WP 4 Energy Supply

Baltic Sea Region Programme 2007-2013

Part-financed by the European Union (European Regional Development Fund and European Neighbourhood and Partnership Instrument)

URB Energy

Energy Efficient and Integrated Urban Development Action

Energy efficient rehabilitation of buildings and energy supply infrastructure – Case Study Berlin

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June 11, 2010, Warsaw, WP 4 Workshop

Structure of presentation

1. Case Study Berlin – introduction
2. Case Study Berlin – current state with focus on improvement of buildings and energy supply infrastructure
3. Lessons learned

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Case Study Berlin – introduction
Objectives

- **Documentation of**
  integrated urban development planning
  with focus on energetic measures

- **Analyses of planning process 1991 – 2010**
  - Documentation of planning steps, plans and measures
  - Elaboration of a critical evaluation on retrospective planning process

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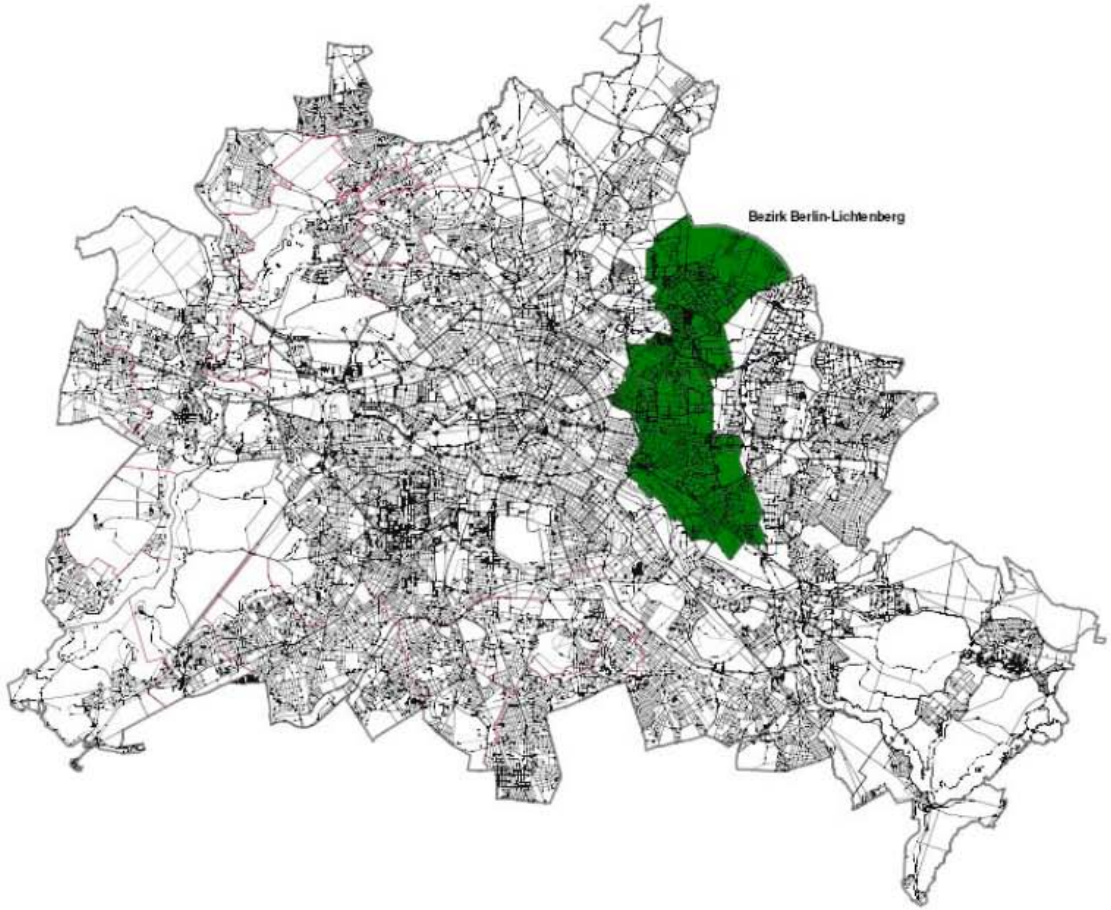
Case Study Berlin – introduction

Location of area



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Case Study Berlin – introduction

Area

Frankfurter Allee-Süd
(large housing estate)

Kaskelkiez
(historic building area)

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Case Study Berlin – introduction

Impressions

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Case Study Berlin – introduction

Steps of general planning process

- survey of the initial state
- ⇩ evaluation of the findings (e.g. SWOT)
- ⇩ needs for action
- ⇩ aims, paradigm
- ⇩ alternatives, priorities
- ⇩ integrated development concept, including financing strategy
- ⇩ implementation process
- ⇩ permanent adjustment and updating of the concept

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Case Study Berlin – introduction

Steps of documentation

- **situation in the beginning of the 90ies (1990-1994)**
- **evaluation of situation in the beginning of the 90ies**
- **formulation of needs for action**
- **documentation of alternatives and of priorities**
- **documentation of integrated development concepts**
- **documentation of realised measures up to today**
- **evaluation of planning process and implementation status**

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Case Study Berlin – introduction

Steps of documentation

- situation in the beginning of the 90ies (1990-1994)
- evaluation of situation in the beginning of the 90ies
- formulation of needs for action
- documentation of alternatives and of priorities
- documentation of integrated development concepts
- documentation of realised measures up to today
- evaluation of planning process and implementation status

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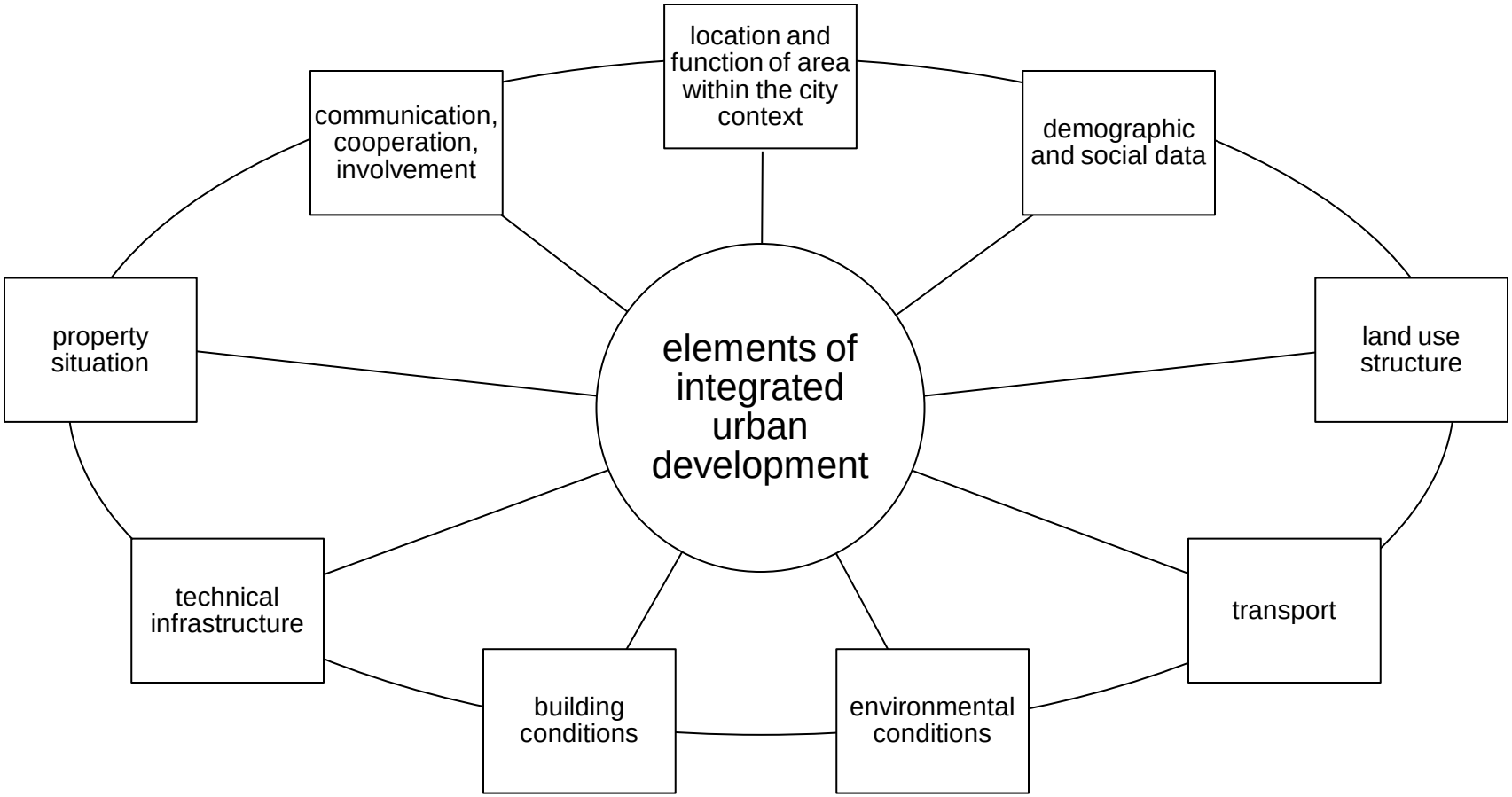
Case Study Berlin – current state

Integral aspects



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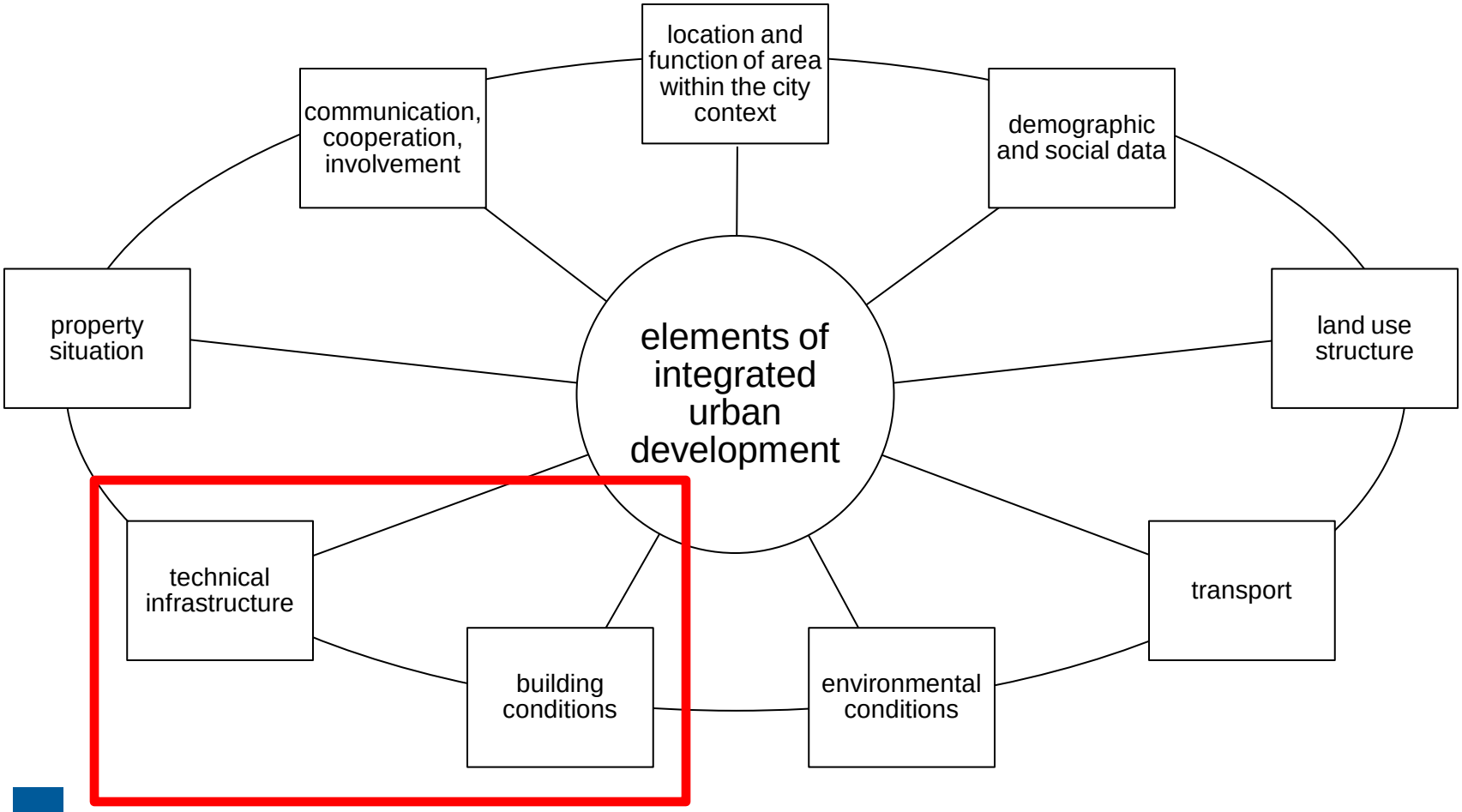
Case Study Berlin – current state

Integral aspects



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Residential buildings, *Frankf.-Allee-Area* in 1991

Number of multi-apartment buildings	*22*
Number of apartments	*4.922*
Total living and heating space, m²	**322.078 m²**
The average living and heating space per apartment, m²	**65,44 m²**

Share of owners / tenants	*1. Wohnungsgesellschaft (housing society) Lichtenberg mbH* *2. Wohnungsgenossenschaft (housing cooperative) 'Vorwärts e.G.'* *→ almost 100% tenants*

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Residential buildings, *Frankf.-Allee-Area* in 1991

- **Typical building types – constructions, materials, number of floors and apartments:**

Type 1 to 3 are prefabricated construction types

- Type 1 (WHHGT 18/21); triple-layer concrete slabs, with thermal insulation core (5 cm), single pipe heating system, central hot-water system, district heating, 18-21 floors, construction date: 1973 - 1975
- Type 2 (P 2 /11); single layer concrete slabs with inside thermal insulation (5 cm wood-wool-slab), single pipe heating system, district heating, local hot-water system via gas flow heater, 11 floors, construction date: 1970 - 1973
- Type 3 (WBS 70); triple-layer concrete slabs, with thermal insulation core (5 cm), double pipe heating system, central hot-water system, district heating, 5-6 floors, construction date: 1987 - 1989

Type 4 covers masonry construction buildings

- Type 4 (Brickwork); 2-5 floors, construction date: 1880 - 1923

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Residential buildings, *Frankf.-Allee-Area* in 1991

	Type 1 *WHHGT18/21*	***Type 2*** *P 2 /11*	***Type 3*** *WBS 70*	***Type 4*** *masonry*	**Total**
Number of buildings	5	9	4	4	22
Number of floors	18/22	11	5-6	2-4	
Number of apartments	1.160	3.432	274	56	4.922
					

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Residential buildings, *Frankf.-Allee-Area* in 1991

	Type 1 *WHHGT18/21*	***Type 2*** *P 2 /11*	***Type 3*** *WBS 70*	***Type 4*** *masonry*	**Total /** average
Total living space	*69.701m²*	231.970 m²	16.684 m²	3.724 m²	322.078 m²
Average living space (apart.)	*60,09 m²*	67,59 m²	60,89 m²	66,50 m²	65,44 m²
Annual heat consumption (district heating system)					
Space heating consumption	135 kWh/m²a	175 kWh/m²a	125 kWh/m²a	200-240 kWh/m²a	164 kWh/m²a
Hot water preparation	105 kWh/m²a	84 kWh/m²a	70 kWh/m²a	45 kWh/m²a	88 kWh/m²a

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Residential buildings, *Frankf.-Allee-Area* in 1991

- **The average annual energy consumption of multi-apartment buildings (kWh/m²) in 1991**

Total heat consumption	*252 kWh/m²a*
Space heating	*164 kWh/m²a*
Hot water preparation	*88 kWh/m²a*
Electricity	*unknown*

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Residential buildings, *Kaskel-Area* in 1991

Number of multi-apartment buildings	*183*
Number of apartments	*1.655*
Total living and heating space, m²	**104.735 m²**
The average living and heating space per apartment, m²	**63,28 m²**

Share of owners / tenants	*1. 15% of buildings: Wohnungsgesellschaft (housing society) Lichtenberg mbH* *2. other: private owners, 'fragmented ownership'*

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Residential buildings, *Kaskel-Area* in 1991

- **Typical building types – constructions, materials, number of floors and apartments:**
  - All residential buildings masonry construction (brickwork) (Type 4)
  - Construction date: 1870 -1910
  - Front building, side wing, building in the back; 3-5 floors
  - Mostly closed blocks, buildings side-by-side
  - Brick wall without thermal insulation
  - Windows partly with only one glass pane
  - Usally stove heating (76%), gas room heater (14%), gas central heat system (10%)
  - Local hot water systems by gas, electricity or coal

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Residential buildings, *Kaskel-Area* in 1991

	Type 1 *masonry*			
Number of buildings	*183*			
Number of floors	*2 - 5*			
Number of apartments	*1655*			

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Residential buildings, *Kaskel-Area* in 1991

- **The average annual energy consumption of multi-apartment buildings (kWh/m²) in 1991**

Total heat consumption	*265 kWh/ m²a*
Space heating	*220 kWh/ m²a*
Hot water preparation	*45 kWh/ m²a*
Electricity	*unknown*

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Residential buildings, *Frankf.-Allee-Area* in 1991

- **The energy saving potential (kWh/m²a, %):**
  - Reduction of energy consumption up to 120-160 kWh/m²a from 250 kWh/m²a to 90-130 kWh/m²a
  - Reduction of 50 – 65%

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Residential buildings, *Kaskel-Area* in 1991

- **The energy saving potential (kWh/m²a, %):**
  - Reduction of energy consumption up to 130-150 kWh/m²a from 265 kWh/m²a to average 130 kWh/m²a (range 60-260 kWh/m²a depend on refurbishment status)
  - Reduction of 50% in average

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Public buildings, *both areas* in 1991

- **Concepts and experience of public building refurbishment:**
  - Refurbishment of a kindergarten:
    before: heating energy: 190 kWh/m²a
    energy for hot water system: 75 kWh/m²a
    after reconstruction:
    heating energy: 80 kWh/m²a
    energy for hot water system: 30 kWh/m²a
  - Reduction of 60%

Since 2006: federal funding programmes for EER ('CO_2-building refurbishment', 'Investment pact energy efficiency of social infrastructure')

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Energy supply, *Frankf.-Allee-Area* in 1991

- **The heat producers and suppliers:**
  - Municipal district heating, (today Vattenfall Europe AG)

- **The energy supply infrastructure:**
  - Share of district heating: 100%
  - Share of individual heating: 0%

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Energy supply, *Frankf.-Allee-Area* in 1991

- **Energy sources:**
  - Lignite (1991), nowadays lignite for baseload and natural gas for peak load
- **Cogeneration:**
  - Central cogeneration plant (today Vattenfall Europe AG)
  - Local cogeneration plant in one building (since 2006)
- **Renewable Energy Sources:**
  - None, in future: part of the central cogeneration from biomass (‘new generation plant’ of Vattenfall AG)

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Energy supply, *Kaskel-Area* in 1991

- **The heat producers and suppliers:**
  - Local heating based on coal and natural gas
  - Gas supply by municipal utility (GASAG)

- **The energy supply infrastructure:**
  - Share of district heating: 0%
  - Share of individual heating: 100%
    - Stove heating: 76%
    - Local gas heating systems: 24%

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Energy supply, *Kaskel-Area* in 1991

- **Energy sources:**
  - Lignite, natural gas (1991)
- **Cogeneration:**
  - none
- **Renewable Energy Sources:**
  - none in 1991, nowadays several solar collectors and Photovoltaic modules

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Current results, *Frankf.-Allee-Area* in 1991

- **The first results:**
  - All residential buildings are refurbished today, serveral public buildings not refurbished yet
  - Average reduction energy consumption: 55%
- **Refurbishment range:**
  - Complex refurbishment including thermal insulation of the whole exterior shell and reconstruction of the heating and ventilation systems
  - Partly reconstruction of heating system: one-pipe to double-pipe
  - High quality energy reconstruction: low-energy-house with 296 apartments (21 floors)

    (largest low-energy-house in Germany: 44,9 kWh/m^{2}a)

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Current results, *Kaskel-Area* in 1991

- **The first results:**
  - Most parts of the buildings are refurbished (also partially), wide range of energy saving quality
  - Extrapolation of energy saving data from 26 buildings
  - Average reduction energy consumption: 50%

- **Urgent Problems:**
  - Different owners and owners' interests
  - Representation of owners as stakeholders in planning process
  - Requirements of monument protection

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Lessons learned, prefabricated construction buildings

- **Refurbishment steps between 1990 and today:**
  1. Reconstruction of heat connecting station (local transfer point of district heating), including hot-water system and pipework restoration; energy saving potential: 20 (-30%)
  2a. Renovation of windows (because of tenants wishes); energy saving potential: up to 10%
  2b. Renovation of the façade because of concrete damages (covering with thermal insulation instead of concrete reconstruction); energy saving potential: up to 20-30%
- **In comparison:**
  - Complex refurbishment including thermal insulation of whole exterior shell and reconstruction of heating and ventilation systems; energy saving potential: 55- max. 80%

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Lessons learned

- **Energy Efficient Refurbishment to be seen in relation to**
  - Condition of building
  - Costs of refurbishment measures
  - Disposable (private) budget
  - Financing instruments (banks, public funding etc.)
  - Refinancing of investments, payoff:
    energy saving = money saving; higher rents
  - Location of building and development of quarter
  - Framework conditions: structure of housing industry; political and economic stability
- **Interrelation:**
  EER of buildings - improvement of energy supply infrastructure

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Lessons learned

- **No refurbishment without participation of tenants (owner may decide, but tenant decides to stay or not)**
- **Necessary: education measures about refurbishment process, energy savings and costs**
- **Integrated urban development planning of quarters:**
  - Owners of buildings important stakeholders in integrated urban development planning process of quarters,
  - If fragmented ownership: interests of owners need to be represented by joint institution

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Outlook on Berlin Seminar

- **21-22 October 2010: Berlin Seminar :**
  - Integrated Urban Development Planning with focus on energy efficiency
  - Results of completed Case Study Berlin
  - Visitation of ‘good practice’ examples

Welcome!

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Thank You for Your Attention!

Any Questions or Comments?

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