating</td>
<td>251</td>
<td>2.329</td>
<td>1,39</td>
<td>348</td>
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<tr>
<td>hot water</td>
<td>30</td>
<td>279</td>
<td>1,31</td>
<td>39</td>
</tr>
<tr>
<td>total area, approx. 187.900 m²</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>heating / hw</td>
<td>216</td>
<td>40.670</td>
<td>1,47</td>
<td>319</td>
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</tbody>
</table>

¹ Estimated by the author, after consultation with STERN Gesellschaft der behutsamen Stadterneuerung GmbH
Situation 1991/1992 - Frankfurter Allee-Süd (FAS)

- Total residential /usable area: 418,500 m²
- Industry/Business on east side
- Good facilities with schools, day-care, retail
- Prefabricated buildings; construction period between 1970 and 1985
  56 % P2/10; P2/11 ; 17 % WHH GT 18/21 ; 4 % WBS 70
- 11 % Masonry structure (incl. business / commercial)
- 12 % remaining buildings (schools, day-care, businesses, etc.)
- Condition of the buildings:
  Facades in need of renovation, concrete damage
  Heating and central hot drinking water preparation inefficient
- Central district service for heating and hot drinking water
- Mainly single-pipe heating system

| spec. heating energy demand | 131 kWh/m²a |
| spec. final energy demand   | 175 kWh/m²a |
| spec. primary energy demand | 125 kWh/m²a |
| CO2 - emission              | 53 kg/m²a  |

<table>
<thead>
<tr>
<th>effective energy dem.</th>
<th>final energy demand</th>
<th>primary energy dem.</th>
<th>CO2-emission</th>
</tr>
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<tbody>
<tr>
<td>kWh/m²*a averaged</td>
<td>kWh/m²*a averaged</td>
<td>MWh/a</td>
<td>E-factor t/a</td>
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<tr>
<td>housing, MW-GZ, approx. 4,600 m²</td>
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<tr>
<td>heating</td>
<td>248</td>
<td>1.145</td>
<td>1,02</td>
</tr>
<tr>
<td>hot water</td>
<td>15,0</td>
<td>69</td>
<td>1,11</td>
</tr>
<tr>
<td>housing type WHH-GT 18/21, approx. 71,600 m²</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>heating</td>
<td>137</td>
<td>9.800</td>
<td>1,02</td>
</tr>
<tr>
<td>hot water</td>
<td>47</td>
<td>3.353</td>
<td>1,14</td>
</tr>
<tr>
<td>housing type P2/11, approx. 234,300 m²</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>heating</td>
<td>114</td>
<td>26.712</td>
<td>1,02</td>
</tr>
<tr>
<td>hot water</td>
<td>39</td>
<td>9.138</td>
<td>1,14</td>
</tr>
<tr>
<td>housing type WBS 70, approx. 16,400 m²</td>
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<td></td>
<td></td>
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<tr>
<td>heating</td>
<td>118</td>
<td>1.929</td>
<td>1,02</td>
</tr>
<tr>
<td>hot water</td>
<td>40</td>
<td>659</td>
<td>1,14</td>
</tr>
<tr>
<td>business, trade, approx. 60,100 m²</td>
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<td></td>
</tr>
<tr>
<td>heating</td>
<td>157</td>
<td>9.460</td>
<td>1,02</td>
</tr>
<tr>
<td>hot water</td>
<td>8</td>
<td>455</td>
<td>1,14</td>
</tr>
<tr>
<td>social instutions, approx. 31,500 m²</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>heating</td>
<td>187</td>
<td>5.877</td>
<td>1,07</td>
</tr>
<tr>
<td>hot water</td>
<td>29</td>
<td>920</td>
<td>1,14</td>
</tr>
<tr>
<td>total area, approx. 418,500 m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>heating/ hw</td>
<td>166</td>
<td>69.519</td>
<td>1,05</td>
</tr>
</tbody>
</table>

Frankfurter Allee Süd (FAS), P2/11

Distribution of total area FAS
Evaluation and Calculation Scheme

- Reference to usable floor space \( A_{\text{NGF}} \), not to building floor space \( A_\text{N} \) according to the EnEV (EnergieEinsparVerordnung / German Energy Conservation Regulations)

- Thereby the named parameters (energy demand / consumption) are approximately 20% higher \((A_\text{N} \approx 1,2 \cdot A_{\text{NGF}})\) than parameters calculated ones pursuant to EnEV.

- Area determination based upon built-up floor space and number of floors (gross floor space), as well as a conversion factor to determine \( A_{\text{NGF}} \) from gross floor space

- Energy parameters are determined on the basis of requirement calculations according to DIN 4108-6 / DIN 4701-10, including approximation approaches for simplification; Comparison to actual consumption data

\[
\begin{align*}
\text{Heat requirement} & \quad Q_H \\
\text{Final heating Energy Consumption} & \quad Q_{\text{End}} = Q_H \cdot e_p \\
\text{Primary energy demand} & \quad Q_p = Q_{\text{End}} \cdot f_p \\
\text{CO}_2 \text{ emissions factor} & \quad f_{\text{CO}_2} \\
\text{CO}_2 \text{ - emissions} & \quad Q_p = Q_{\text{End}} \cdot f_{\text{CO}_2} \\
\text{Potential for CO}_2 \text{ savings} & \quad \text{CO}_2 \text{ Emission} = Q_{\text{End}} \cdot f_{\text{CO}_2} \\
\text{CO}_2 \text{ Output Reduction} & \quad \text{Reduced heat consumption} \cdot \text{Improved plant equipment} \cdot \text{Change CO}_2 \text{ E-factor} \end{align*}
\]

Input factor \( e_p \)

- Technical systems
- Losses during distribution, conversion, storage

- Wall insulation
  / Roof / basement / ceiling
- Thermal insulation windows
- Ventilation / heat recovery
- A/V-Ratio

 primary energy factor \( f_p \) (PE-factor)

- Used energy sources
- Renewable energy content
- CHP use

- Energy sources
- Renewable resources
- CHP credit

Energy sources

- Primary energy demand
  \( Q_p = Q_{\text{End}} \cdot f_p \)

- Final heating Energy Consumption
  \( Q_{\text{End}} = Q_H \cdot e_p \)
Building Types and Average Energy Demand 1991/92

The various buildings in the case-study area were classified into the following building types:
(Heating and hot water related to the heated floor area of buildings)

<table>
<thead>
<tr>
<th>Building type</th>
<th>Building characteristics</th>
<th>Final energy (kWh/m² a)</th>
<th>Primary energy (kWh/m² a)</th>
<th>CO₂ Emissions (kg/m² a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW-GZ</td>
<td>Masonry construction, 3-5 floors, block development, decentralised heat supply</td>
<td>314</td>
<td>378</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td>Year of construction. 1870 -1920</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2/11</td>
<td>Residential bldg 11 floors</td>
<td>161</td>
<td>113</td>
<td>48</td>
</tr>
<tr>
<td>WHH-GT</td>
<td>Residential bldg 18/21 floors</td>
<td>193</td>
<td>135</td>
<td>58</td>
</tr>
<tr>
<td>WBS 70</td>
<td>Residential bldg 5/6 floors</td>
<td>166</td>
<td>116</td>
<td>50</td>
</tr>
<tr>
<td>Day-care</td>
<td>1-2 floors</td>
<td>197</td>
<td>138</td>
<td>59</td>
</tr>
<tr>
<td>Schools</td>
<td>5 floors</td>
<td>187</td>
<td>131</td>
<td>56</td>
</tr>
<tr>
<td>Shopping centres</td>
<td>1 floor</td>
<td>261</td>
<td>182</td>
<td>78</td>
</tr>
<tr>
<td>Production facilities</td>
<td>1-2 floors</td>
<td>128</td>
<td>90</td>
<td>38</td>
</tr>
</tbody>
</table>

Energy networks

Kaskelkiez
- Completely developed with natural gas
- The network was upgraded to the greatest possible extent in the 1980’s and steel piping was laid
- Dimensioning was sufficient to supply the area
- No district heating supply, although lines were adjacent

FAS
- District heating network completely developed
- Natural gas supply existing, only partially used for heating
Energy-related renovation actions at Kaskelkiez

Initial situation

- Partially desolated structural condition, as well as poor energy condition
- Unsettled ownership situations complicate restoration activity (restitution claims)
- Fragmented ownership structure, approximately 20 % owner-occupied
- Historical monument protection, or restoration and conservation statutes limit energy-related renovation

Kaskelkiez Actions

- Replace decentralised heat generators (stove heating / gas outer wall heating),
  Installed central heating equipment with modern low-temperature / condensation boilers, almost completely based on natural gas
- Occasional installation of storey-level gas heating per housing unit (via residents renovation programme in the 1990s)
- Installation of central hot water equipment during total renovation
- Renovation of leaky roofs, to some extent with insulation of the top ceiling
- Insulation of the roof during loft conversions to extend residential use
- Insulation of the lowest ceiling / basement ceiling
- Replacement/Refurbishing of old wood windows
- Renovation of the facades (stucco facades) without insulation in the case of historical monument protection
- Insulation of only rear facade surfaces (courtyard or side wing) in the case of buildings protected as historical monuments or with restoration/conservation statutes
- Application of renewable energy sources for particular properties:
  4 properties with solar thermal energy
  1 property with photovoltaic technology
  1 property with a biomass furnace (pellets)
Energy-related renovation actions at Frankfurter-Allee-Süd

Initial Situation

- Buildings constructed from prefabricated components show defects in the facade (outer walls/windows), as well as in the technical equipment (defective condition / dimensioning / adjustment)
- Initial situation in terms of energy parameters clearly better than at Kaskelkiez
- Ownership situations for the most part clarified (restitution claims excluded for prefabricated residential buildings)
- Buildings are the property of a few larger owners (housing associations/cooperatives), by whom mainly complex renovations were implemented

Energy-related Actions Frankfurter Allee Süd

- Renovation of the district heating feed point stations, including hot water preparation
- Installation of thermostatic valves as well as consumption-based billing
- Replacement of the single-pipe heating equipment by twin-pipe equipment in the process of complex renovation
- Renovation of the supply equipment (ventilation, cold/hot water distribution, electric distribution) in the process of complex renovation projects
- Insulation of the hot water / circulation lines to reduce distribution losses
- Complex renovation of building types:
  P2/11 (mainly 1995-98)
  WBS 70
  including
  - heat insulation of the facades
  - heat insulation of the lowest / top ceilings
  - window replacement
  - renovation of the building supply equipment
- Maintaining district heating supply
- Partial renovation of a school and day-care
- Renovation of a sports hall in 2010 within the framework of a stimulus programme
- One combined heat and power unit by heating station in the low-energy building WHH GT 18/21
Energy Concepts 1991/92 to 2010

- Energy-saving measures in existing buildings are voluntary; if renovated, however, the modified or replaced components are subject to requirements oriented to new buildings (EnEV)
- Short-term economic measures (replacement of heating boilers from before 1978, insulation of the top ceilings, insulation of lines, consumption-based billing) are prescribed by law.

Inception of the Heat Insulation Ordinance (WSVO) or Energy-Saving Regulations (EnEV) (Following: Development of heat requirements for new construction, W. Ornth, BMVBS)

The development of energy prices since 2000 provides stimulus for energy-savings (source BMWI)

- Since renovation is voluntary, government programmes provide incentives for energy-saving actions: the KfW Programme with interest subsidy (by partial repayment waiver for low energy standard), government programme for the launch of renewable energy sources (BAFA)
- Outstanding examples for energy efficiency:
  - Existing low-energy building, WHH GT 18/21 high-rise, renovation 2005/06
  - Renovation on new construction level with solar thermal technology: Kaskelstrasse 49 (2005/06)
  - New low-energy building with solar thermal technology: Spittastrasse 36 (2009/10)
- In case of historic buildings and facades, historic monument protection has priority over energy saving.
Achieved level of energy-related renovation

- large part of houses renovated: approx. 60% completely / partially approx. 15% basically
- New construction for living buildings, businesses (offices) and trade
- Total area increase approx. 82% through new buildings and extensions
- Absolute reduction of CO₂ emissions by approx. 6.500 t/a

Energy consumption and CO₂ emissions

- Residential buildings:
  80% central heating / natural gas
  15% storey-level gas heating
  5% stove heating / other
- Businesses: 100% central heating natural gas
- Hot water: 85% centralised / natural gas; 15% decentralised (electric)

Surface-related energy parameters 2010:

<table>
<thead>
<tr>
<th></th>
<th>spec. heating energy demand</th>
<th>spec. final energy demand</th>
<th>spec. primary energy demand</th>
<th>CO₂-emission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-25%</td>
<td>-42%</td>
<td>-46%</td>
<td>-63%</td>
</tr>
<tr>
<td>152 kWh/m²*a</td>
<td>184 kWh/m²*a</td>
<td>205 kWh/m²*a</td>
<td>40 kg/m²*a</td>
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</tbody>
</table>

### Table: Energy Consumption and CO₂ Emissions

<table>
<thead>
<tr>
<th></th>
<th>effective energy demand averaged kWh/m²*a</th>
<th>input factor ep averaged MWh/a</th>
<th>final energy demand averaged kWh/m²*a</th>
<th>primary energy demand averaged MWh/a</th>
<th>CO₂-emission averaged t/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>housing, MW-GZ + new + extensions of roofs, approx. 162,900 m²</td>
<td>163</td>
<td>26.599</td>
<td>1,12</td>
<td>182</td>
<td>29.663</td>
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<td>heating</td>
<td>19</td>
<td>3.054</td>
<td>1,11</td>
<td>21</td>
<td>3.377</td>
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<td>hot water</td>
<td>136</td>
<td>22.957</td>
<td>1,10</td>
<td>149</td>
<td>25.150</td>
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<td>business, trade, including new buildings, approx. 168,300 m²</td>
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<td>1,494</td>
<td>1,11</td>
<td>10</td>
<td>1,664</td>
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<td>heating</td>
<td>225</td>
<td>2.465</td>
<td>1,12</td>
<td>250</td>
<td>2.749</td>
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<tr>
<td>hot water</td>
<td>23</td>
<td>247</td>
<td>1,10</td>
<td>25</td>
<td>272</td>
</tr>
<tr>
<td>social institutions, approx. 11,000 m²</td>
<td>166</td>
<td>56.817</td>
<td>1,11</td>
<td>184</td>
<td>62.877</td>
</tr>
<tr>
<td>heating / hw to 1991/92</td>
<td>-23%</td>
<td>40%</td>
<td>-42%</td>
<td>5%</td>
<td>-3%</td>
</tr>
</tbody>
</table>
Achieved level of energy-related renovation

- Nearly 100% renovation of residential buildings
- Schools and day-cares only partially until now, currently renovation of day-care and gymnasiams
- No energy-related renovation of commercial halls
- Partial energy-related renovation of office buildings
- Decentralised heat and power unit in the low-energy building of Howoge 175 MWh heat, 85 MWh power annually
- Clear reduction of CO₂ emissions of district heating (decrease of emission factor from 300 to 149 kg/MWh)

<table>
<thead>
<tr>
<th>Spec. heating energy demand</th>
<th>78 kWh/m²a</th>
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<tbody>
<tr>
<td>Spec. final energy demand</td>
<td>103 kWh/m²a</td>
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<td>Spec. primary energy demand</td>
<td>-60 kWh/m²a</td>
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<tr>
<td>CO2 - emission</td>
<td>16 kg/m²a</td>
</tr>
</tbody>
</table>

| Housing, MWh/G2 + extensions of roofs, approx. 5,000 m² (increase in 400 m²) |
|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|...
Summary

Changes in the areas (absolute values)

Parameters of Energy Demand and CO₂ Emissions 2010 and achieved CO₂ Savings

<table>
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<th></th>
<th>Kaskelkiez</th>
<th>Frankfurter Allee Süd</th>
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<tr>
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<td>through energy sources</td>
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</table>
Potential for Energy Savings / Energy Efficiency

Kaskelkiez
- Small-scale ownership structure leads to differentiated planning and renovation
- Partial renovation in steps according to urgency and financial possibilities
- Energy-related renovation of building shell still holds great potential.
- Renovation of the heating / hot water equipment prevalingly implemented
- Until now very few investments in renewable energy sources, since investments in heat insulation and heating system modernisation were more economic
- Connection of the area to district heating had only been investigated in 2006 - majority of the renovation and new construction actions were already completed and supplied for example with natural gas, district heating supply still assessed as uneconomical.

Frankfurter-Allee-Süd
- 5 owners (housing associations/cooperatives) possess 99% of housing → best conditions for large-scale implementation of renovation and energy-efficient measures
- All residential buildings were renovated using state-of-the-art technology while respecting legal energy demand guidelines
- Until now only a few investments in renewable energy sources: not more energy-efficient compared to district heating from combined power and heat technology available in the area.
- Intensive use of government incentive programmes (KfW Programme, Berlin Prefabricated construction incentive progr. 1993 to 2001, Urban development progr.)
- Definite effects via energy source change and efficiency improvement of district heating applications (network operator) without individual investments of the building owners

Conclusions

1. Large owners or organised ownership structures more successful in energy-related renovation
2. Planning / decisions as to energy sources / supply networks to be considered from outset
3. Partial renovation possible, but coordinated total concept needed; otherwise: risk of structural damages/ inefficiency/ higher efforts of user involvement.
4. Targets for energy-related area development should be defined individually, subsequently renovation concepts with information as to the approach, renovation sequence or data on savings potential should be developed.
5. Energy-related renovation of building shell should be implemented on the highest possible level, since energy saving measures have long usage duration (20 - 40 years).
6. Stepwise energy-related improvement of building components recently renovated at present uneconomical.
7. Involvement of the tenants / occupants in process very important, since user behaviour bears considerable influence on the actual energy consumption.

Disclaimer: This leaflet has been produced with the assistance of the European Union. The content of this publication is the sole responsibility of Planergemeinschaft Hannes Dubach, Urs Kohlbrenner, contractor of Center of Competence for Major Housing Estates e.V., and can in no way be taken to reflect the views of the European Union.