FP 7 Research Project SUME
Urban Development 2050: Resource efficiency as guiding principle for rebuilding European cities

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FP 7 Project SUME: Partners & Case study cities

- Scenario Cities (Countries)
- SUME Project Partner

Map showing cities and partners involved in the SUME project, including:

- Newcastle upon Tyne (GB)
- Berlin (DE)
- Potsdam Inst. of Climate Change Impact (SE)
- Warsaw (PL)
- Warsaw School of Economics
- Munich (DE)
- Vienna (AT)
- OIR / Social Ecology Vienna
- Porto (PT)
- Marseille (FR)
- Athens (GR)
- Iraklion (GR)

Partners include:

- University of Porto, Faculty of Engineering (CITTA–FEUP)
- Nordic Centre for Spatial Development (Nordregio)
- Foundation for Research and Technology–Hellas (FORTH)
- University of Newcastle upon Tyne (UNEW)
- Delft University of Technology (TU Delft)
- Klagenfurt University, Faculty for Interdisciplinary Studies (UNI-KLU)
- Potsdam Institute of Climate Change Research (PIK)
- Chinese Academy of Sciences (CASIA)
- Warsaw School of Economics (SGH)

SUME – project: Workpackages

WP1
Scenarios of urban development in Europe

WP2
Spatially explicit modelling of urban metabolism

WP3
Metabolic impact of urban development projects & restructuring

WP4
Urban development policy guidelines
Urban form in Europe: Spatial diversity and divergent dynamics
UMZ Urban Morphological Zones

UN Habitat Definition, implemented by EEA:

Corine Landcover, max. 200m between buildings = urbanized zone
Population density in the “Urban Fabric“ (pop./km$^2$)
Index of Fragmentation (perimeter of UMZ / perimeter of circle same area)
Background: Social Metabolism

- Social systems as thermodynamically open
- Energy and material flows into socio-economic system
- Internal energy and material flows
- Energy and material flows back to nature
- Main operationalizations
  - Material and energy flows
  - Life cycle analysis LCA
  - Stocks and flows dynamics
Metabolic Modelling: Modular Approach

Building Component (PIK)

Transport Component (IFF)

ABM Component (IFF)
SUME scenario approach
Urban development scenarios 2050: Inputs and guiding principles

- Spatial development paths for different cities, 2000 – 2050
- Main drivers: population and job change (projections), development of living space per capita
- Spatial disaggregation level (ca. 150-700 cells)
- Inputs: Land use, densities and building typologies, protected areas and restrictions, infrastructure plans, larger development projects, development plans
Urban development scenarios: Guiding principles

- **BASE scenario** as the continuation of current spatial trends (densities, spatial configurations)

- **SUME scenario** as a path of sustainable spatial planning – focusing on the interrelations between urban form and metabolic performance

- **SUME – scenarios** **4 planning principles:**
  - gradual step up of densities in existing urban fabric
  - where attractive public transport can be provided
  - mix of functions (esp. in public transport nodes)
  - potential of enforced thermal renovation and reconstruction (combining replacement activities with densification)
Scenarios 2050: Overview

- Vienna
- Athens
- Marseille
- Munich
- Newcastle upon Tyne
- Oporto
- Stockholm
Vienna

- 1.8 Mio. population
- → 2050: + 35 %
- Pop.+jobs/km² in urban fabric: 7.251
BASE scenario 2050:
urban fabric + 55%
SUME scenario 2050:
urban fabric
+ 14%
Key development strategies up to 2050:

Inner-city, densify fringe areas, focus on main transport axes
Newcastle upon Tyne

- 1.1 Mio. population
- \( \rightarrow 2050: +12\% \)
- Pop.+jobs/km² in urban fabric: 6.700
BASE scenario 2050:
urban fabric + 7%
SUME scenario 2050:
urban fabric + 0%
Key development strategies up to 2050:

Inner city re-development, expand public transport system
Oporto

- 1.3 Mio. population
- → 2050: - 4 %
- Pop.+jobs/km² in urban fabric: 5.403
BASE scenario 2050:
urban fabric + 0%
**SUME scenario 2050:**

*urban fabric + 0%*

**PT-focus**
Key development strategies up to 2050:

- Inner city re-development
- Polycentricity
- Public transport

Oporto: Difference between SUME and BASE
Stockholm

- 1.3 Mio. population
- → 2050: + 44 %
- Pop.+jobs/km² in urban fabric: 5.278
- BASE scenario 2050:
  - urban fabric + 47%
**SUME scenario 2050:**
urban fabric +20%
Key development strategies up to 2050:

Urban development in fringe areas, new regional centres, transport axes
Urban spatial development: BASE and SUME scenarios
### Scenarios BASE and SUME: Growth of “urbanized zones” 2000 – 2050

<table>
<thead>
<tr>
<th>City</th>
<th>BASE (2000-2050)</th>
<th>SUME (2000-2050)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vienna</td>
<td>55%</td>
<td>14%</td>
</tr>
<tr>
<td>Stockholm</td>
<td>47%</td>
<td>20%</td>
</tr>
<tr>
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<tr>
<td>Munich</td>
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<td>13%</td>
</tr>
</tbody>
</table>
Spatial development – impact on urban form

- BASE scenarios 2050 show urban spatial expansion faster than population dynamics, also in stagnant urban agglomerations.
- Fast growing cities will show massive growth of their urban fabric, but they also have the greatest potential to re-focus their development (reducing land consumption) – Vienna, Stockholm.
- Cities with low densities and high fragmentation need an approach focusing on attractive public transport and creating good access to centers of activities (sub-centers at transport nodes with offices, services and shops).
- Stagnant or shrinking cities have much less options for spatially relevant re-development (Newcastle, Oporto).
Population distribution by density categories in the UMZ

![Graph showing population distribution by density categories in cities such as Vienna, Stockholm, Porto, and Newcastle.](image)

- Share of population in cells of specific density.
- Population density categories are represented by different colors and ranges:
  - lower than 1.500
  - 1.500 - 3.000
  - 3.000 - 5.000
  - 5.000 - 8.000
  - 8.000 - 10.000
  - 10.000 - 15.000
  - 15.000 - 20.000
  - 20.000 - 30.000
  - 30.000 - 40.000
  - higher than 40.000
Land consumption by density categories in the UMZ

- Vienna
- Stockholm
- Porto
- Newcastle

Population density (persons/km²)
- lower than 1.500
- 1.500 - 3.000
- 3.000 - 5.000
- 5.000 - 8.000
- 8.000 - 10.000
- 10.000 - 15.000
- 15.000 - 20.000
- 20.000 - 30.000
- 30.000 - 40.000
- higher than 40.000

Share of area in cells of specific density
Modelling urban form and development: Impact on energy consumption for heating and transport
Vienna: Per capita energy consumption for housing and transport 2050
Final energy per capita heating & transport

Vienna

Stockholm

Newcastle

Oporto

May 14, 2012

C. Schremmer - Österreichisches Institut für Raumplanung (ÖIR)
Strategies & Policies
Key-strategies for urban development

- Re-development of existing urbanized areas with excellent public transport is the key to reduce large-scale future expansion and energy consumption

- A new policy-set beyond green-field and brown-field development is needed:
  - **Attractiveness**: better green area and open space quality in inner-city neighborhoods
  - **Densification strategies** and mobilizing building land in areas with lower densities and good access to public transport
  - Building and energy-oriented renovation and reconstruction strategies

- Large scale development-projects can give an impulse to form new centers to improve the overall urban diversity pattern

- Major efforts in coupling of policies for transport infrastructure and spatially focused housing, residential and economic development is needed → links between sectoral policies and between municipalities in agglomerations
Integrative policy packages

- Planning and building regulation
- Fiscal and non-fiscal incentivisation
- Promotion of behavioural change
- Education and awareness raising
- Direct provision by public and/or voluntary sectors
Integrative, smart policy packages

- All new and re-development within existing urbanized areas is an opportunity to improve the status quo.

- An urban agglomeration perspective (e.g. UMZ) should form the basis for coordinated policy development and implementation, using comparative, long-term metabolic scenarios for information, coordination and action.

- **Agglomeration-wide governance** and decision-making is needed for implementation.

- **Cross-sectoral policy coherence** is essential for impact: Integrating land-use planning with transport, legal structures and incentive patterns, energy planning, public awareness and other policy areas.
European policy perspectives

- European urban agglomerations show great diversity of urban form, infrastructures and building qualities as well as divergent development perspectives – but urban spatial expansion in all types faster than population dynamics

- The SUME-scenario development principles show large action space over time - e.g. reducing new urbanization by up to 80%

- Major efforts in the urban agglomeration transport and energy infrastructure will be needed, to be closely linked with housing, residential and economic development

- The **Smart City/Smart Region approach** is a potential platform for bringing together the relevant actors in an agglomeration and to provide strategic orientation

- **Research, innovation and implementation processes** need to be initiated and closely monitored