

# **Energy Efficient Communities – Technological Strategies and their Implementation –**

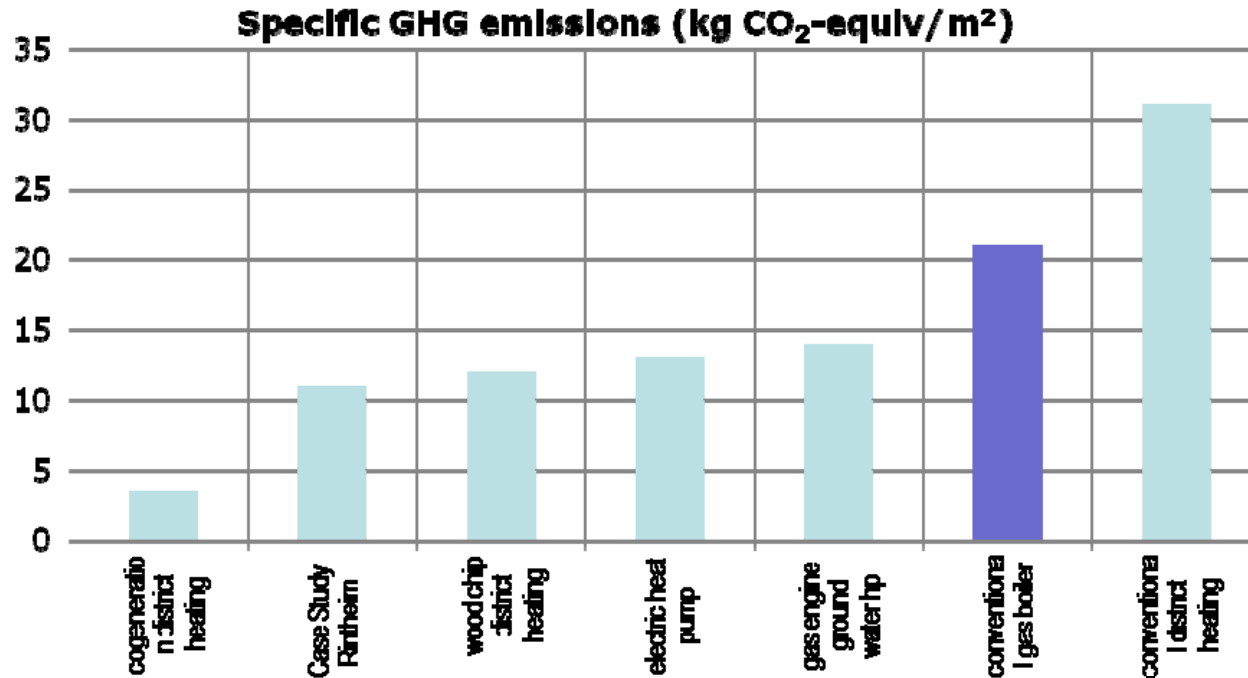
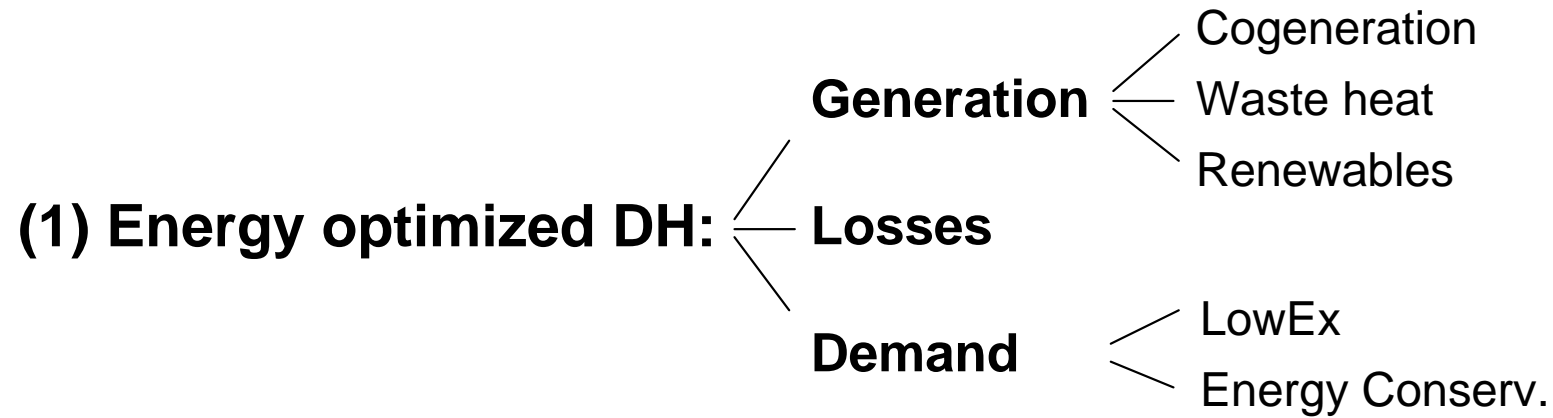
**„Emerging Urban Sustainability by Co-Evolution  
of Technical Infrastructure and Urban Form“**

**Reinhard Jank  
„EnEff:Stadt“ program, Germany**

→ Target: **- 80 % GHG?** →  
- Renewables  
- Building stock → Cities!

Stuttgart downtown





## (2) Energy optimized buildings:

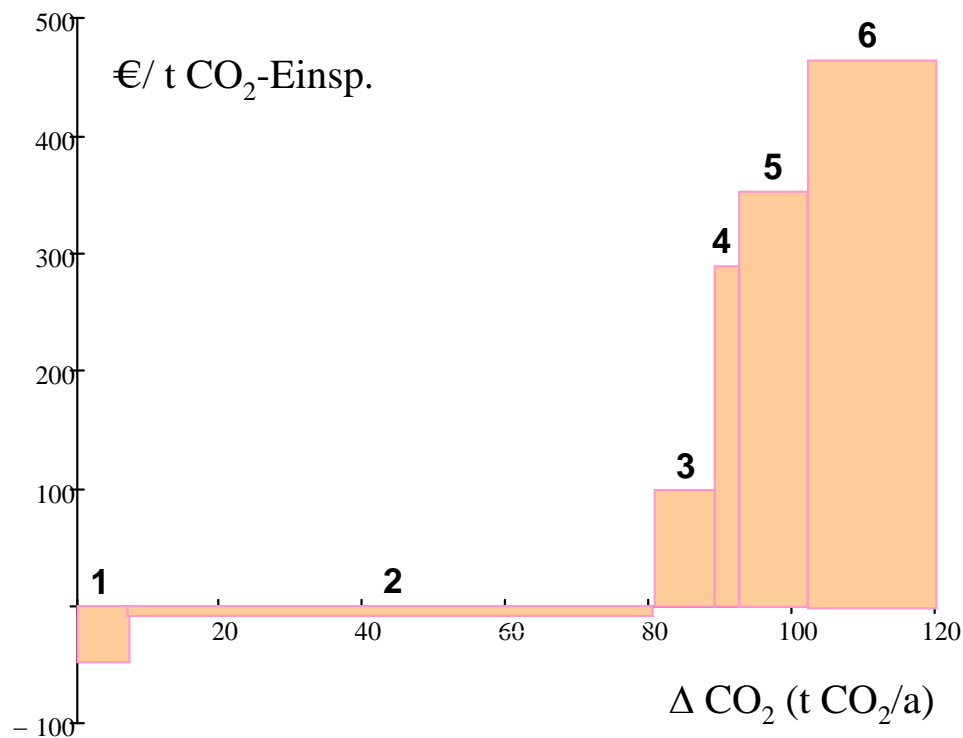
Envelope

Ventilation / HR

renewables

user behaviour

### GHG savings vs additional costs:



1: room control

2: envelope retrofit (inc. windows)

3: ventilation / heat recovery

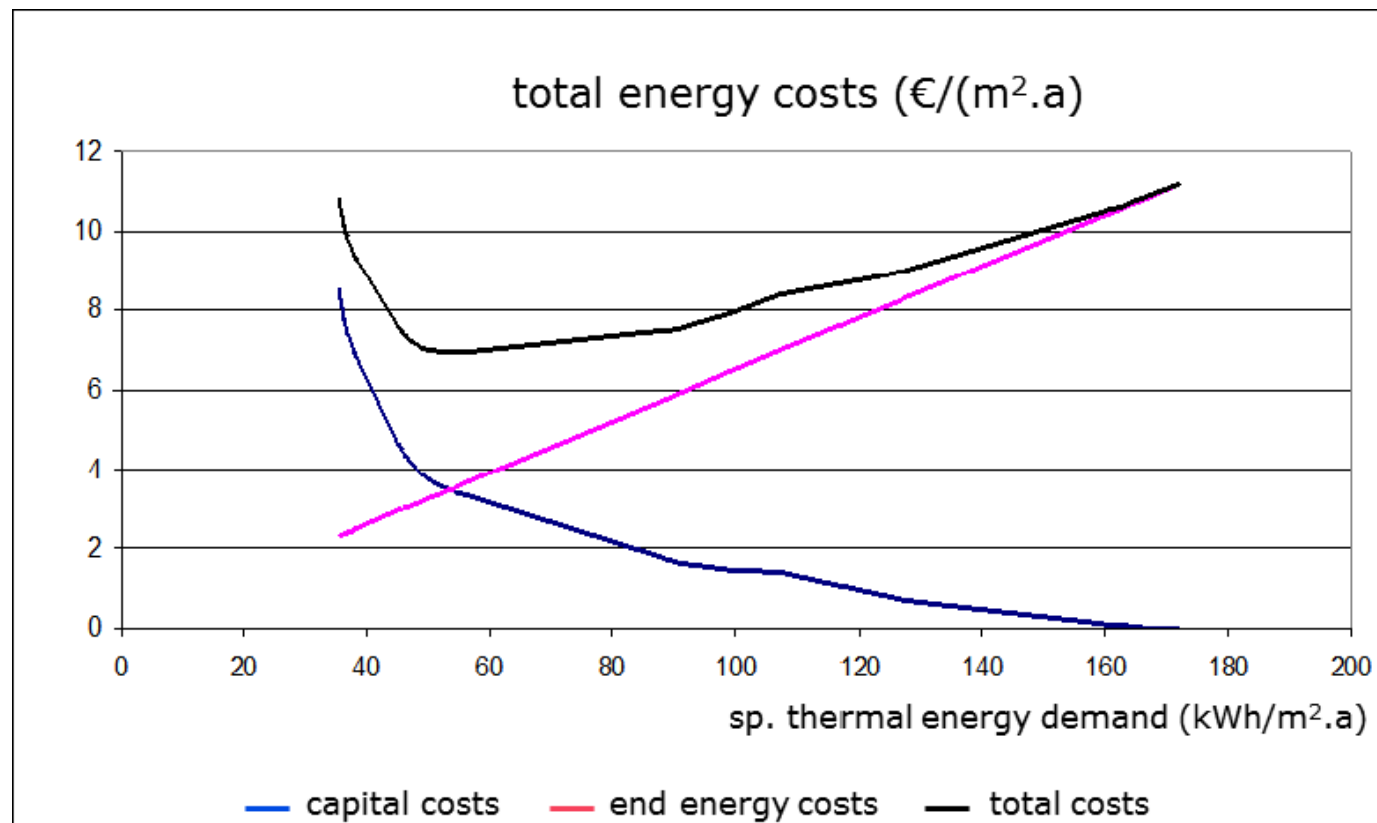
4: PV panel (6,5 kWp)

5: Solar collectors

6: Passivhaus standard

**Multi-family residential building: 50 years, 230 kWh<sub>PE</sub>/m<sup>2</sup>**  
(36 flats, 9 floors)

## Retrofit optimization, MF residential building, Karlsruhe-Rintheim:



## Investment costs of „city energy transition“?

→ building energy retrofit ~ 300 €/m<sup>2</sup>

→ DH infrastructure ~ 80 €/m<sup>2</sup>

→ City of 300.000: ~ 11 mio. m<sup>2</sup>

→ **3,6 billion €** total investments over ~ 30 years (120 mio. €/a)

## Energy costs of private households?

- Thermal energy: ~ 150 mio. €/a

- Electricity: ~ 80 mio. €/a

**Conclusion: System optimization!!**

## Neighborhood refurbishment Rehmplatz / Aachen

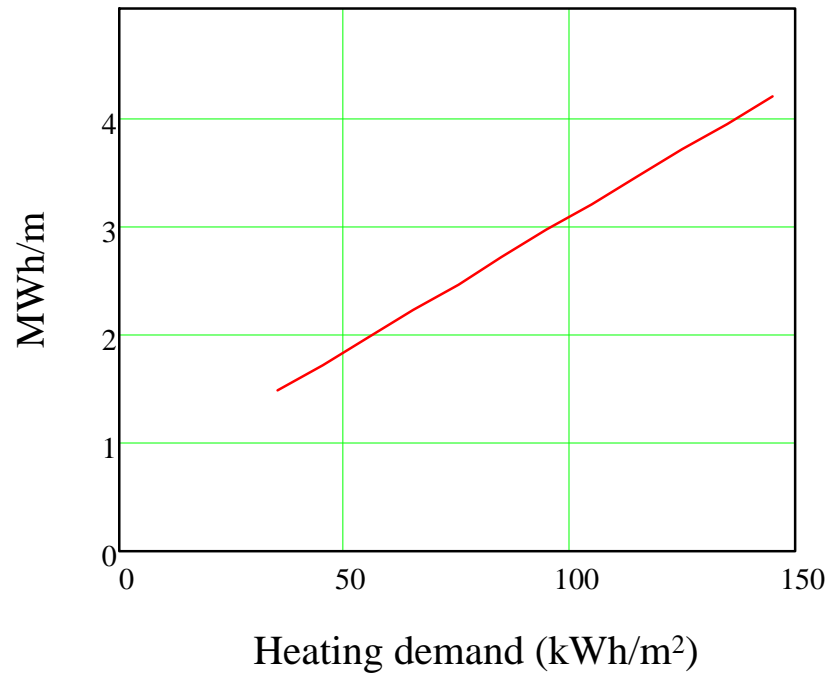
160 – 280 kWh<sub>E</sub>/m<sup>2</sup>  
(heating/DHW)

< 100 kWh<sub>E</sub>/m<sup>2</sup>

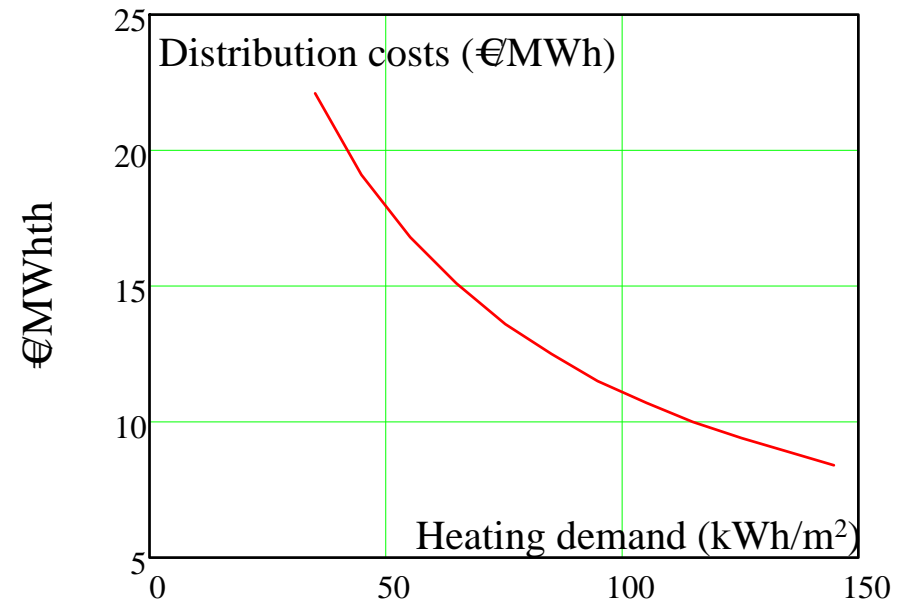


1.750 flats → 80 mio. € (46.000 €/flat)

Line density (MWh/m)

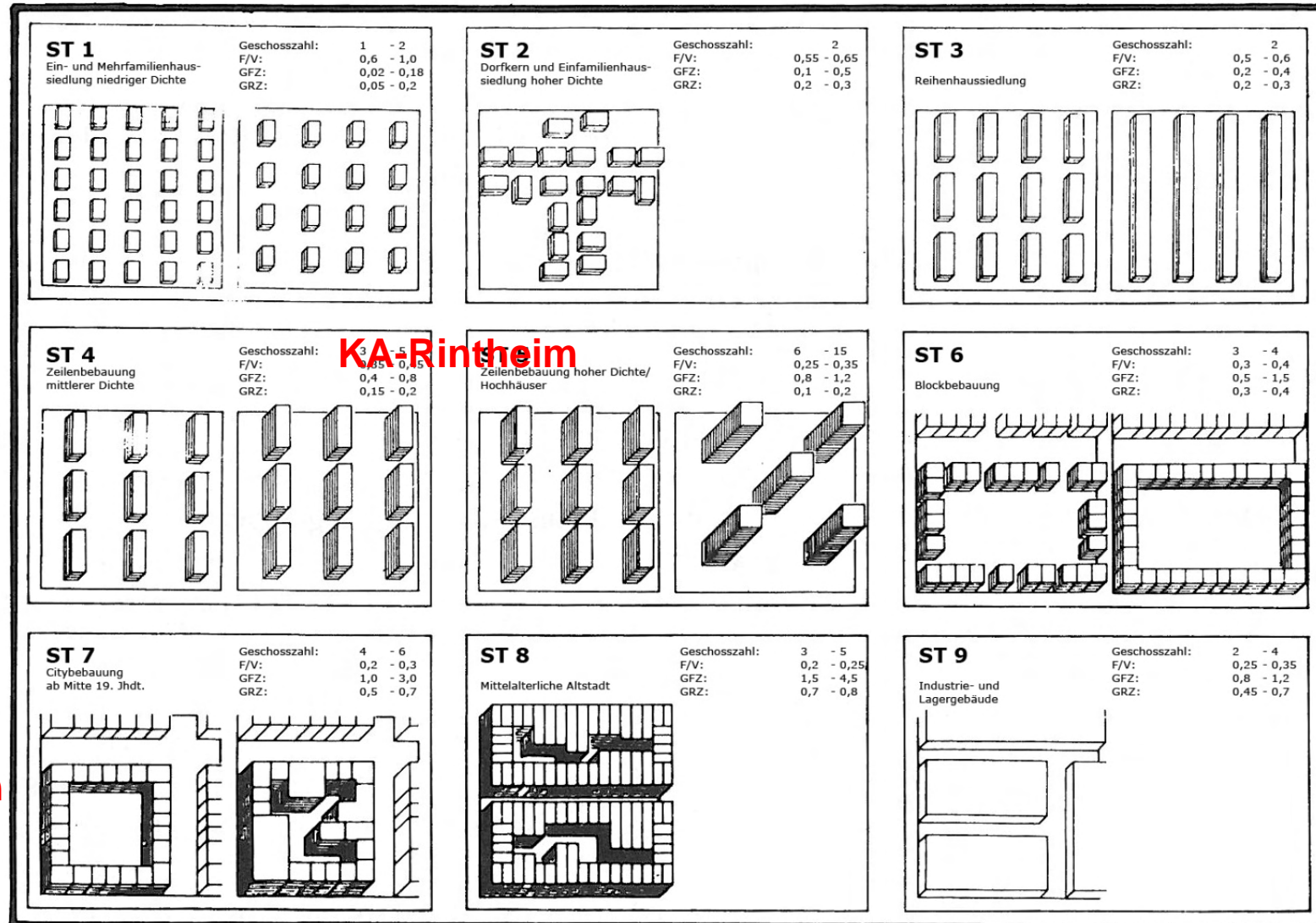


## DH scheme Rintheim: Impact of energy conservation on distribution costs





## „Settlement archetypes“ (U. Roth, 1980):



KA-Rintheim

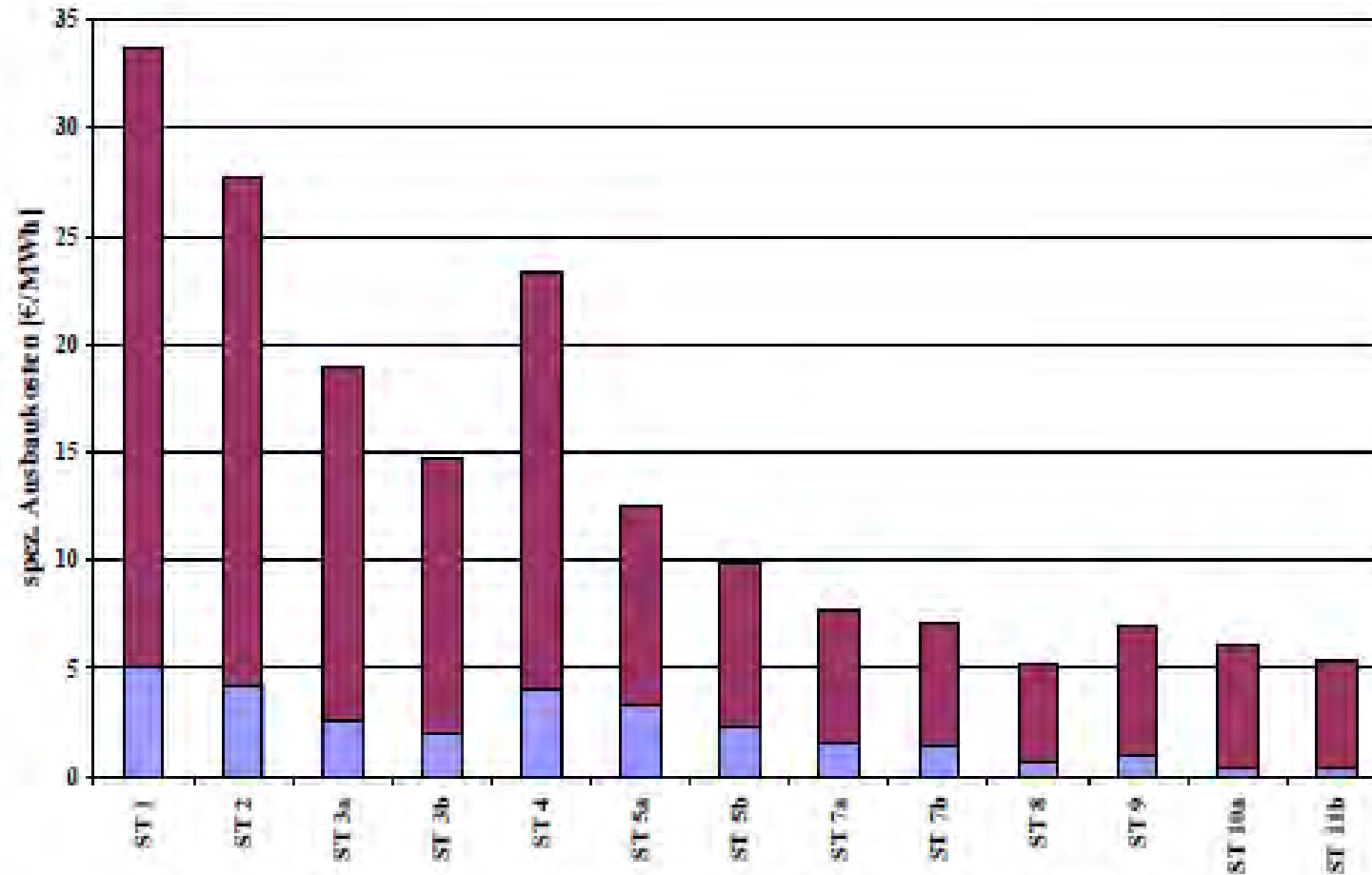
Aachen



mobil 08'08

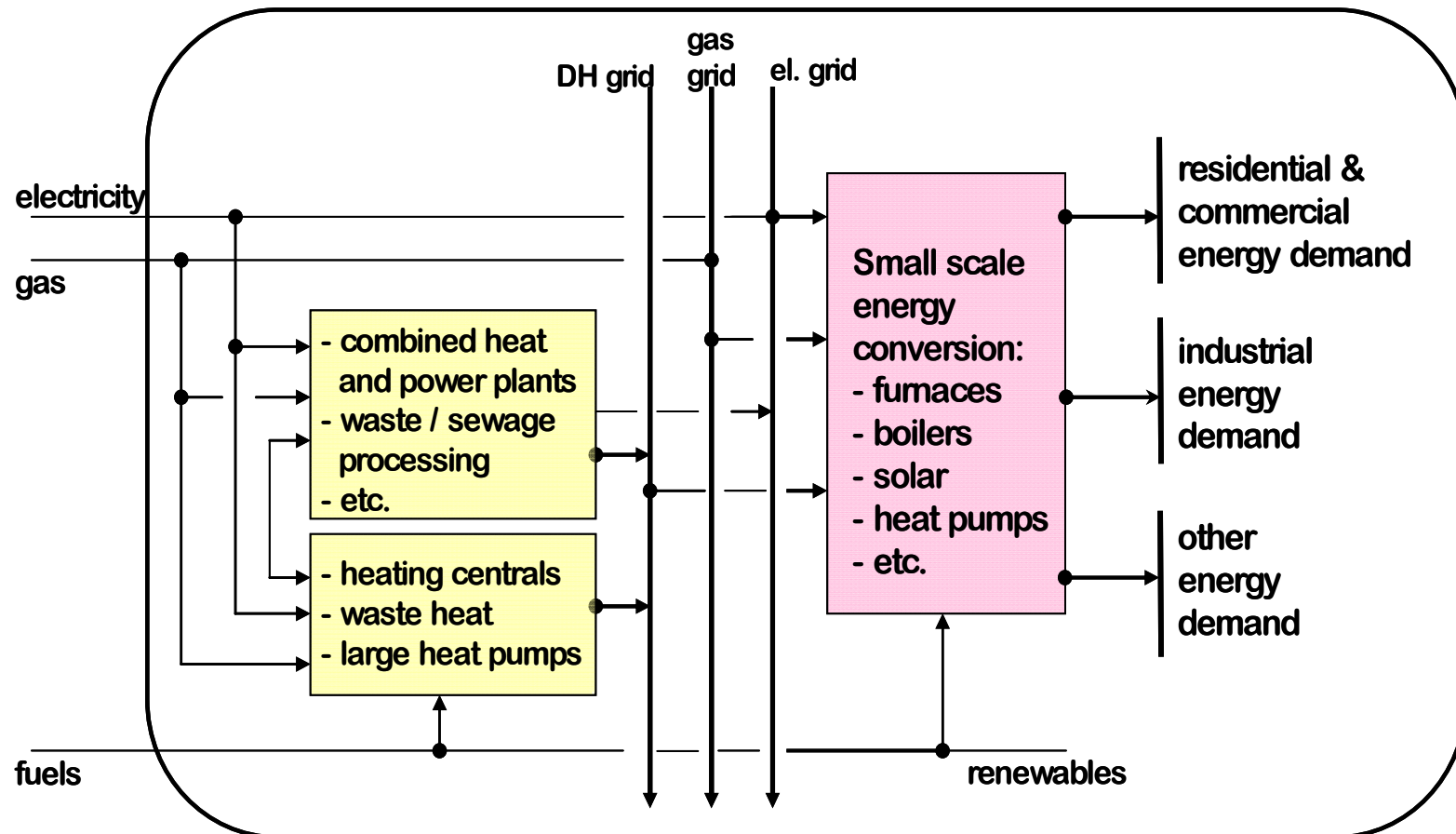
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DH distribution costs of various types of settlements (€/MWh)

## Community energy system model: RES – the traditional picture (MARKAL, TIMES etc.)



## New grid: interlinked, „smart“ ...

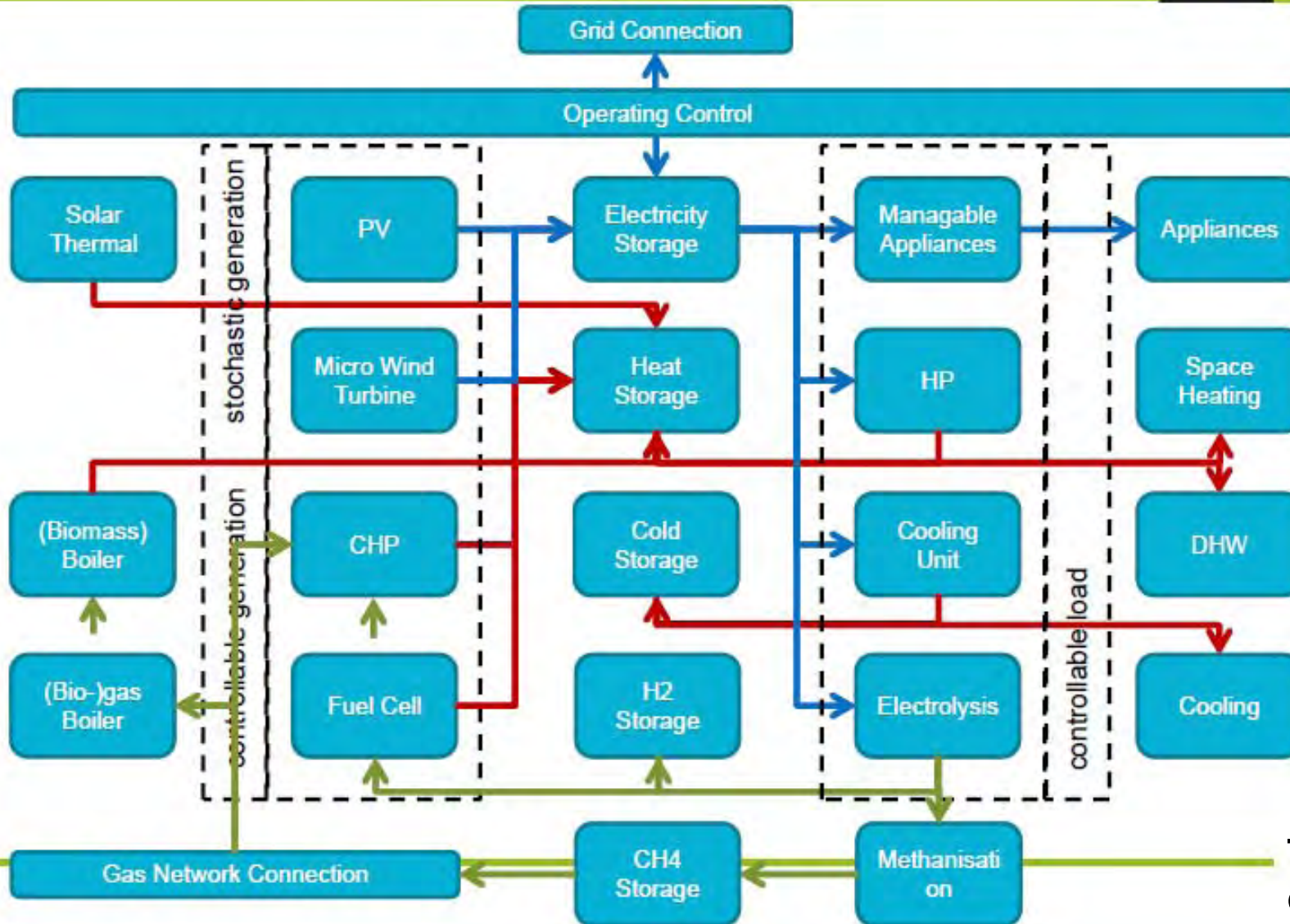
Baseload: Coal, Gas, Nuke Hydro, Biomass	Transmission: DC / AC	Smart Buildings: LowE, DH, HP, MicroGen, th. storage
Large scale storage	Cogeneration	micro grids
Renewables (fluctuating): Wind; solar	Smart Grids (bidirectional, peak-shaver)	e-mobility

... from passive to active ...

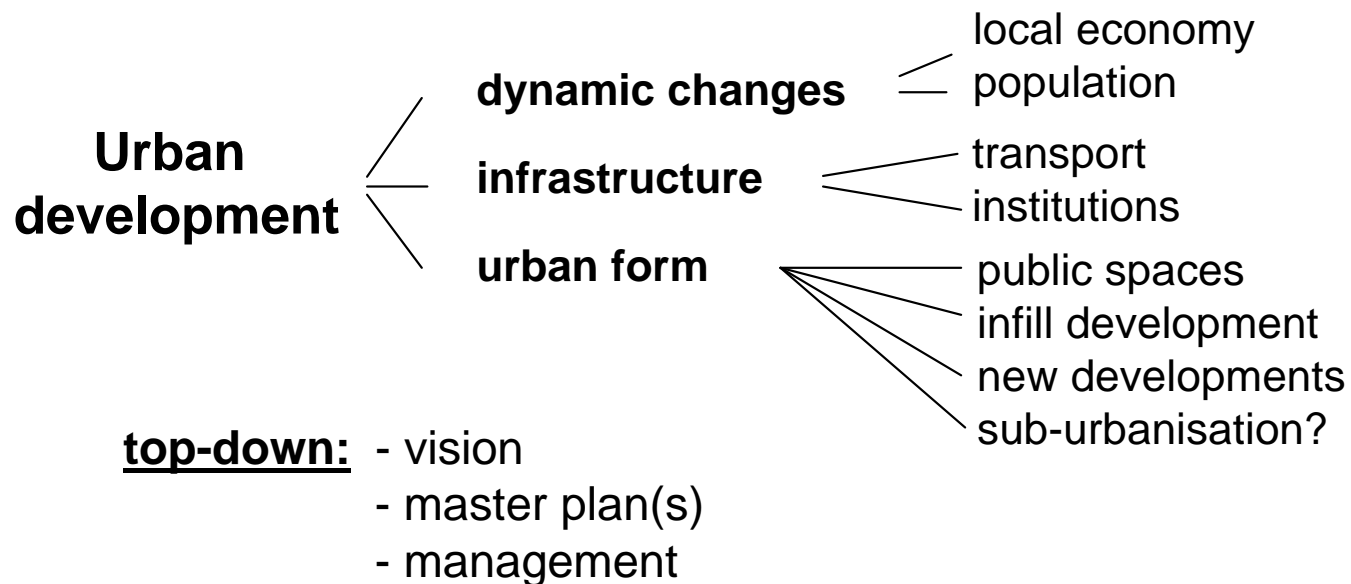
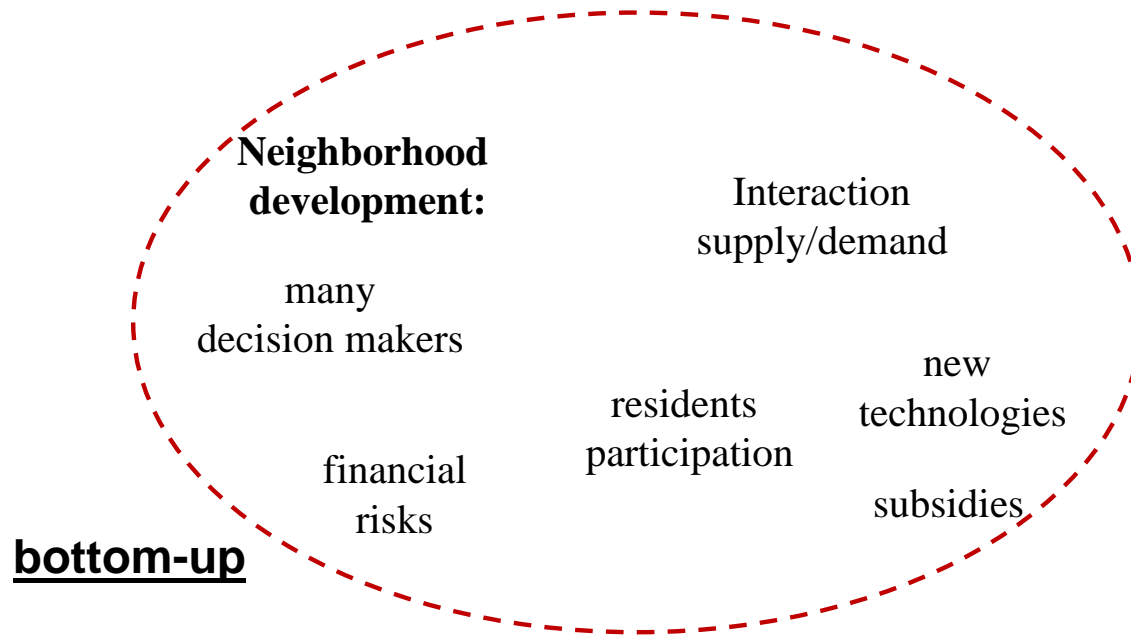
# Smart System - Use Cases



EIFER



... are we technically ahead of reality in cities?



## What drives the transition processes?

### → incentives:

- energy prices
- carbon taxes
- subsidies

### → legal requirements

### → local urban planning

### → local economic development

### → population migration

### → technical developments

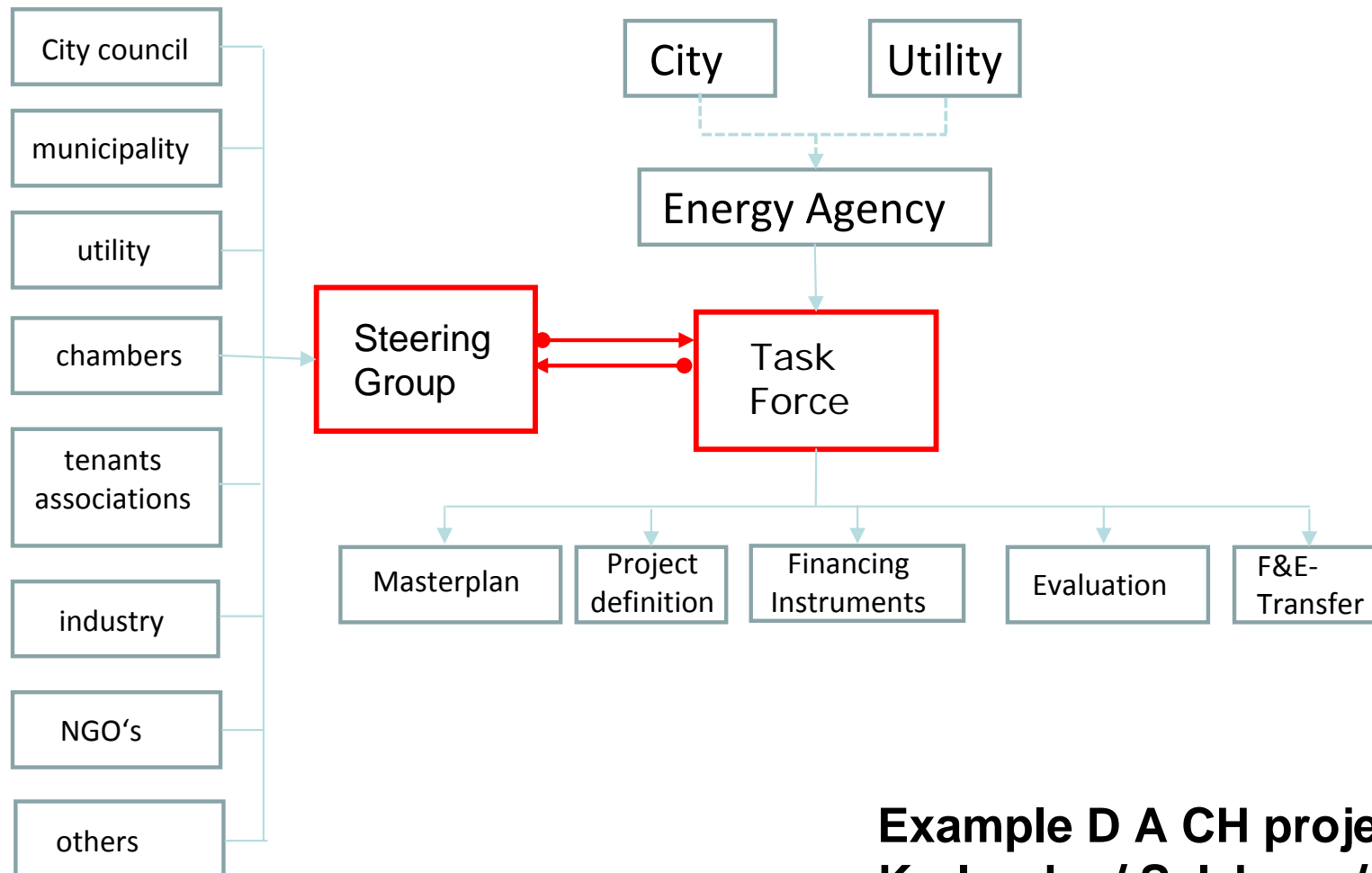
### → new business opportunities

### → ...

„invisible hand“  
+  
„coordination“



## Implementation management:



**Example D A CH project:  
 Karlsruhe / Salzburg / Basel**

## Conclusions:

„City transformation“

- building/NB refurbishment
- energy infrastructure



## City development:

- foster circularity of mass flows
- optimize use of regional resources
- improve urban form (infill, density, multifunctionality)
- transportation

→ quality of living: *urban sustainability*

**requires** → **long-term plan**  
→ **continuous management**