



# Energy efficiency and CO<sub>2</sub>-balance

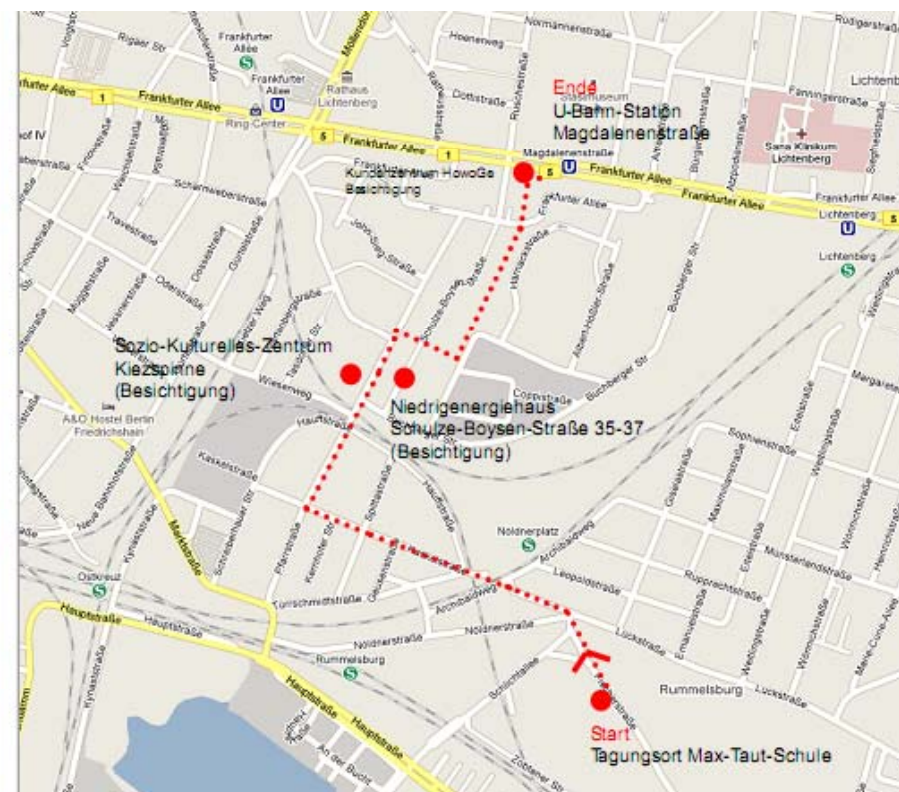
## Case Study Berlin

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## Content of the presentation

- The case-study area, objectives and methods
- Energetic parameters 1991/92
- Deficits and needs for action
- Realised refurbishments
- Achieved energetic parameters and CO<sub>2</sub>-reduction 2010
- Conclusions

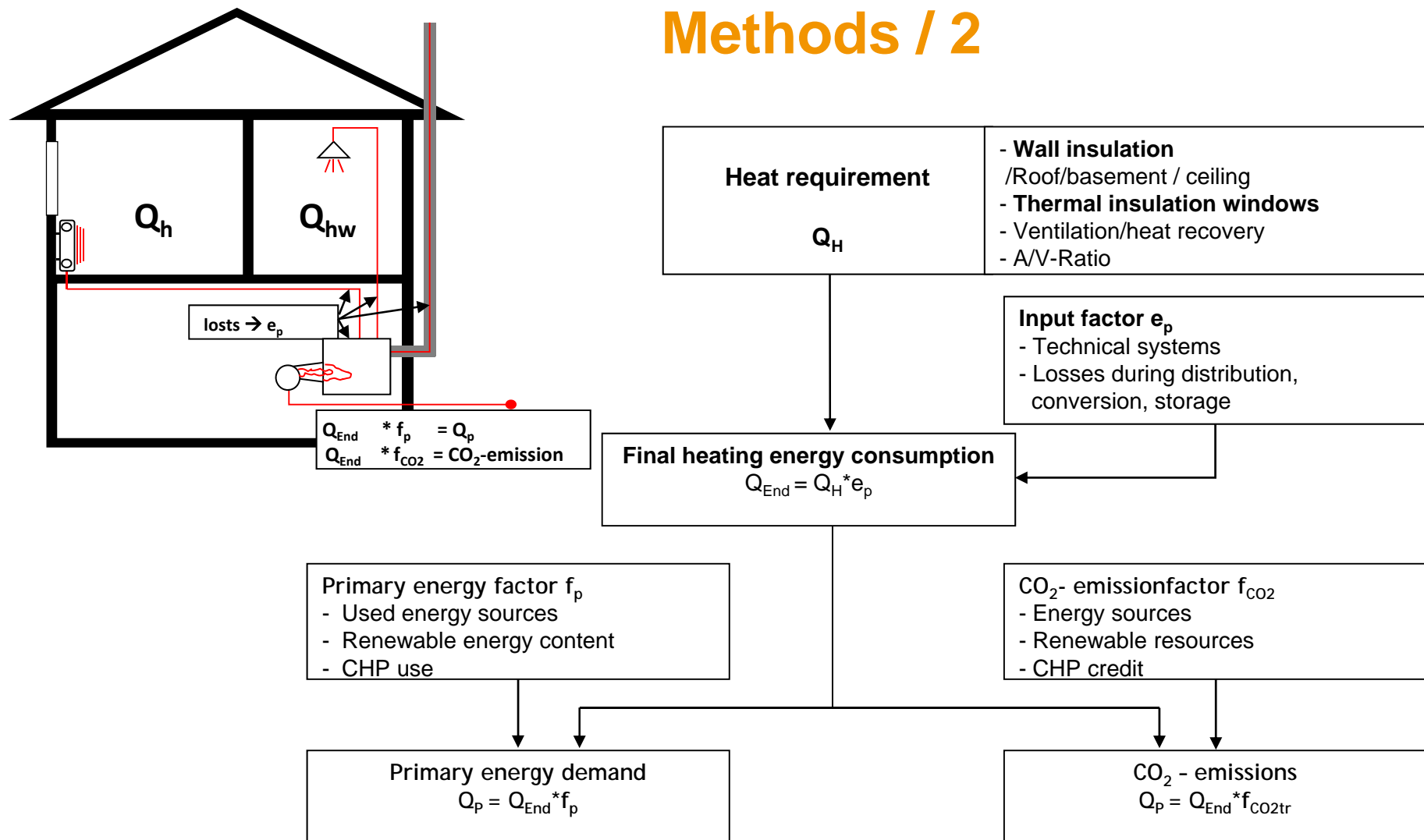
# Investigation area: Kaskelkiez / Frankfurter-Allee-Süd



## Objectives and methods of the study

- **Valuation of the energetic parameters of the building stock before and after refurbishment**
- **Relevant elements:**
  - insulation status
  - existing heating systems
  - primary energy usage
- **Approach:**
  - calculation for typical building types
  - extrapolation from single buildings to floor space of the case-study area

## Methods / 2



## Procedure

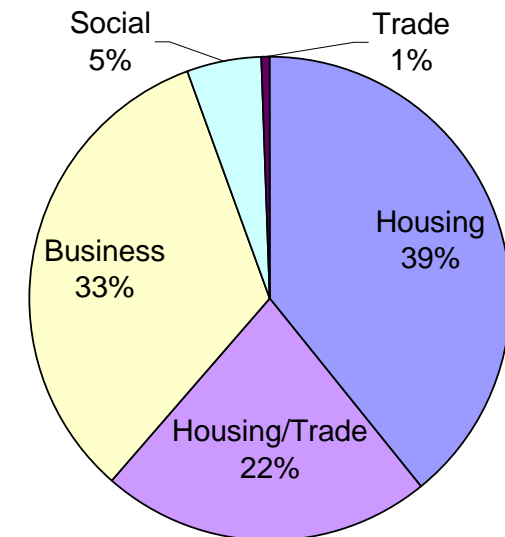
1. **Ascertaining of the energetic relevant building types in the case-study area (e.g. year of construction, heating system, used primary energy...)**
2. **Ascertaining of the related energetic- and CO<sub>2</sub>-parameters with feasible accuracy**
3. **Compilation of**
  - **Primary-energy factors and**
  - **CO<sub>2</sub>-emission-factors**
4. **Allocation of floor-areas**
5. **Multiplying and Summarizing of energy demand / consumption and CO<sub>2</sub>-emission-values**

**→ Find the comprehensive calculation scheme for the Berlin Case-Study-Area on the Urb Energy web-site ([www.urbenergy.eu](http://www.urbenergy.eu))**



## Description *Kaskelkiez (KAS) 1991/92*

- Buildings mainly masonry structure (brick walls, construction period 1875-1920), lower part for trade and social institutions  
Industry / business in western part of area (e.g. Knorr Co.)
- Block development with war-related gaps
- Total living / usable area: ca. 187.450 m<sup>2</sup>

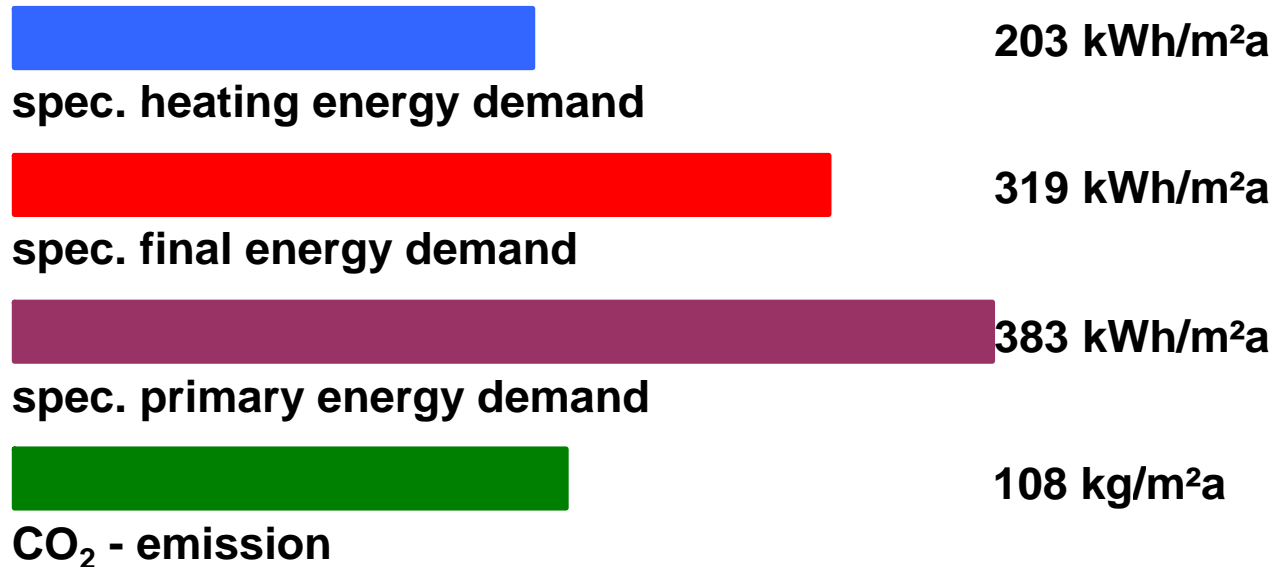


## Description *Kaskelkiez (KAS) 1991/92*

- 99% buildings masonry type, constructed before 1920
- Poor constructive conditions of buildings
  - 12 % poor / desolate
  - 59 % moderate damages
  - 29 % normally usable
- Heating systems (residential):
  - 76 % stove heating (single room)
  - 14 % gas individual room heater (type Gamat e.g.)
  - 2 % gas storey heating
  - 8 % central heating (coal)
- Hot water (residential):
  - 45 % coal stoves
  - 30 % electrical storage heaters
  - 25 % gas instantaneous water heaters
- No district heating service



## Results *Kaskelkiez (KAS) 1991/92*

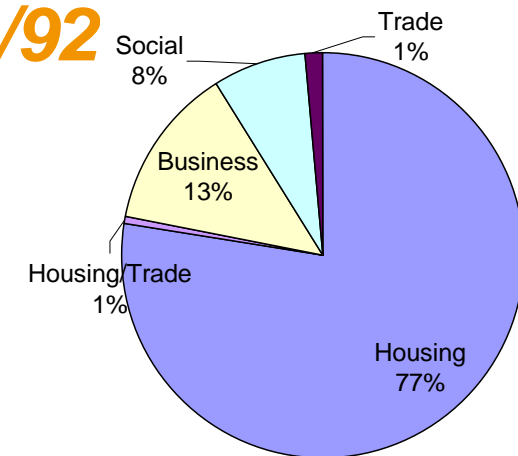


- final energy demand (heating/hot water) : ca. 59.900 MWh/a
- primary energy demand (heating/hot water) : ca. 72.000 MWh/a
- CO<sub>2</sub>-emission : ca. 20.200 t/a

for  $\approx 188.000$  m<sup>2</sup> total living/usable area

## Description *Frankf.-Allee-Süd 1991/92*

- Mainly residential area (prefabricated building type), social institutions e.g. schools, day-care-facilities as well as industry / trade / business



## Description *Frankf.-Allee-Area 1991/92*

- **Description of buildings**

**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, central hot-water, 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*

**Community Buildings**

- *Schools / gymnasiums also in prefabricated construction type, heated by district heating service*

## Results *Frankf.-Allee-Süd 1991/92*

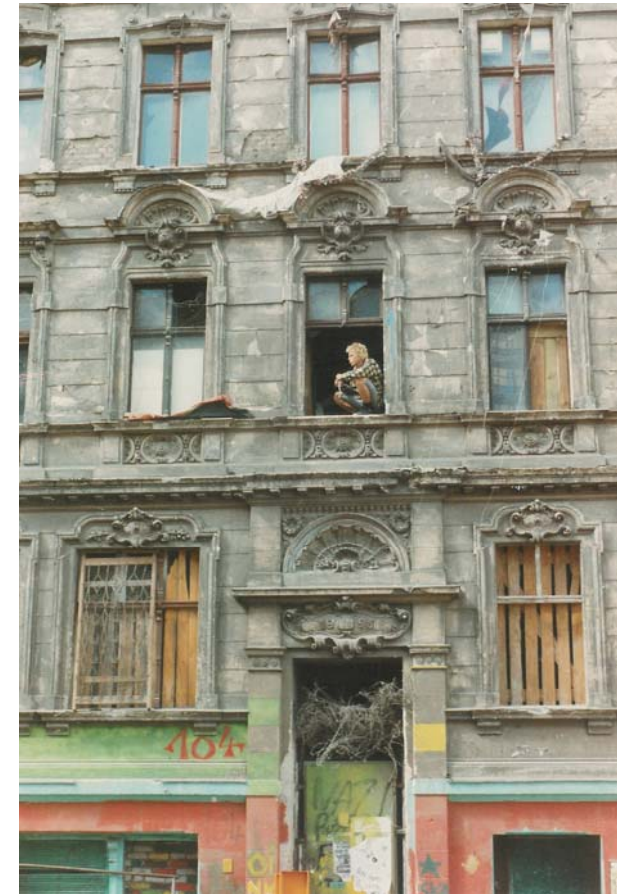
	131 kWh/m <sup>2</sup> a
spec. heating energy demand	
	175 kWh/m <sup>2</sup> a
spec. final energy demand	
	125 kWh/m <sup>2</sup> a
spec. primary energy demand	
	53 kg/m <sup>2</sup> a
CO <sub>2</sub> - emission	

- final energy demand (heating/hot water) : ca. 73.300 MWh/a
- primary energy demand (heating/hot water) : ca. 52.400 MWh/a
- CO<sub>2</sub>-emission : ca. 22.100 t/a

for  $\approx 418.000$  m<sup>2</sup> total living/usable area

## Refurbishment requirements

- **Deficites Kaskelkiez**
  - high need of repair concerning building's outer shell and technical equipment
  - partly buildings not usable for living
- **Deficites Frankfurter-Allee-Süd**
  - buildings mainly damages of facades (outer walls and windows) and roofs
  - technical equipment (heating stations) in poor conditions  
(technical standard / dimensions / adjustment control)



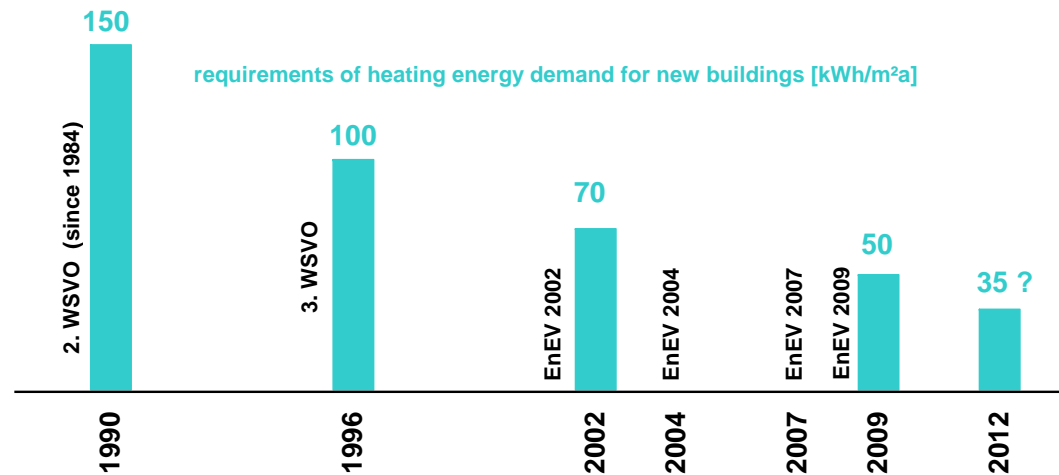
## Discussions / conflicts

- **ownership situation influence restoration activities**
  - **FAS: buildings are property of a few large owners (housing associations / cooperatives)**
  - **KAS: fragmented ownership structure**  
**partly not clarified ownership (restitution)**  
**ca. 20 % of building owners live in area**
- **Restoration and conservation statutes / historical monument protection**
  - **requirements of historical monument protection increase costs**
  - **partly waiving of thermal insulation**  
**or only insulation of the backside facades (side wings, yard)**

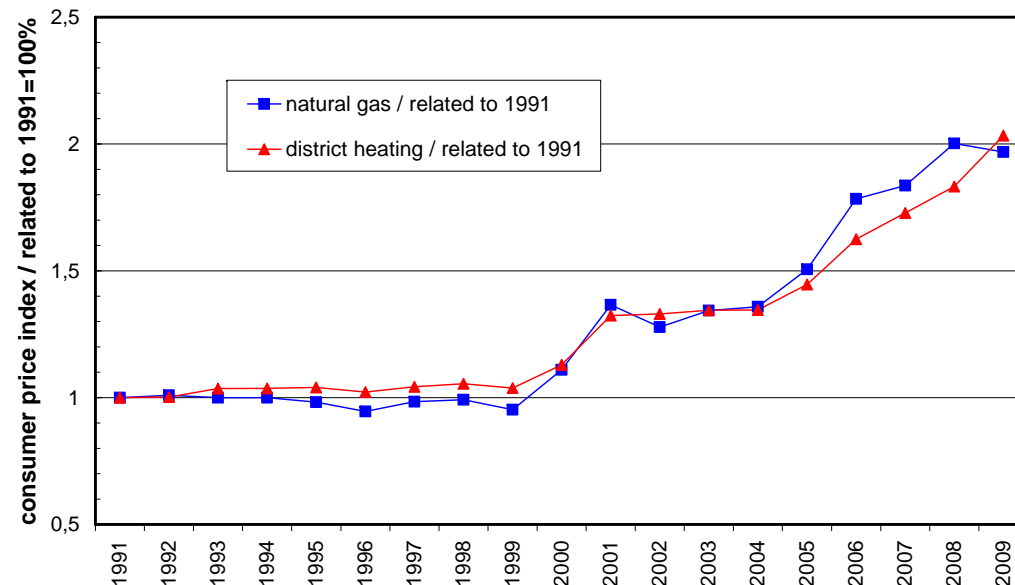


# Energy requirements

- Development of Heat Insulation Ordinance or Energy Saving Regulations



- Development of energy costs



## Realised energy-efficient measures

### Kaskelkiez

- stove heating → central heating with modern low-temperature / condensation boilers based on natural gas
- single drinking water supply → central supply combined with heating system
- renovation of leaky roofs, partially by insulation of the top-ceiling
- Replacement / Refurbishing of old wood windows

### Frankfurter-Allee-Süd

(100 % complex renovation of prefabricated residential)

- Insulation of the facades
- Insulation of the lowest / top ceilings
- Window replacement
- Maintenance of the district heating supply
  - Renovation of the district heating stations
  - single-pipe heating → twin-pipe heating system (or by-pass pipes)

## Kaskelkiez - Status quo 2010

Large part of houses renovated  
ca. 60 % completely / partially  
ca. 15 % basically  
ca. 25 % simple or not renovated

### Differentiated renovation status

- change of heating systems mostly realised
- renovation of facades and windows
- outer walls in most cases without thermal insulation (due to historical monument protection)

### Complex energetic reconstruction partly done:

Example Kaskelstraße 49:  
reconstruction on new-building-level  
thermal insulation of outer walls, roofs, basement,  
windows with triple-layer-glasses  
gas heating system with upper heating value  
+ thermal solar collector

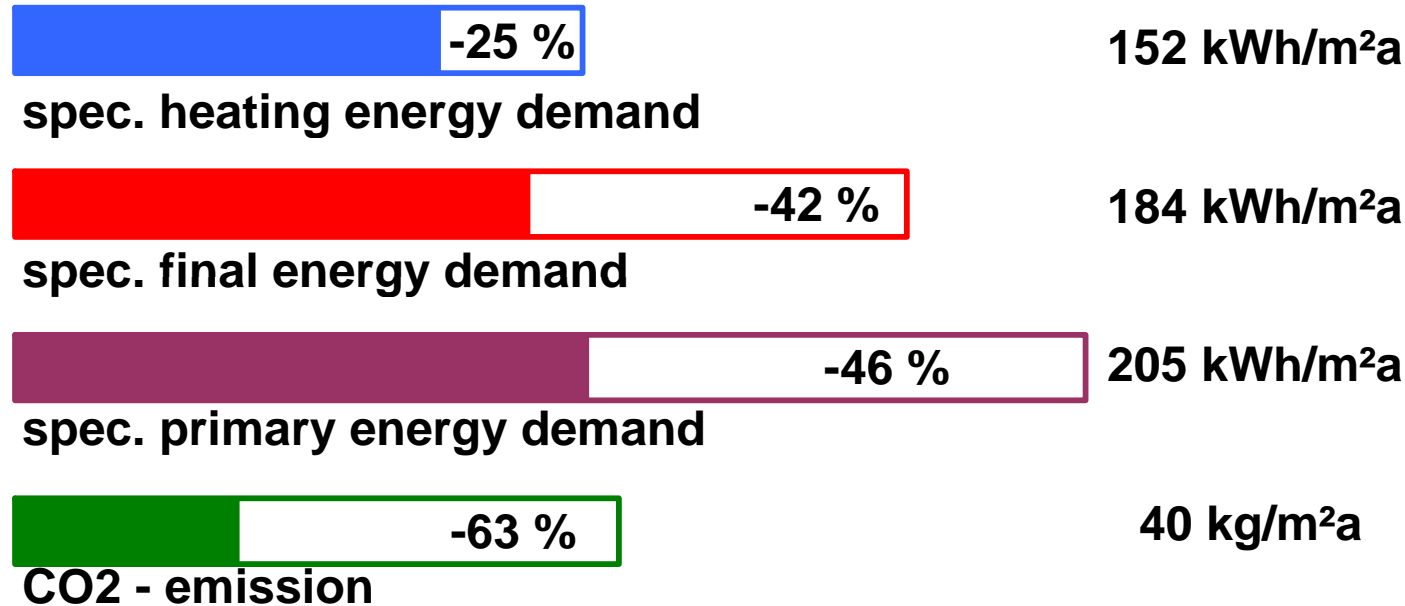


## Frankfurter-Allee-Süd - Status quo 2010

- **FAS – renovation status**
  - prefabricated residential buildings almost completely energetically renovated
  - schools and gymnasiums renovated
  - office buildings no energy-related renovation
- **mostly complex renovation projects**
  - thermal insulation of all outer walls, roofs etc.
  - new windows
  - replacement of 1-pipe to 2-pipe heating system
  - reconstruction of electrical equipment and water systems
- **largest low-energy-building-reconstruction**
  - 21-storey residential building
  - Schulze-Boysenstr. 35/37



## KAS 2010 - Energy efficiency / CO<sub>2</sub>-emission



- realised through
  - renovation on different levels
  - new heating systems (central), mostly based on natural gas
  - replacement of coal as primary energy source

## FAS 2010 – Energy efficiency / CO<sub>2</sub>-emission



spec. heating energy demand

78 kWh/m<sup>2</sup>a



spec. final energy demand

103 kWh/m<sup>2</sup>a



spec. primary energy demand

60 kWh/m<sup>2</sup>a



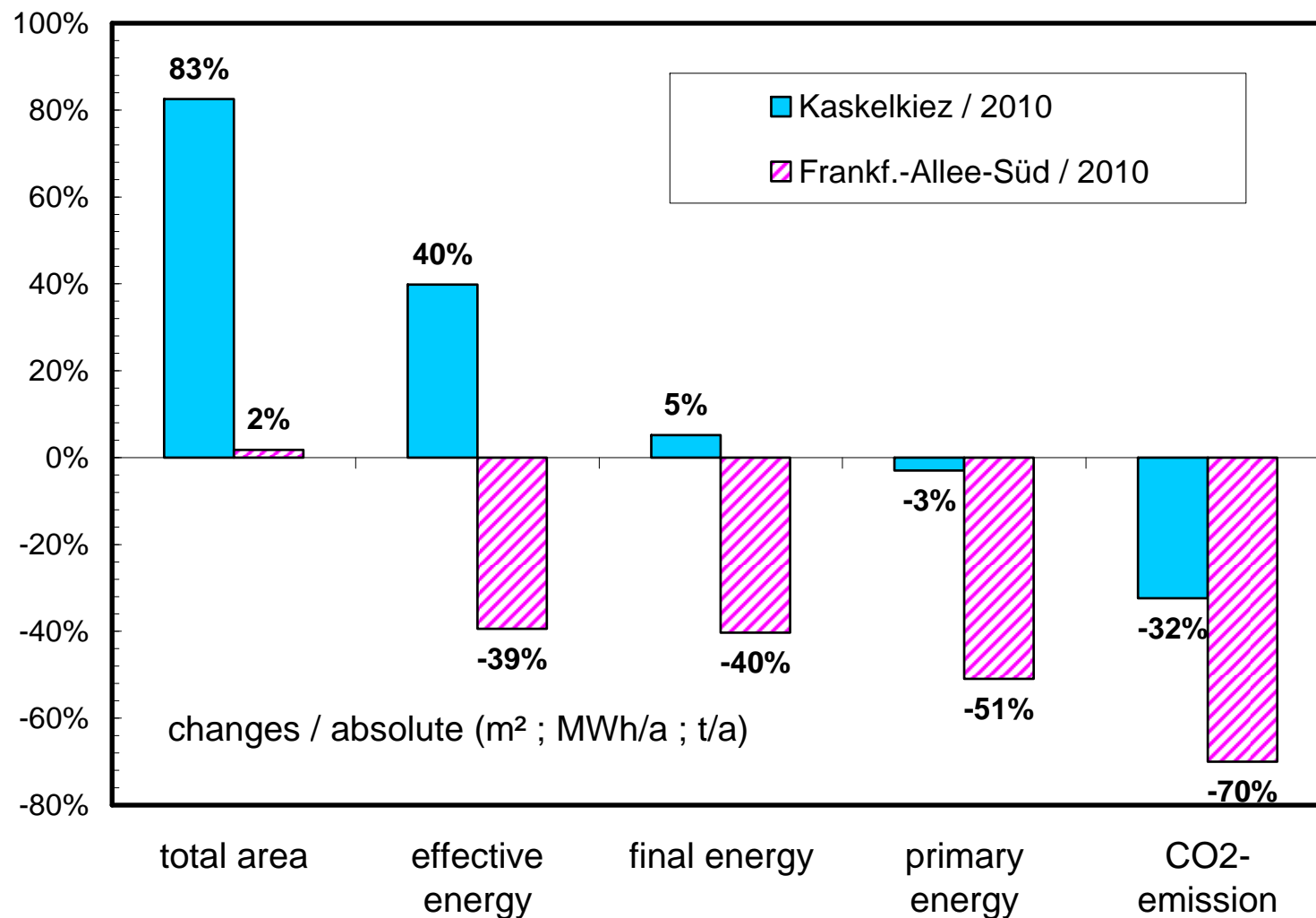
CO<sub>2</sub> - emission

16 kg/m<sup>2</sup>a

- realised through
  - complete reconstruction
  - renewal of building equipment (heating / hot water / ventilation)
  - district heating generation with combined heat and power process (CHP)



## Comparison - Energy efficiency / CO<sub>2</sub>-emission



# Conclusions

- **First priority: planning supply networks**
  - **District heating (CHP) available?**
  - **Decentralised heating-solutions necessary?**
- **Preference on implementation of one-time complex EEM**
- **Small-scale ownership needs intensive constructional and financial advising and support**

## Perspectives

Achieved energy efficiency status (heating + warm water)		
	Final energy	Primary energy
Kaskelkiez	184 kWh/m <sup>2</sup> a	205 kWh/m <sup>2</sup> a
Frankfurter Allee-Süd	103 kWh/m <sup>2</sup> a	60 kWh/m <sup>2</sup> a

### Potential for further actions:

#### Kaskelkiez

- more insulation measures
- more efficient usage of primary energy

#### Frankfurter Allee-Süd

- classical EEM-potential implemented
- long term objectives:  
district heating shift to renewable energies

# End

- **Thank you for your interest.**
- **Questions / discussions ?**
- **Further details can be given during the tour after lunch.**