

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

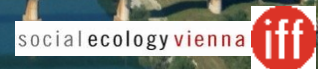
Christof Schremmer, Ursula Mollay, Barbara
Saringer-Bory

ÖIR (project coordinator)

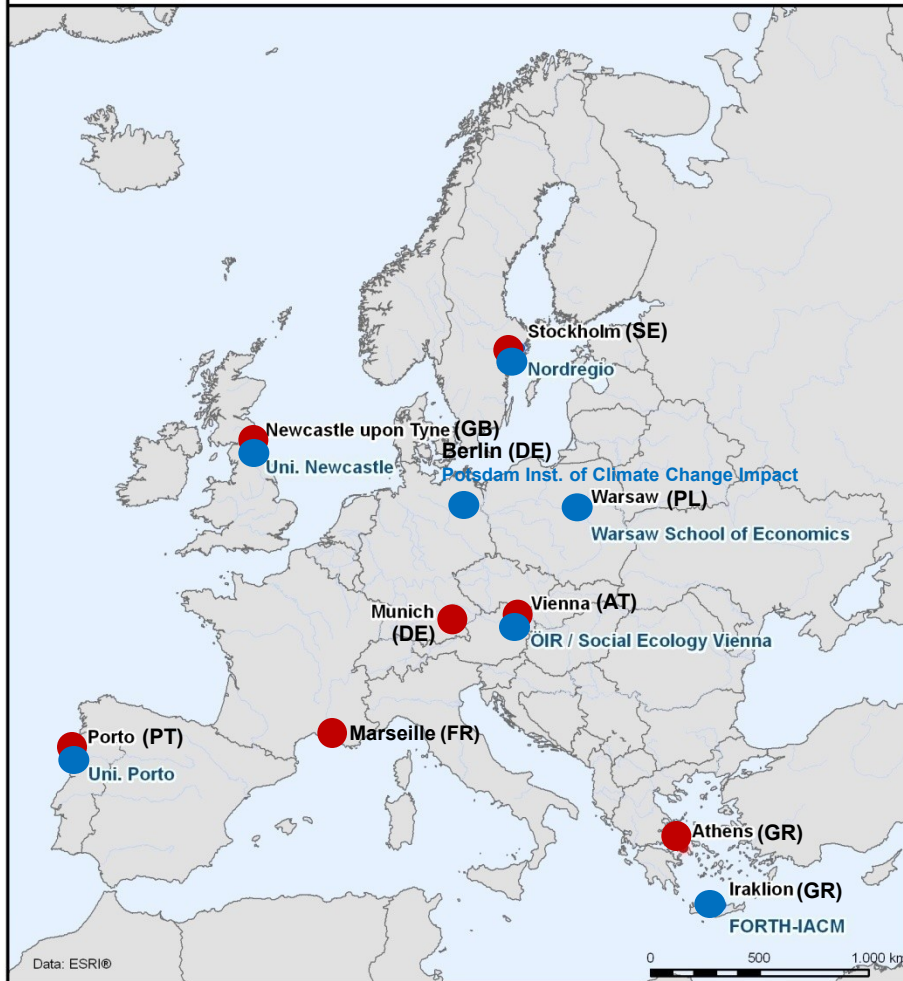
www.sume.at

May 14, 2012

Schwechat, Austria



FP 7 Project SUME: Partners & Case study cities



ÖIR
 Austrian Institute for Regional
 Studies and Spatial Planning
 Project co-ordinator

Citta
 FEUP FACULDADE DE ENGENHARIA
 UNIVERSITARIO DO PORTO

Newcastle University

PIK

szkółna Główna Handlowa
 WARSZAWY

TU Delft Delft
 University of
 Technology

social ecology vienna iff

FORTH
 Foundation for Research & Technology Hellas

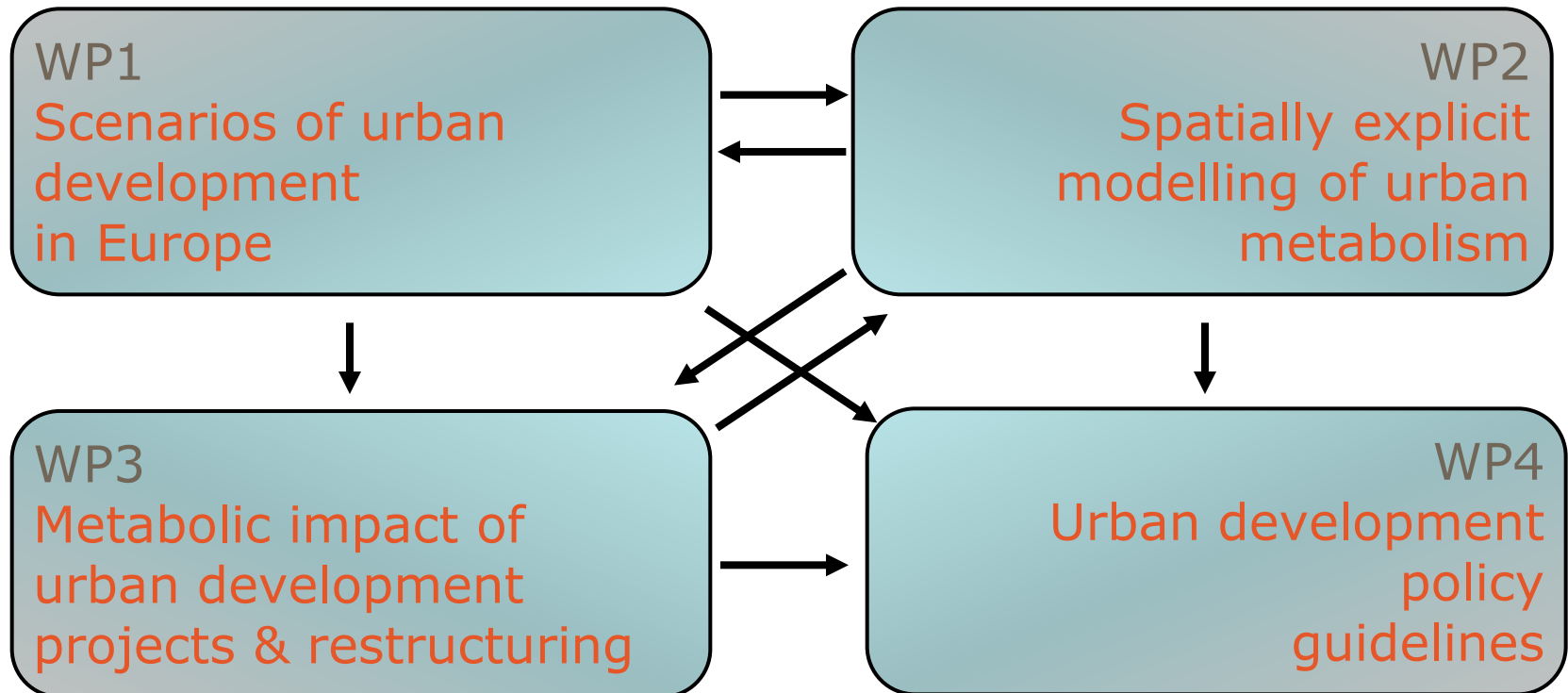
NORDREGIO
 Nordic Centre for Spatial Development

**INSTITUTE OF AUTOMATION
 CHINESE ACADEMY OF SCIENCES**

● **Scenario Cities (Countries)**

● **SUME Project Partner**

SUME – project: Workpackages



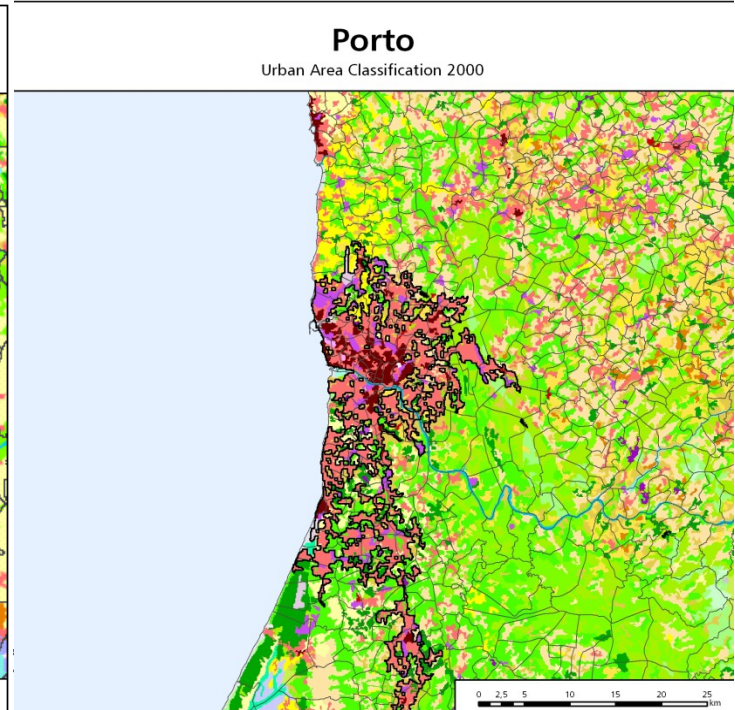
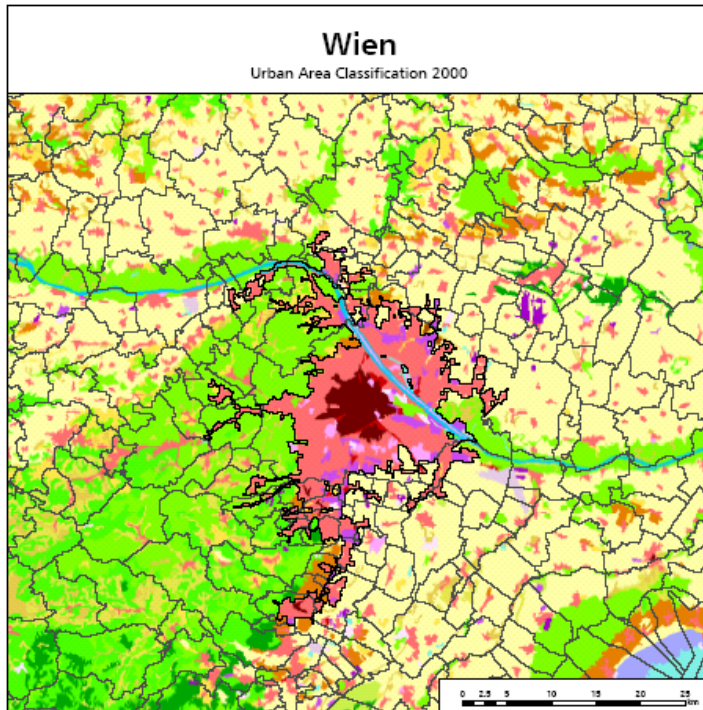
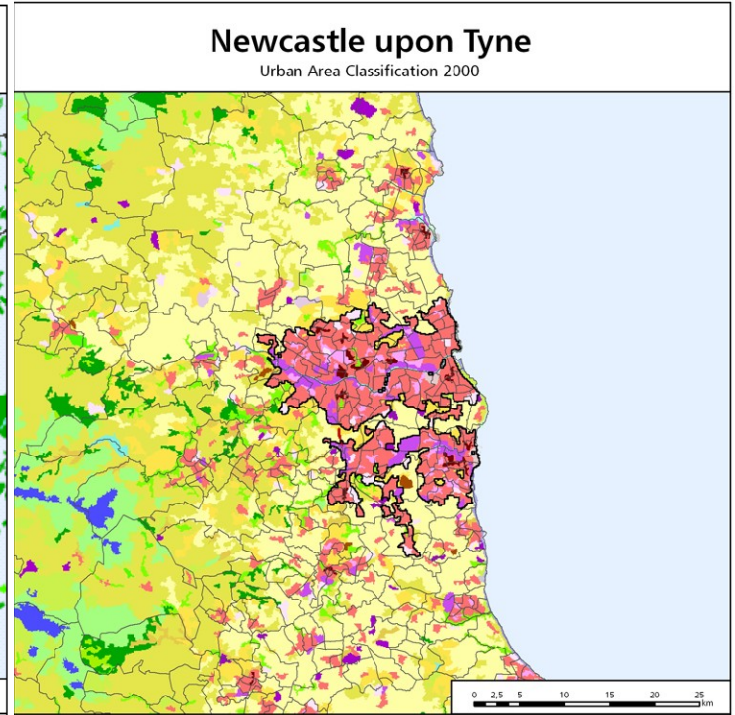
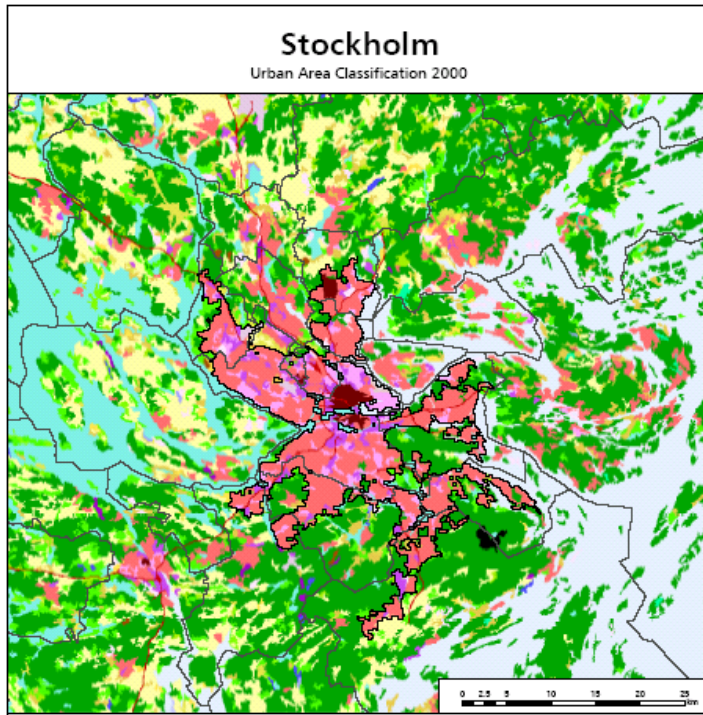
Urban form in Europe: Spatial diversity and divergent dynamics



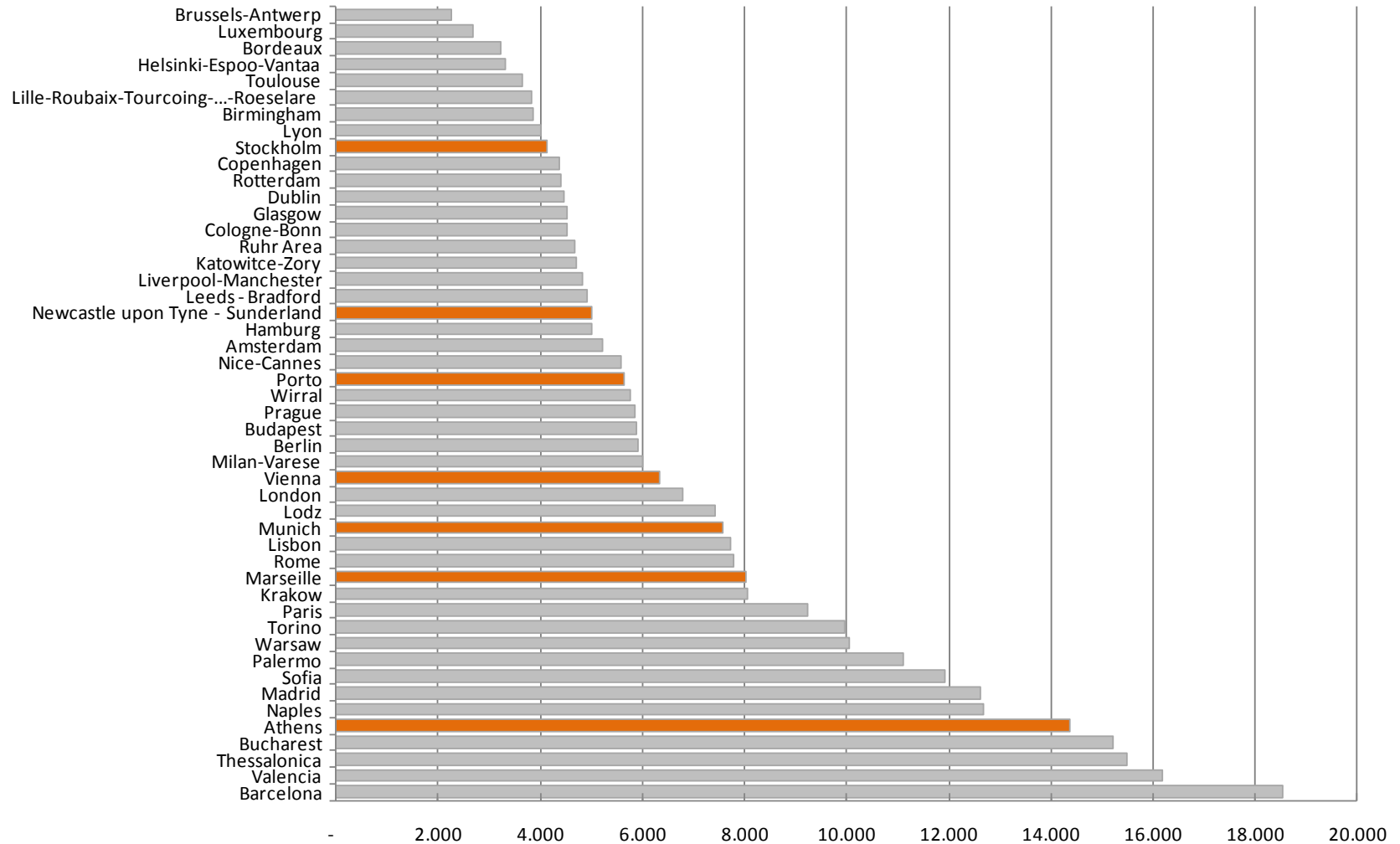
UMZ
Urban
Morphological
Zones

UN Habitat
Definition,
imple-
mented
by EEA:

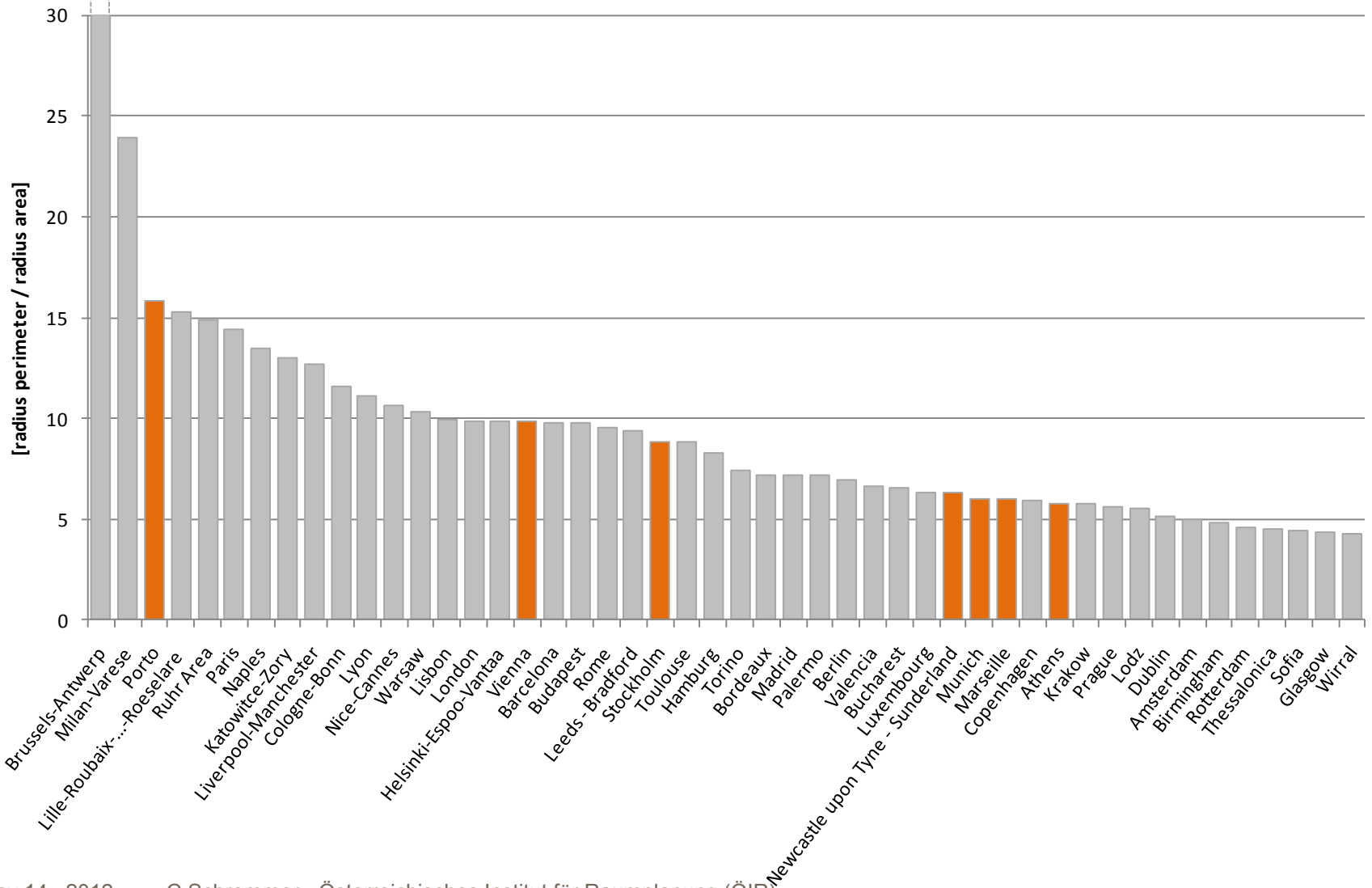
Corine
Landcover,
max. 200m
between
buildings
=
urbanized
zone



Population density in the “Urban Fabric“ (pop./km²)

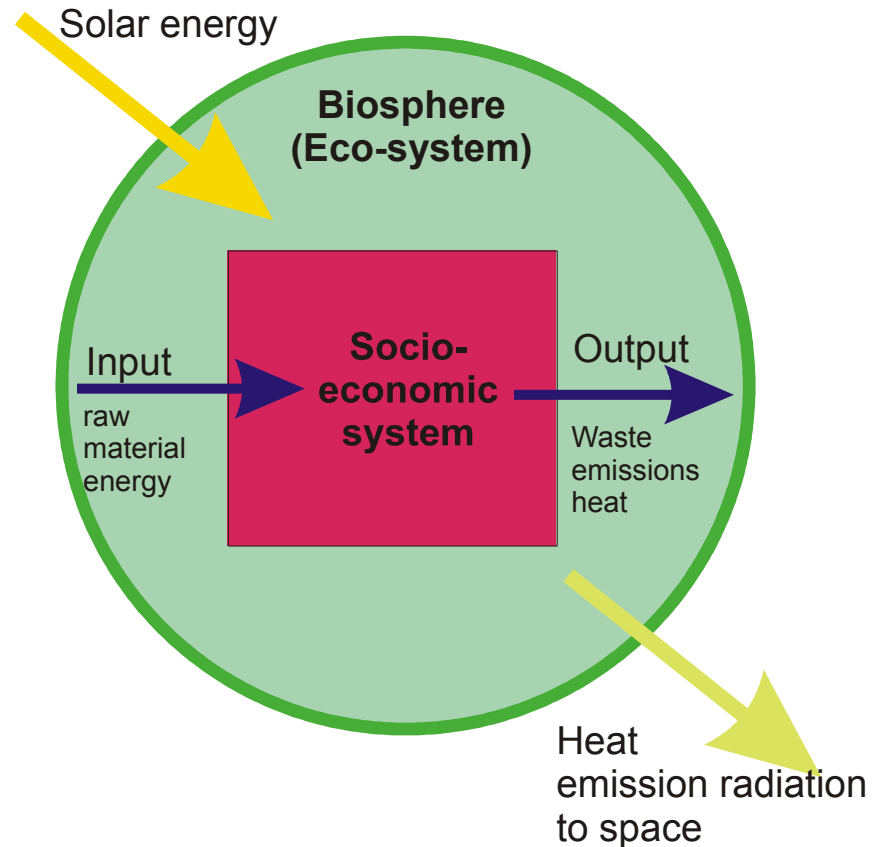


Index of Fragmentation (perimeter of UMZ / perimeter of circle same area)

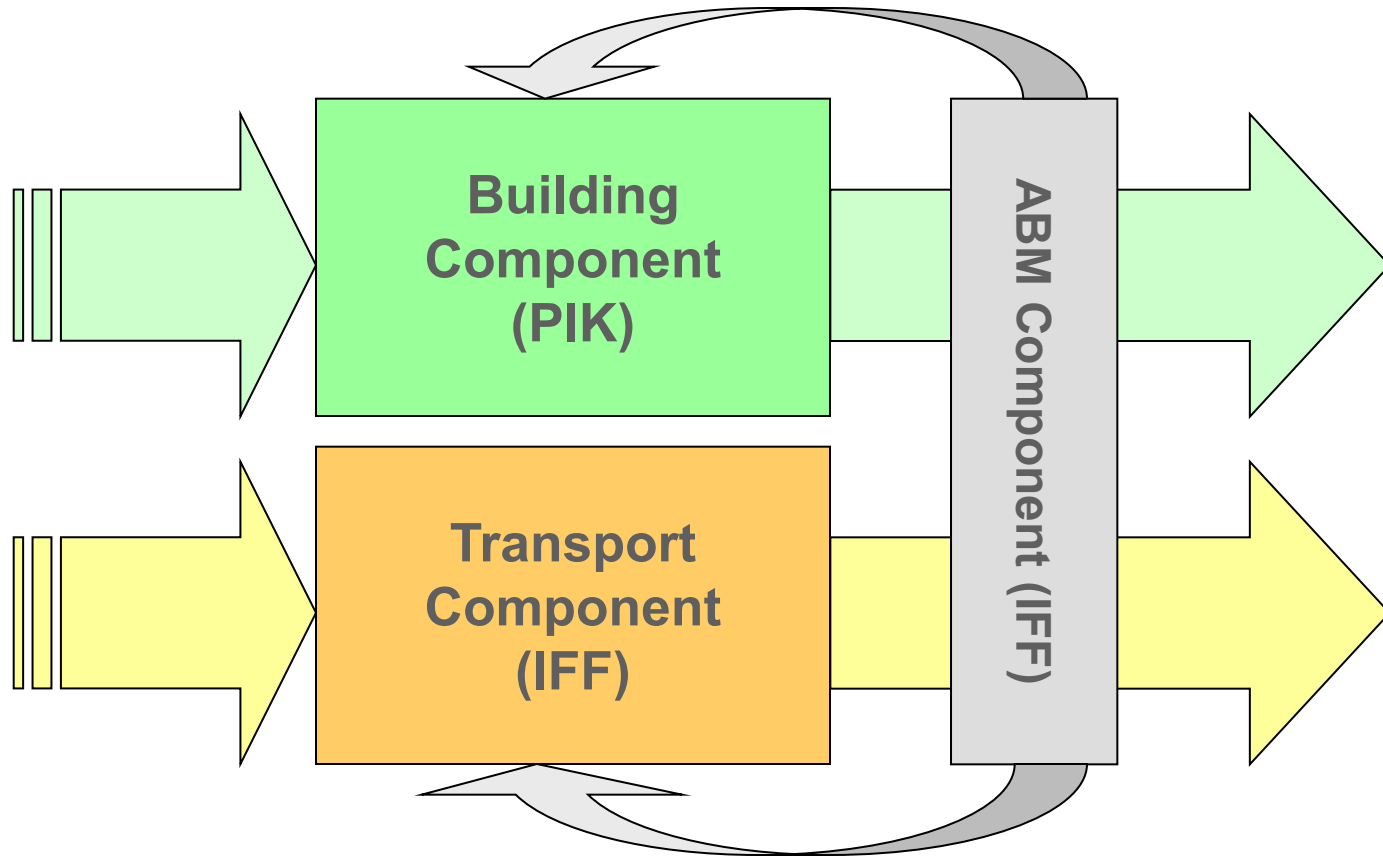


Background: Social Metabolism

- ▶ 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



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**



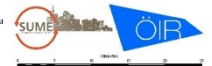
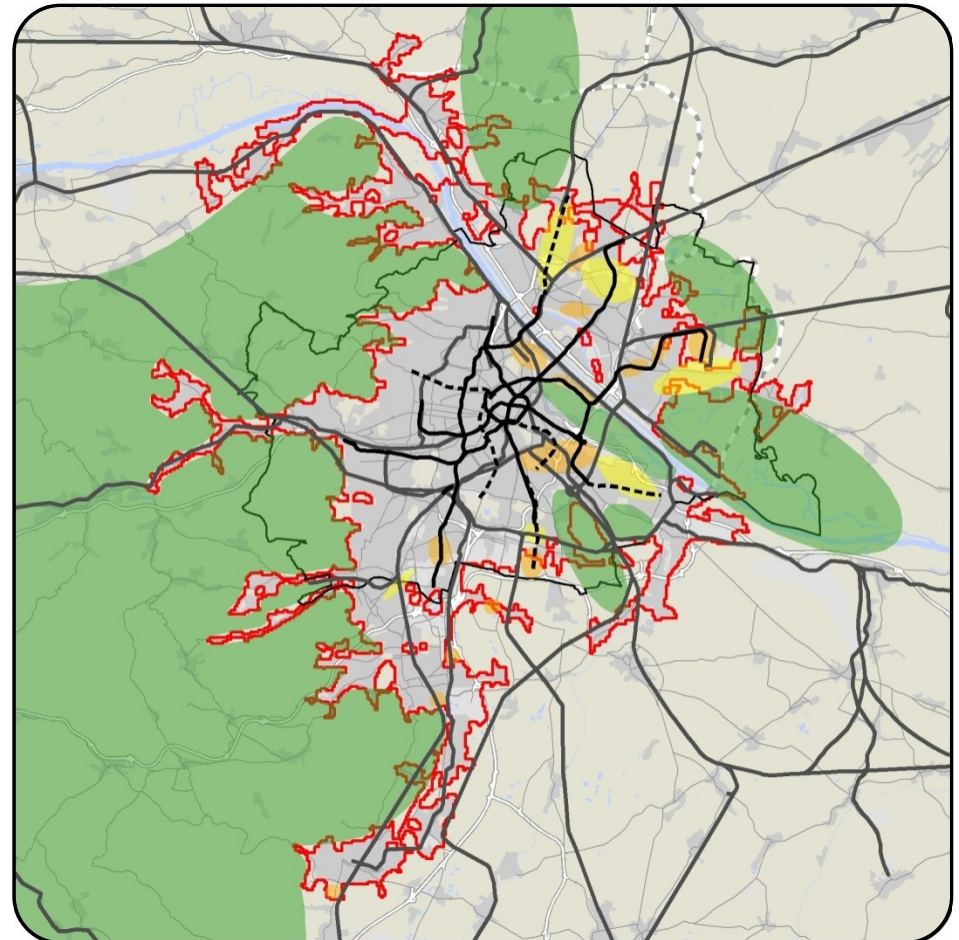
Vienna

- ▶ 1.8 Mio. population
- ▶ → 2050: + 35 %
- ▶ Pop.+jobs/km2 in urban fabric: 7.251

Legend of City Details

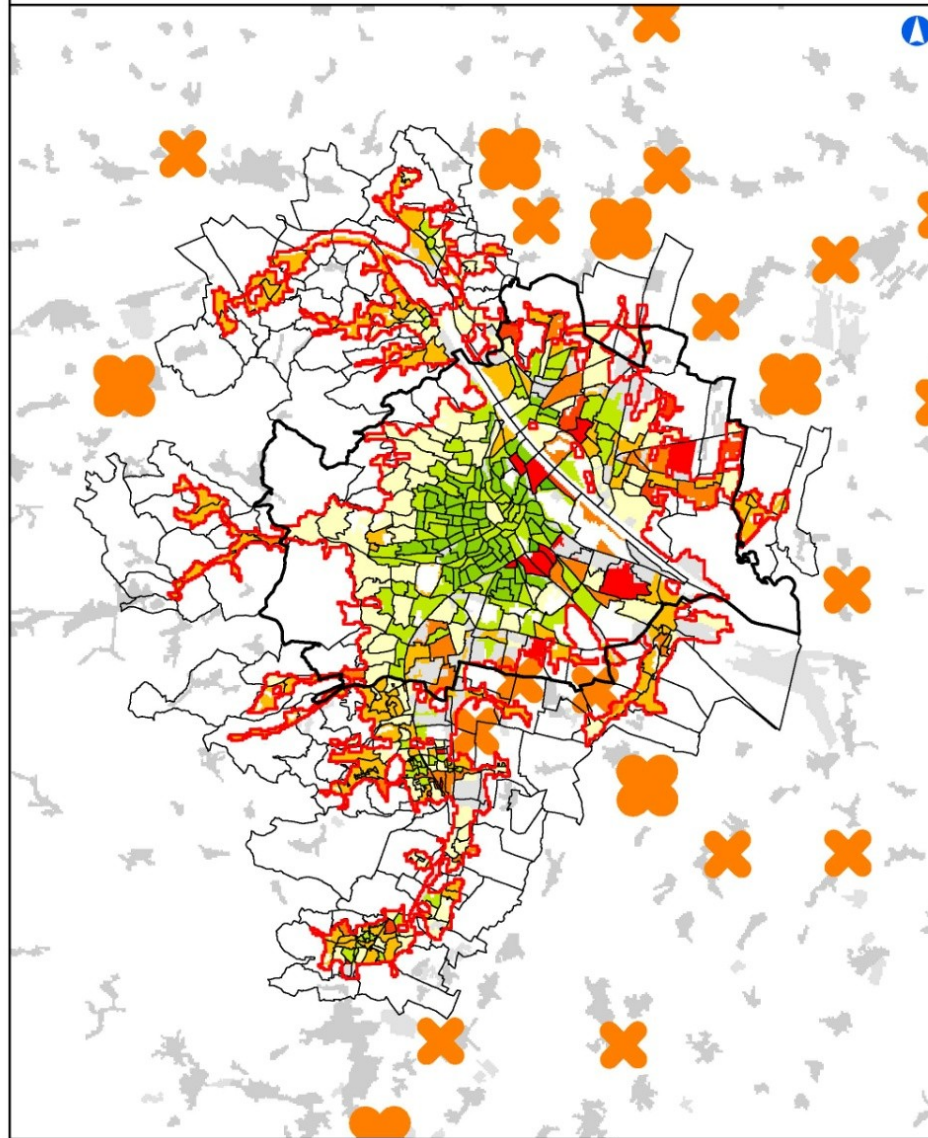
Area	Infrastructure
<ul style="list-style-type: none"> ○ 2a: Key Areas of Urban Development until 2025 ○ 2b: Long Term Options for Urban Development ○ Supra Regional Green Areas, Protected Areas 	<ul style="list-style-type: none"> — Subway Network, Existing and Under Construction - - - Subway Network, Projected — Railway Network Existing and Under Construction — Existing Motorway — Road Network - - - Motorways planned
Land Cover [According Corine 2000]	Borders
<ul style="list-style-type: none"> ■ Urban fabric (outside UMZ) ■ Industrial or commercial uses ■ Water ■ Others 	<ul style="list-style-type: none"> — UMZ — Administrative Border of the respective City — National Borders

Sources
Copyright EEA, Copenhagen, 2007 - www.eea.europa.eu
www.openstreetmap.org
National Statistics of
Greece, Switzerland, France, Germany,
United Kingdom, Portugal, Sweden, Austria

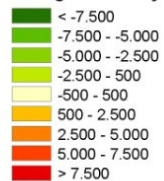



Vienna: Change of population and workplace density 2001 - BASE

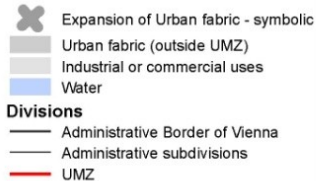
► **BASE**
scenario
2050:
**urban
fabric
+ 55%**



Change in density

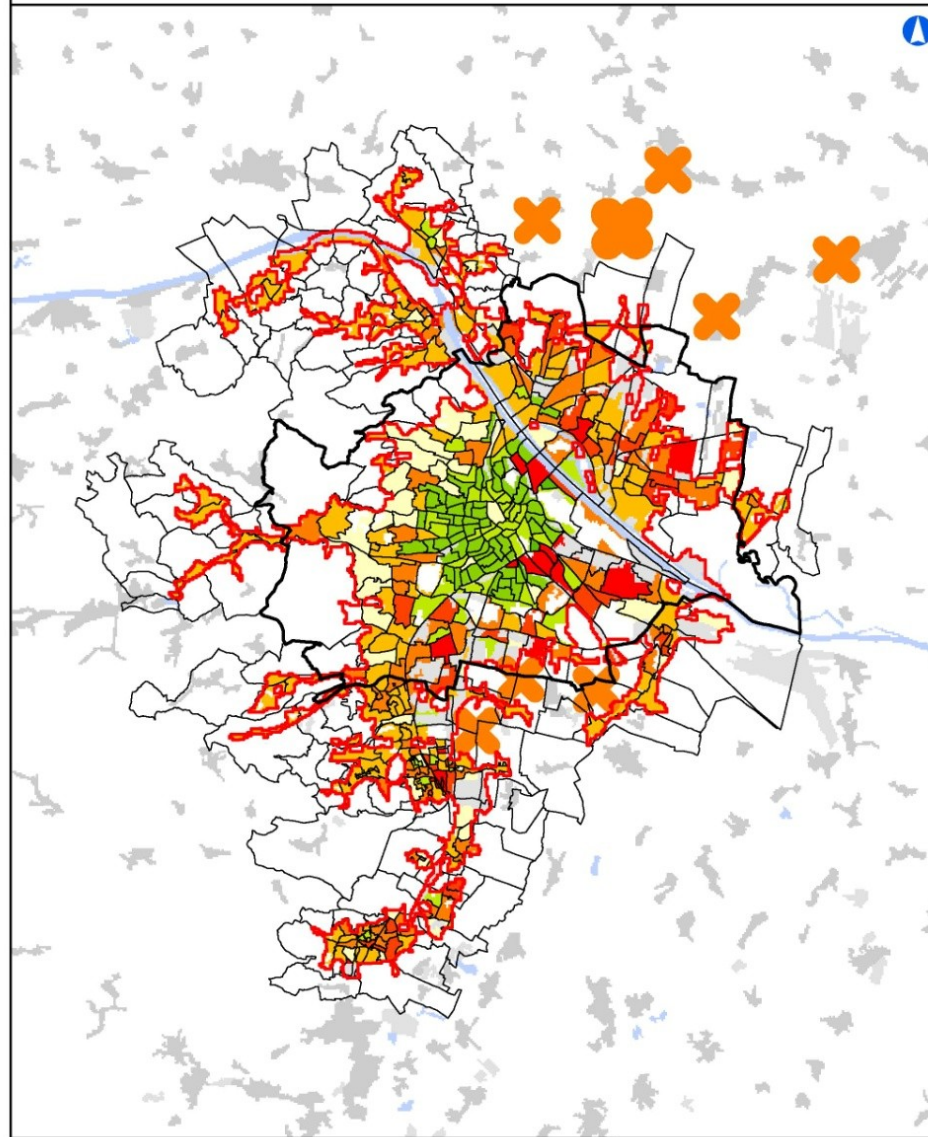


Corine Land Cover 2000

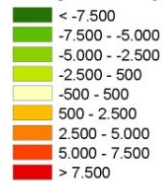


Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria

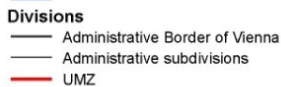
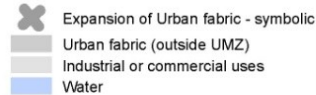
► **SUME**
scenario
2050:
**urban
fabric
+ 14%**



Change in density



Corine Land Cover 2000

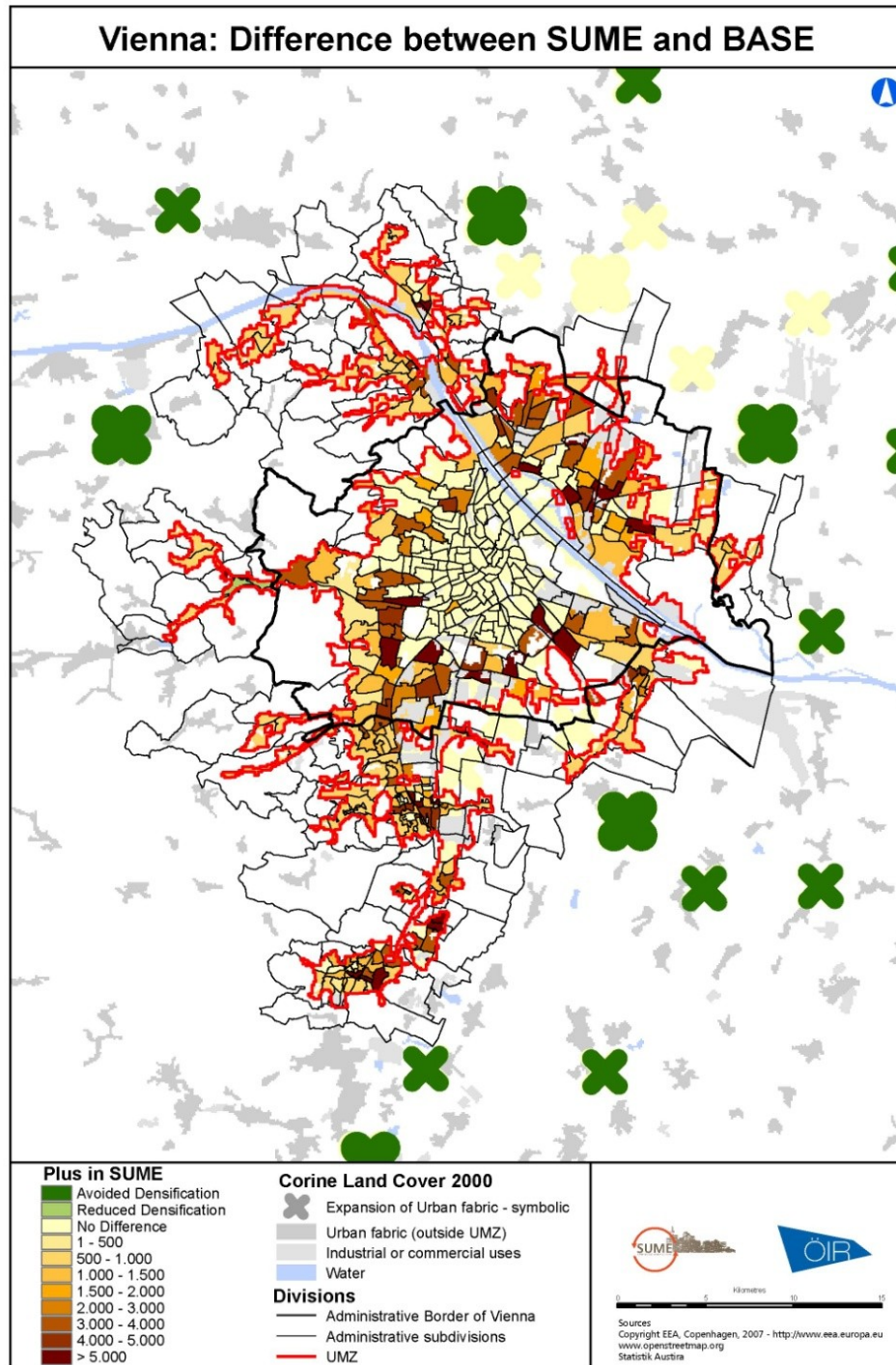


Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria

Vienna: Difference between SUME and BASE

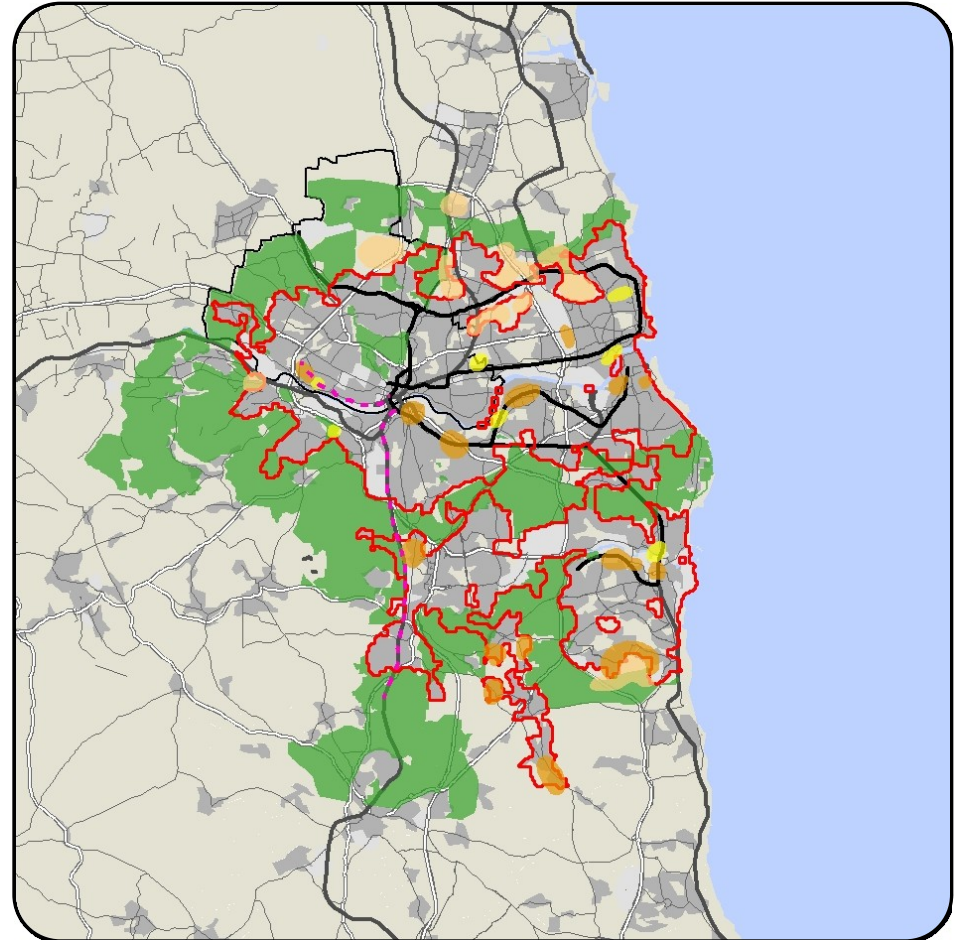
► **Key development strategies up to 2050:**

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



Newcastle upon Tyne

- ▶ 1.1 Mio. population
- ▶ → 2050: + 12 %
- ▶ Pop.+jobs/km2 in urban fabric: 6.700



Legend of City Details

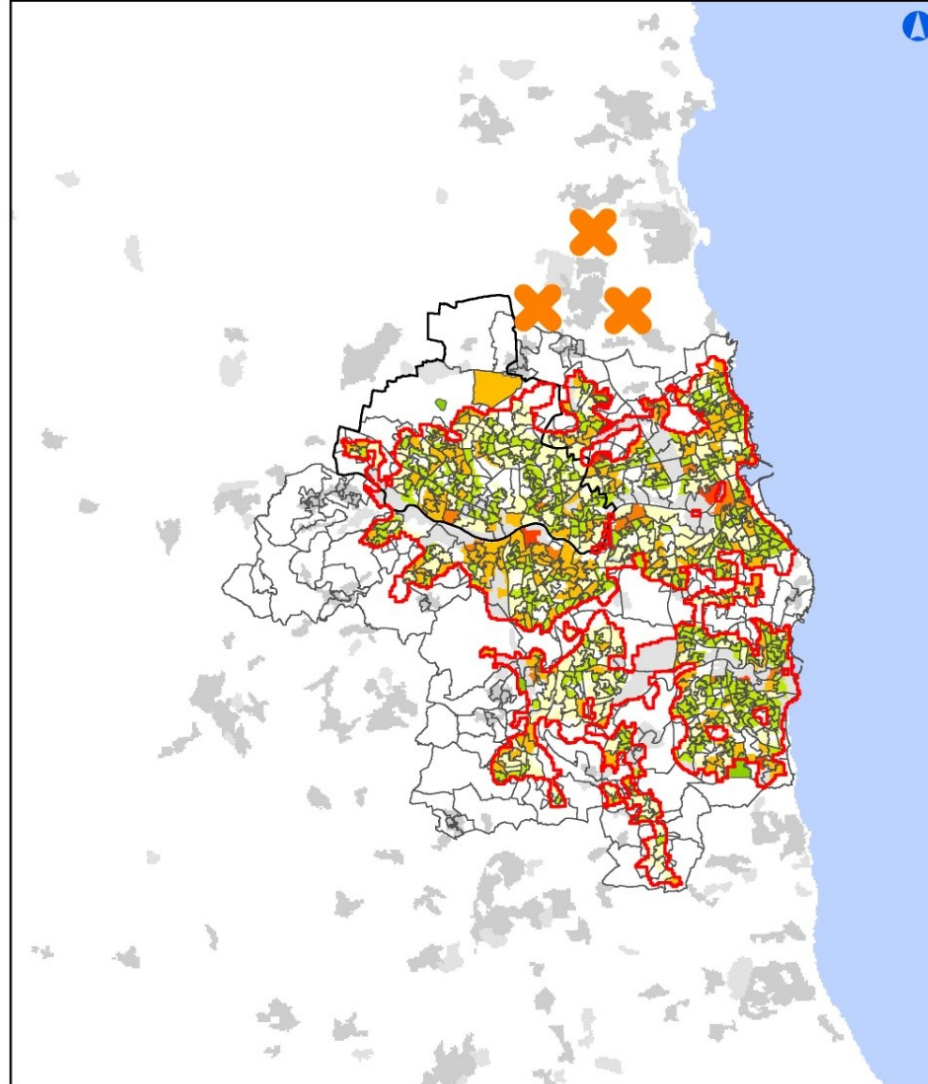
Area	Infrastructure
<ul style="list-style-type: none"> ○ 2a: Key Areas of Urban Development until 2025 ○ 2b: Long Term Options for Urban Development ○ Supra Regional Green Areas, Protected Areas 	<ul style="list-style-type: none"> — Subway Network, Existing and Under Construction - - - - Subway Network, Projected — Railway Network Existing and Under Construction — Existing Motorway — Road Network - - - - Motorways planned
Land Cover [According Corine 2000]	Borders
<ul style="list-style-type: none"> ■ Urban fabric (outside UMZ) ■ Industrial or commercial uses ■ Water ■ Others 	<ul style="list-style-type: none"> — UMZ — Administrative Border of the respective City — National Borders

Sources
Copyright EEA, Copenhagen, 2007 - www.eea.europa.eu
www.openstreetmap.org
National Statistics of
Greece, Switzerland, France, Germany,
United Kingdom, Portugal, Sweden, Austria

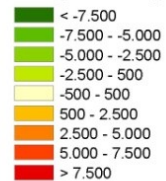
Newcastle upon Tyne Change of population and workplace density 2001 - BASE

► **BASE**
scenario
2050:

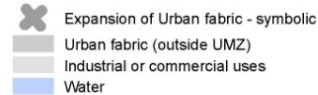
**urban
fabric
+ 7%**



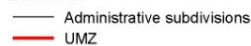
Change in density



Corine Land Cover 2000



Divisions

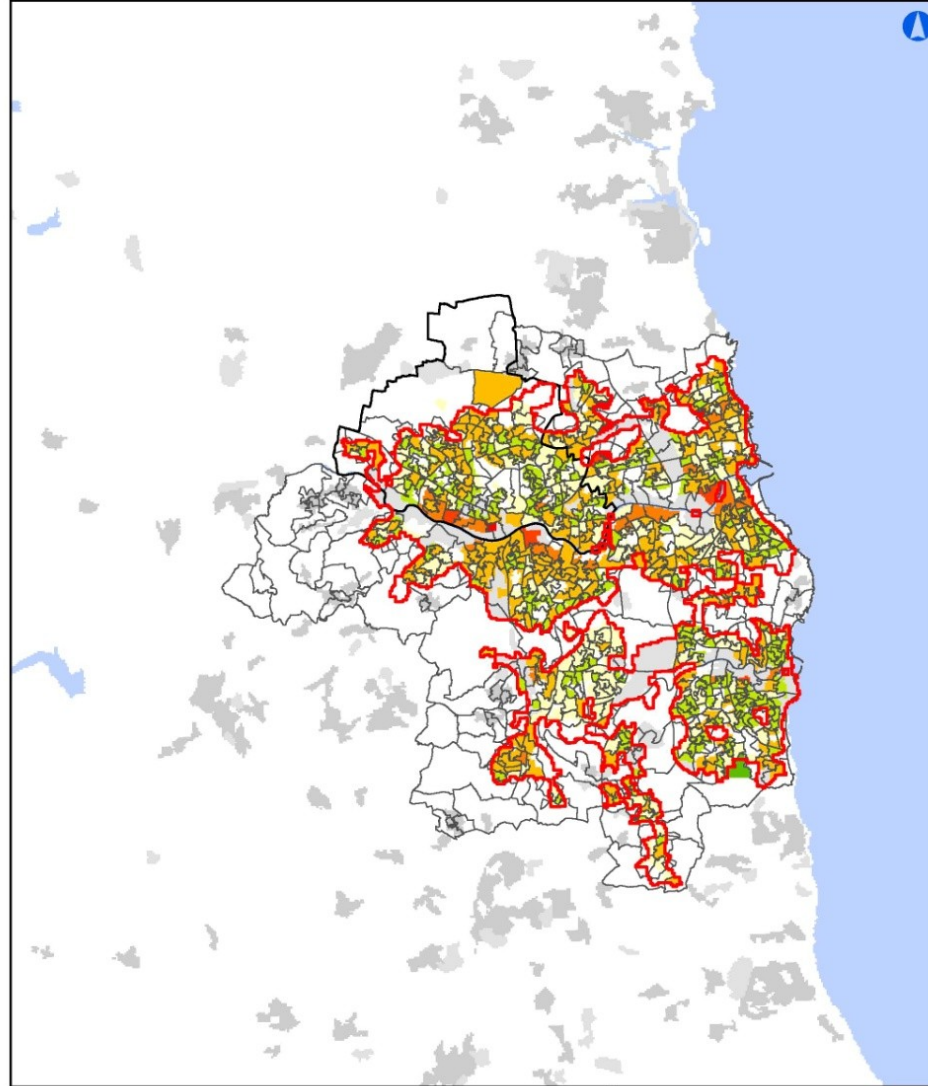


Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria

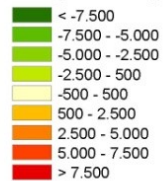


Newcastle upon Tyne Change of population and workplace density 2001 - SUME

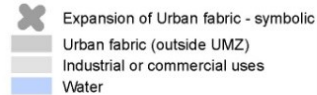
- **SUME** scenario 2050:
urban fabric + 0%



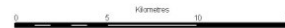
Change in density



Corine Land Cover 2000



Divisions

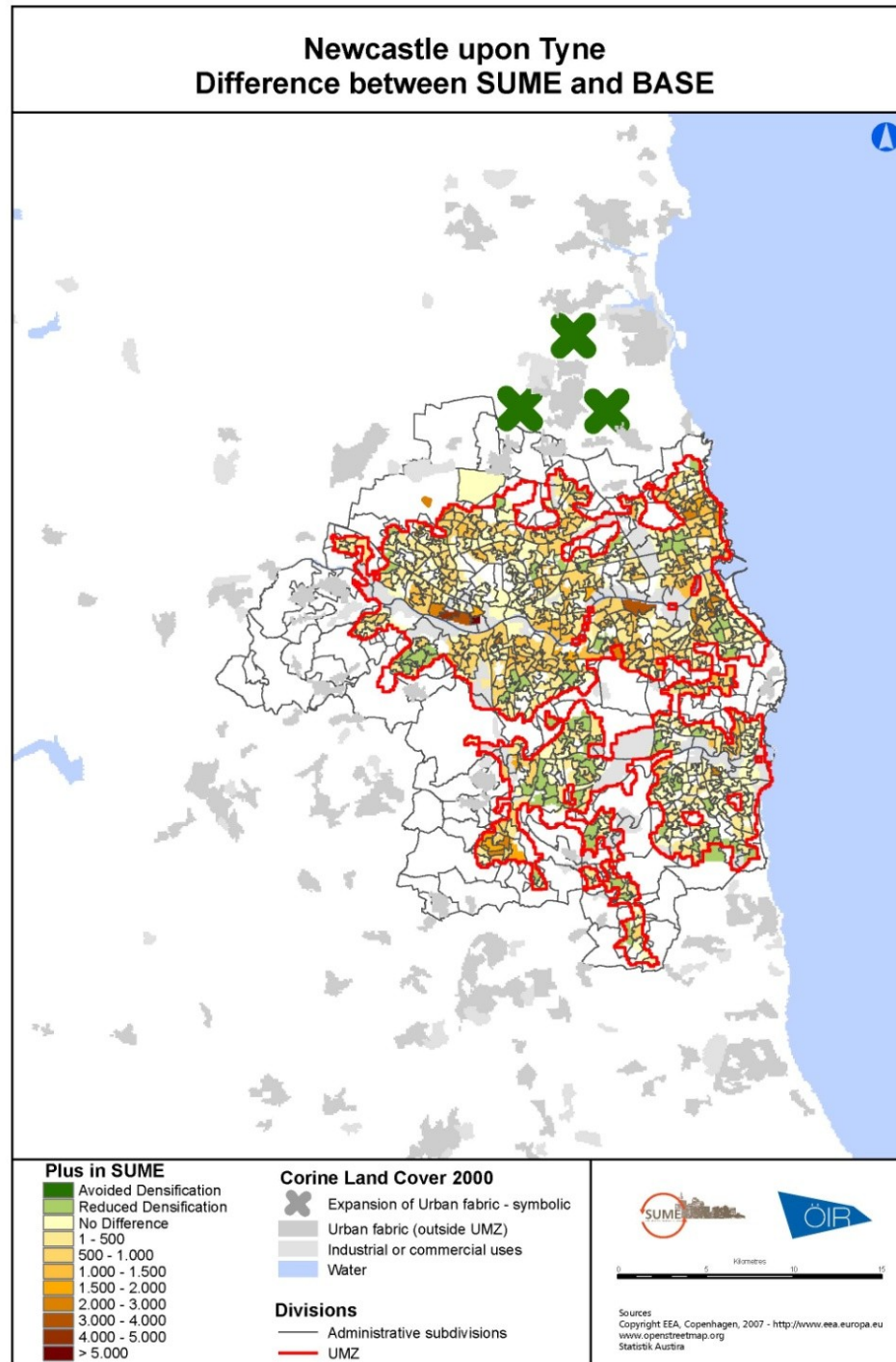


Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria



► **Key development strategies up to 2050:**

Inner city re-development, expand public transport system





Oporto

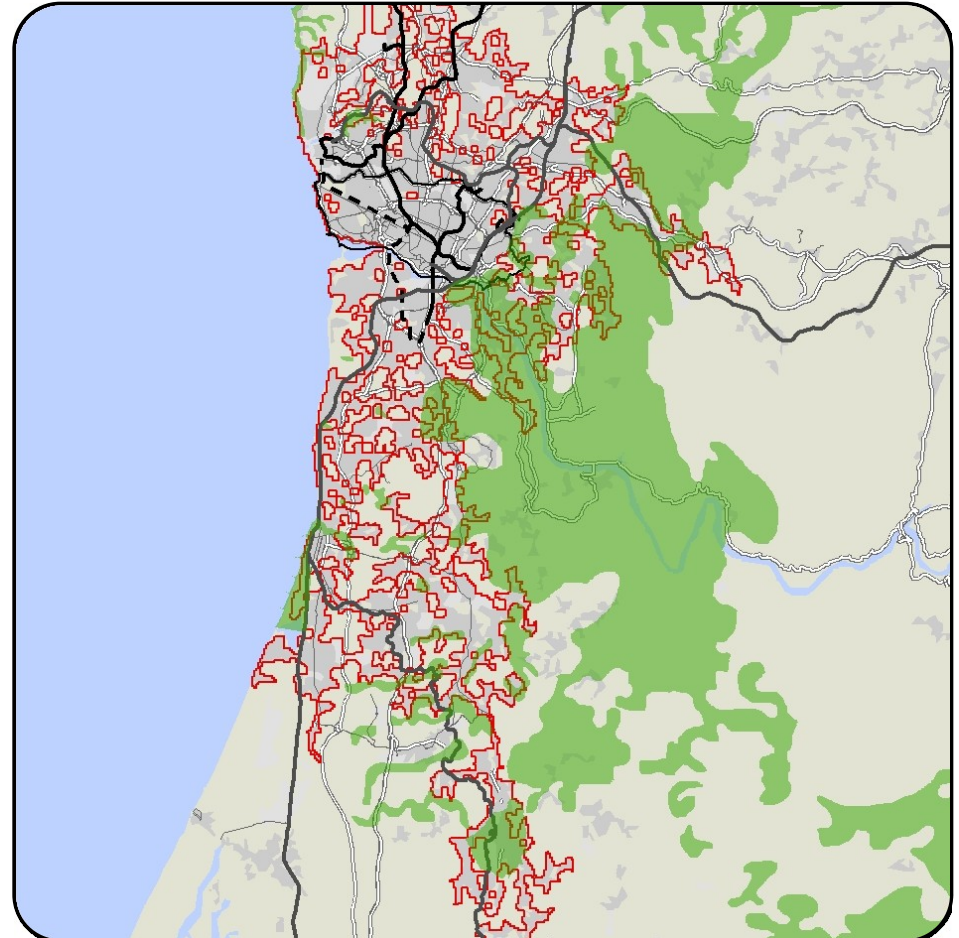
- ▶ 1.3 Mio. population
- ▶ → 2050: - 4 %
- ▶ Pop.+jobs/km² in urban fabric: 5.403

Legend of City Details

<p>Area</p> <ul style="list-style-type: none"> 2a: Key Areas of Urban Development until 2025 2b: Long Term Options for Urban Development Supra Regional Green Areas, Protected Areas <p>Land Cover [According Corine 2000]</p> <ul style="list-style-type: none"> Urban fabric (outside UMZ) Industrial or commercial uses Water Others 	<p>Infrastructure</p> <ul style="list-style-type: none"> Subway Network, Existing and Under Construction Subway Network, Projected Railway Network Existing and Under Construction Existing Motorway Road Network Motorways planned <p>Borders</p> <ul style="list-style-type: none"> UMZ Administrative Border of the respective City National Borders
--	--

Sources: Copyright EEA, Copenhagen, 2007 - www.esa.europa.eu
www.openstreetmap.org
National Statistics of Greece, Switzerland, France, Germany, United Kingdom, Portugal, Sweden, Austria

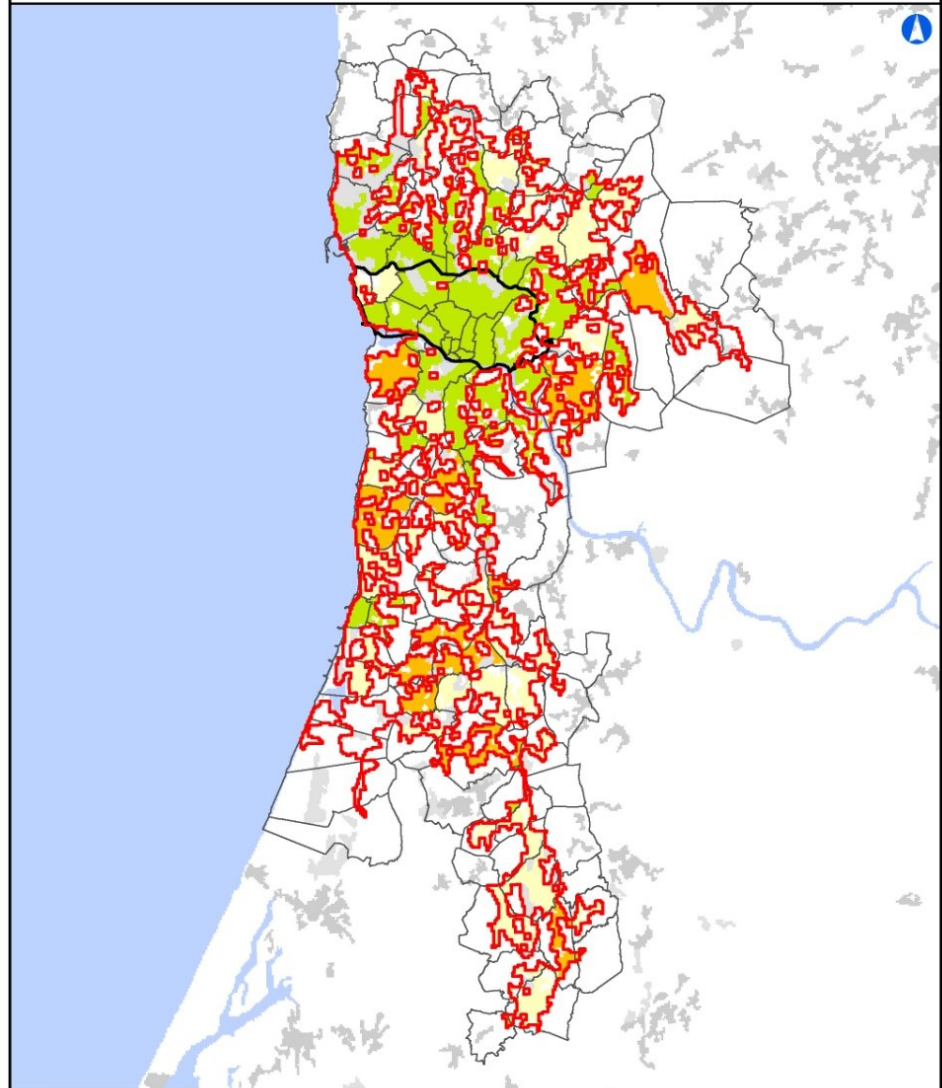





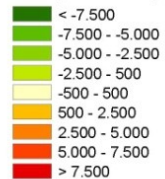
Oporto: Change of population and workplace density 2001 - BASE

► **BASE**
scenario
2050:

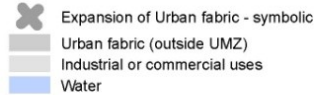
**urban
fabric
+ 0%**



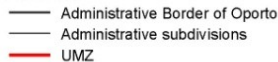
Change in density



Corine Land Cover 2000



Divisions

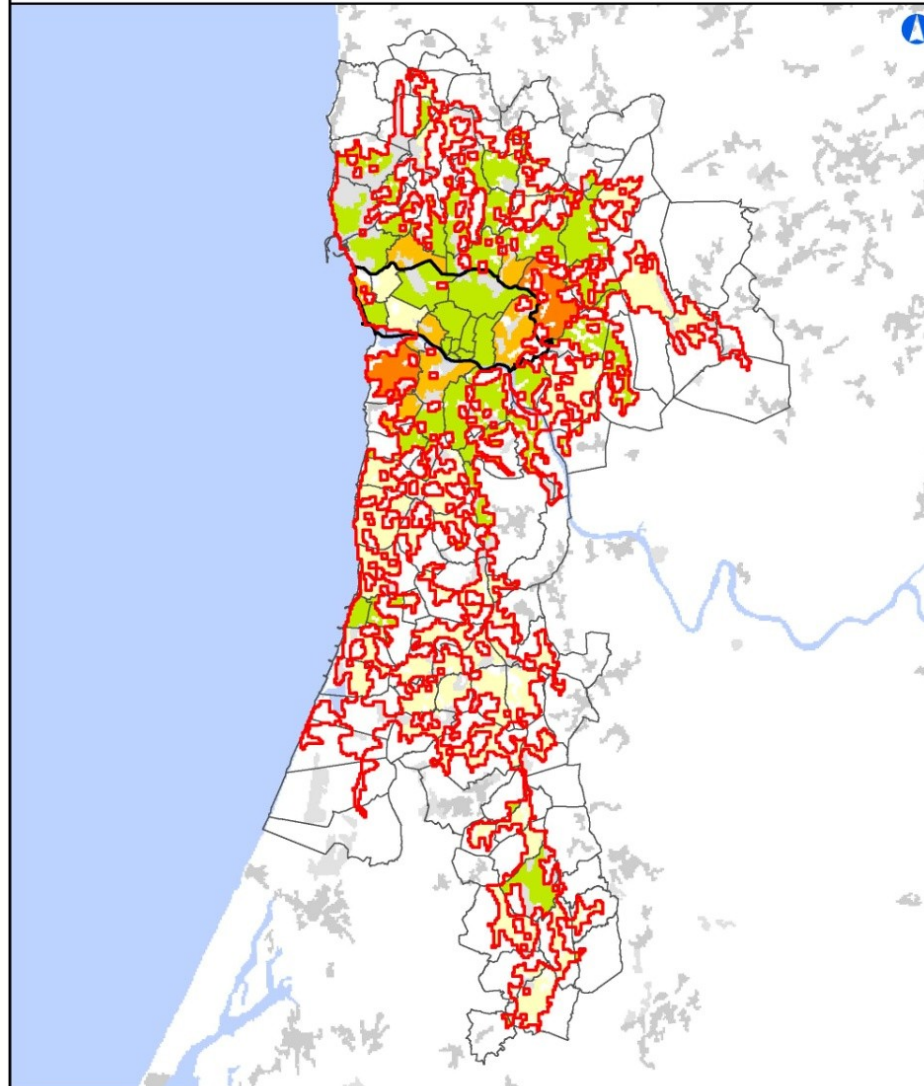


Source:
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria

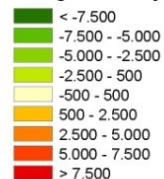
► **SUME**
scenario
2050:

**urban
fabric
+ 0%**

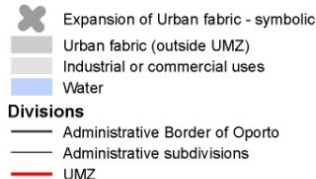

**PT-
focus**



Change in density



Corine Land Cover 2000

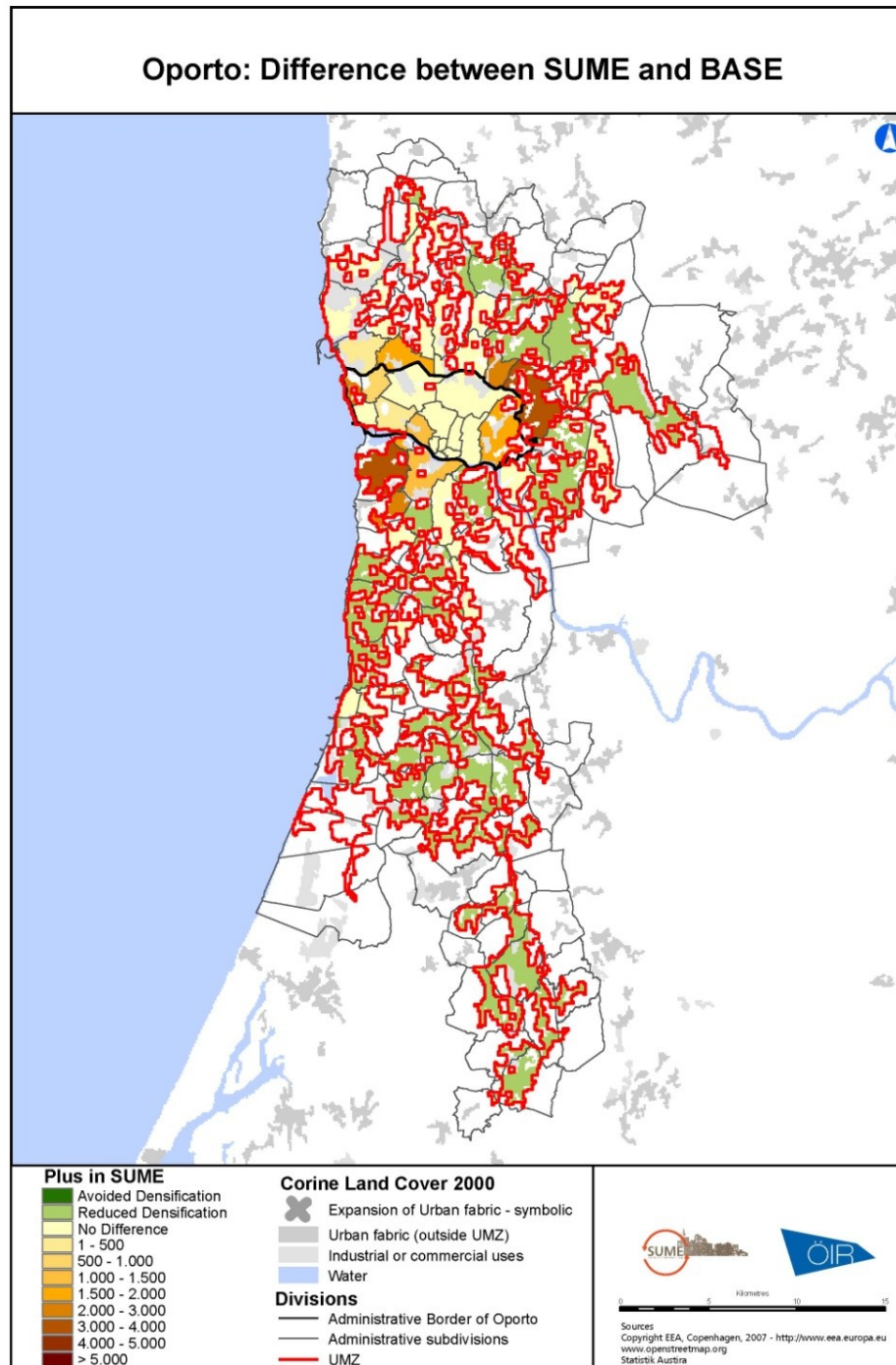
0 5 10 Kilometers

Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.openstreetmap.org
Statistik Austria

Oporto: Difference between SUME and BASE

► Key development strategies up to 2050:

Inner city re-development, polycentricity, public transport



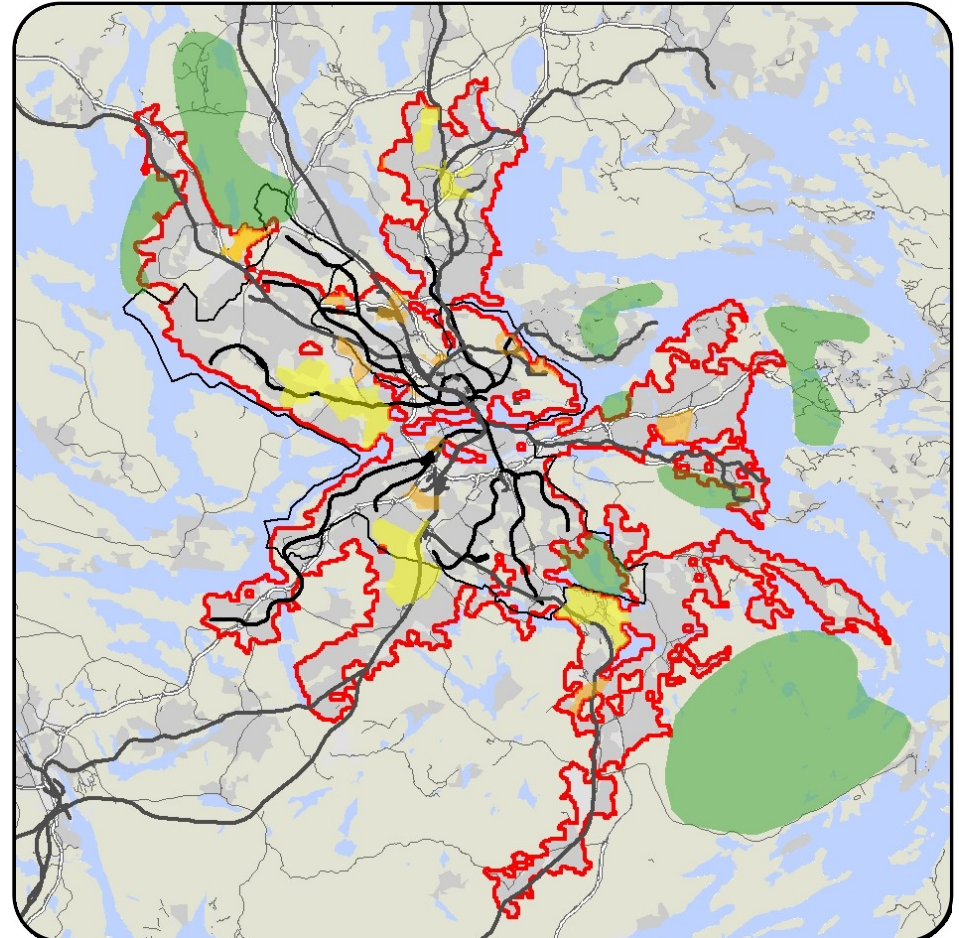
Stockholm

- ▶ 1.3 Mio. population
- ▶ → 2050: + 44 %
- ▶ Pop.+jobs/km2 in urban fabric: 5.278

Legend of City Details

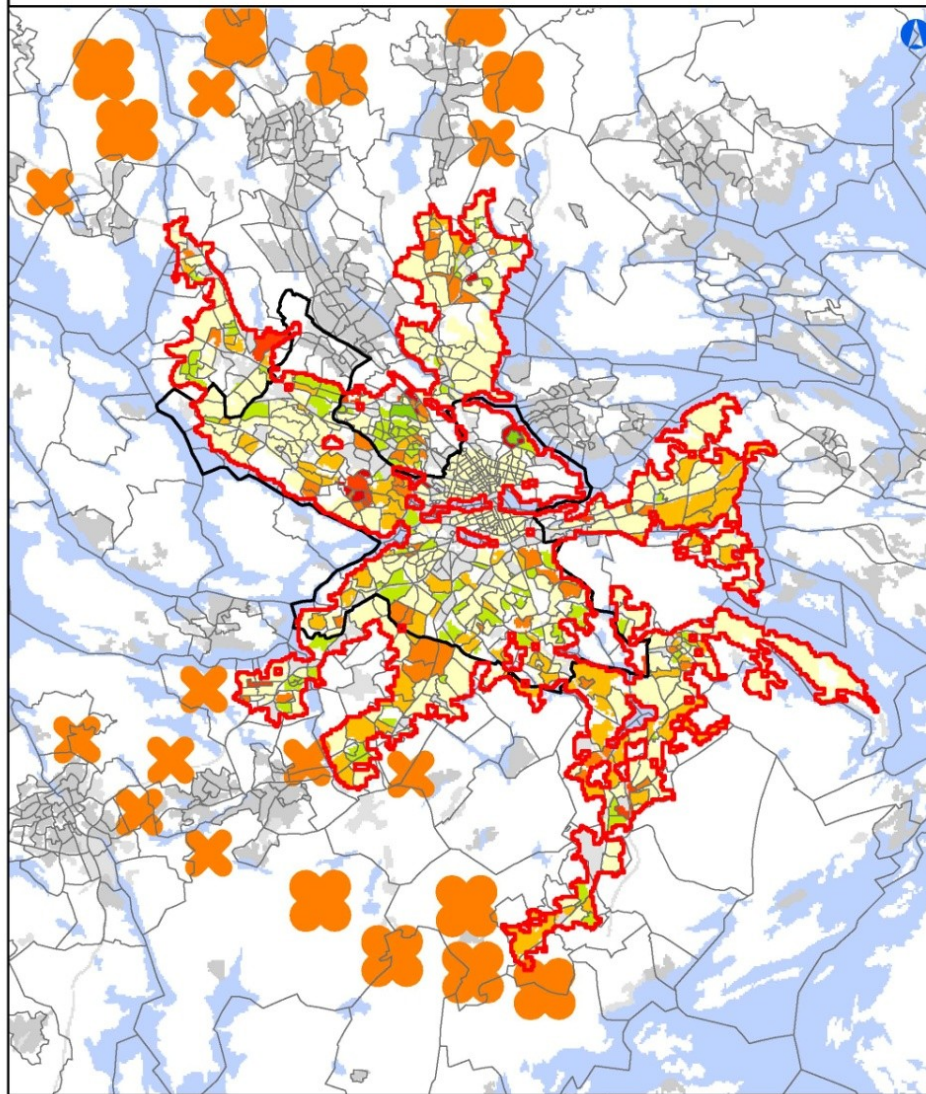
Area	Infrastructure
<ul style="list-style-type: none"> ○ 2a: Key Areas of Urban Development until 2025 ○ 2b: Long Term Options for Urban Development ○ Supra Regional Green Areas, Protected Areas 	<ul style="list-style-type: none"> — Subway Network, Existing and Under Construction - - - Subway Network, Projected — Railway Network Existing and Under Construction — Existing Motorway — Road Network - - - Motorways planned
Land Cover [According Corine 2000]	Borders
<ul style="list-style-type: none"> ■ Urban fabric (outside UMZ) ■ Industrial or commercial uses ■ Water ■ Others 	<ul style="list-style-type: none"> — UMZ — Administrative Border of the respective City — National Borders

Sources
Copyright EEA, Copenhagen, 2007 - www.eea.europa.eu
www.openstreetmap.org
National Statistics of
Greece, Switzerland, France, Germany,
United Kingdom, Portugal, Sweden, Austria

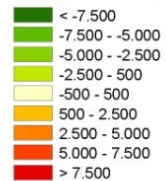


Stockholm: Change of population and workplace density 2001 - BASE

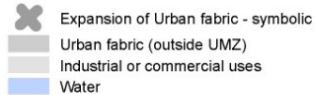
► **BASE**
scenario
2050:
**urban
fabric
+ 47%**



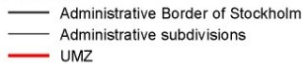

Change in density



Corine Land Cover 2000



Divisions

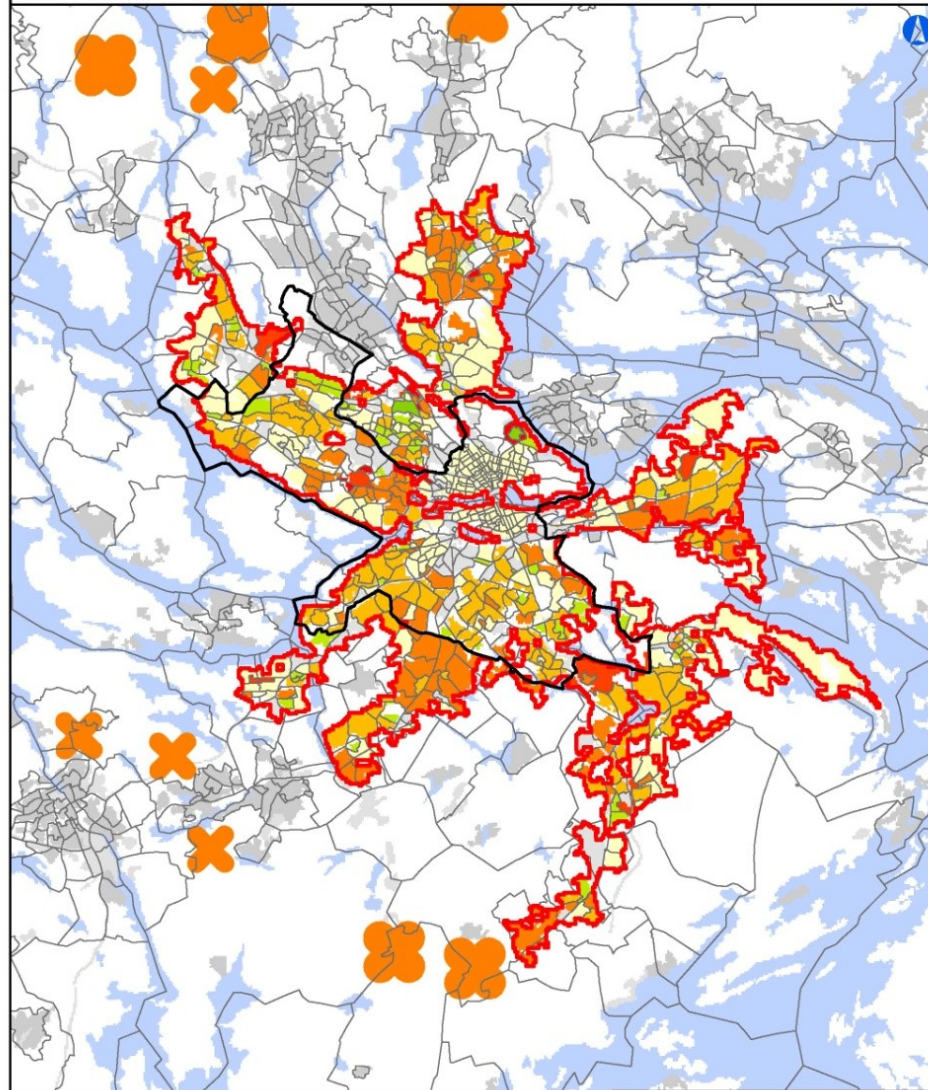



0 5 10 15
Kilometers

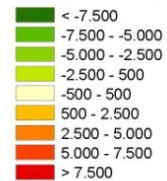
Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.operstreetmap.org
Statistik Austria

Stockholm: Change of population and workplace density 2001 - SUME

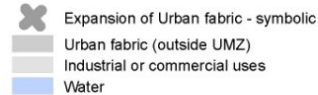
► **SUME**
scenario
2050:
**urban
fabric
+20%**



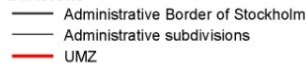
Change in density



Corine Land Cover 2000



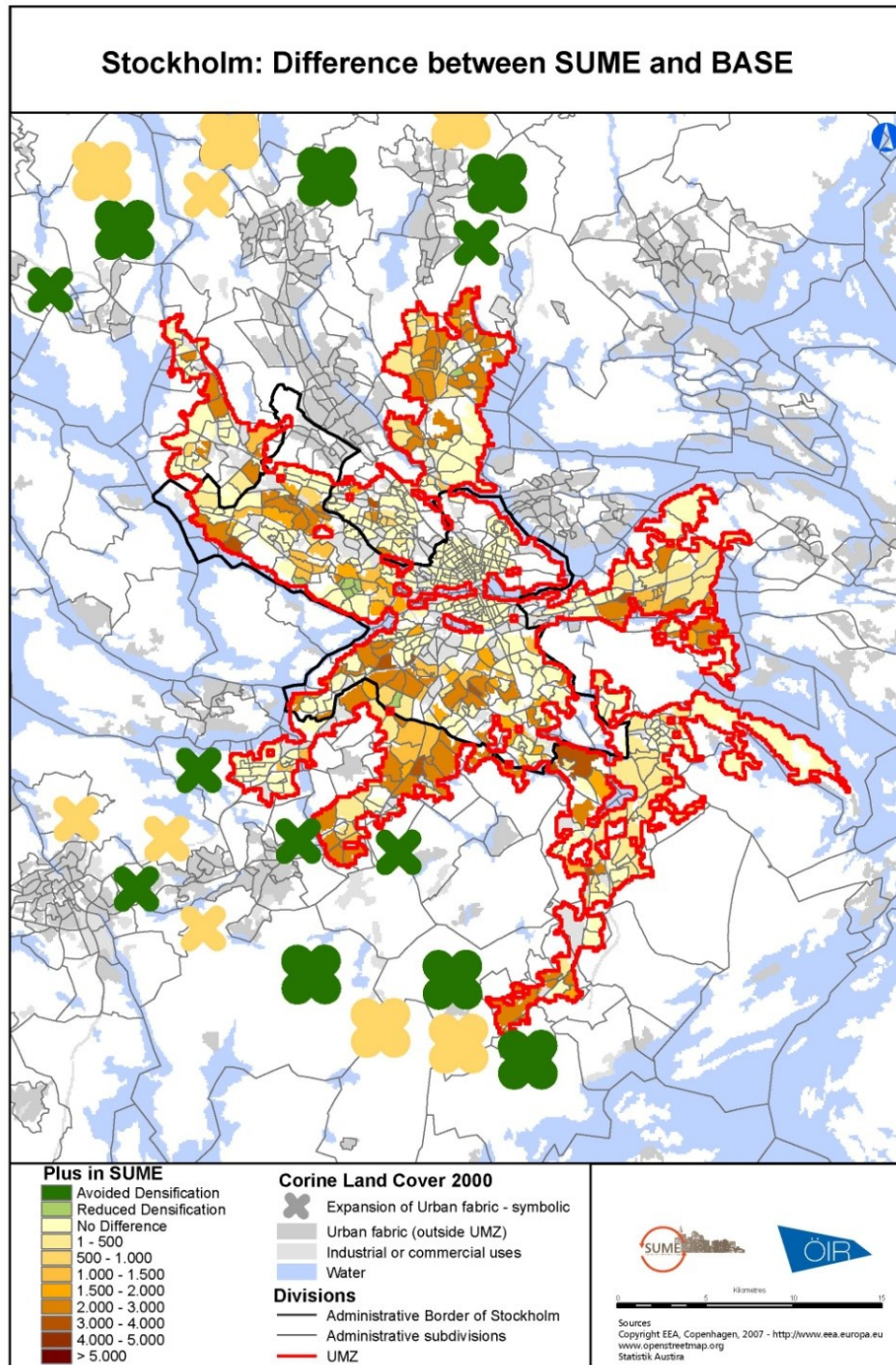
Divisions



Sources
Copyright EEA, Copenhagen, 2007 - <http://www.eea.europa.eu>
www.operstreetmap.org
Statistik Austria

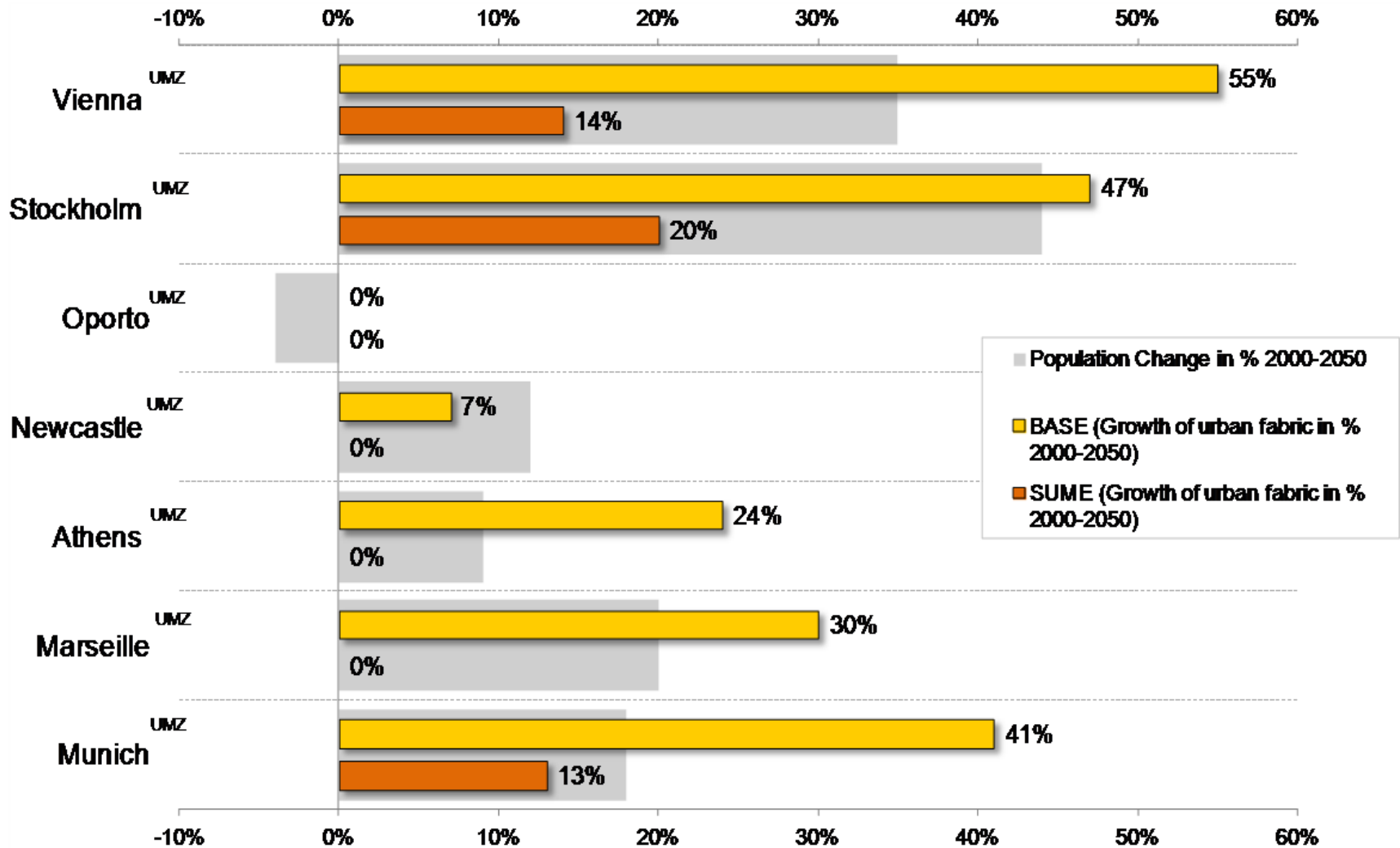
► **Key development strategies up to 2050:**

Urban development in fringe areas, new regional centres, transport axes



Urban spatial development: BASE and SUME scenarios

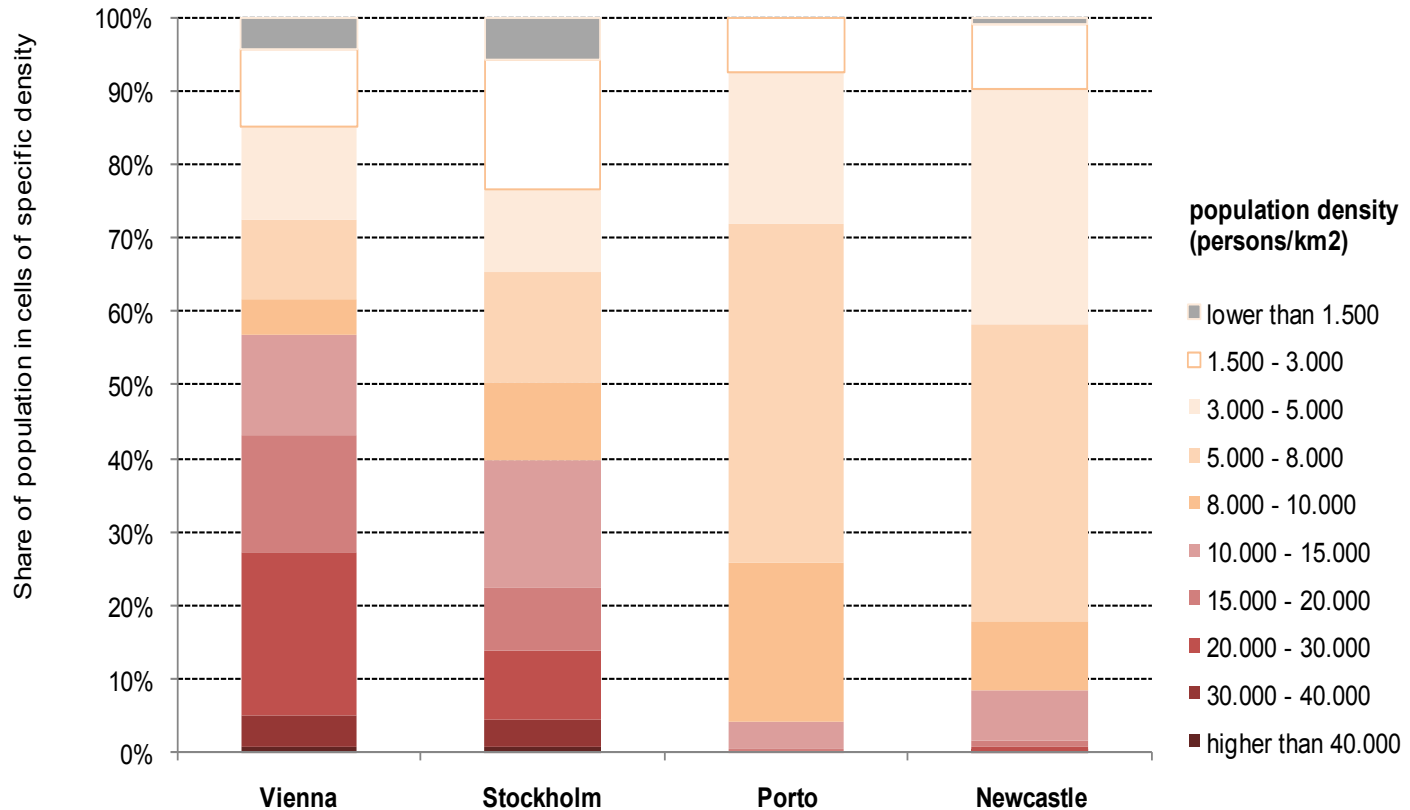
Scenarios BASE and SUME: Growth of “urbanized zones” 2000 – 2050



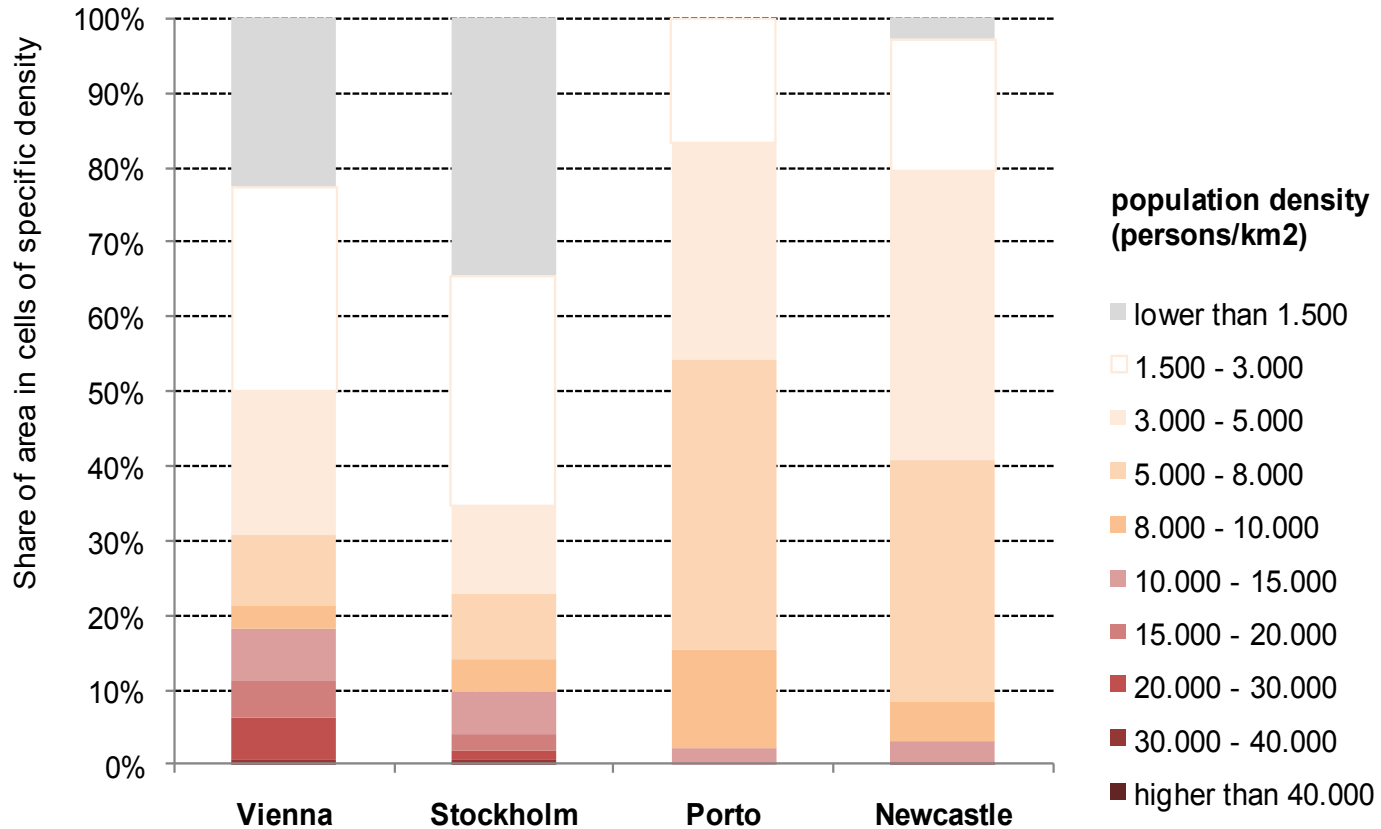
Spatial development – impact on urban form

- 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

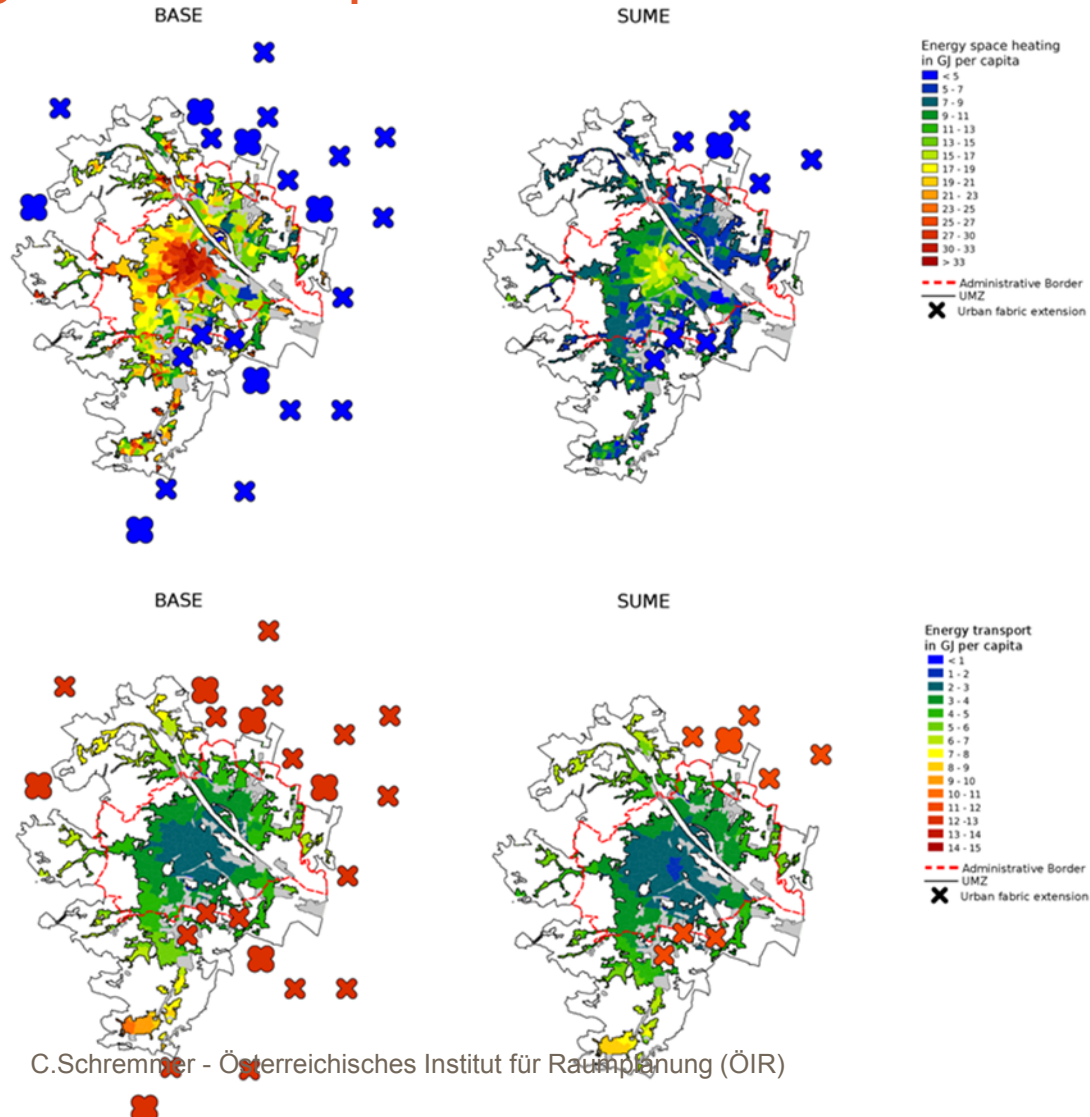


Land consumption by density categories in the UMZ



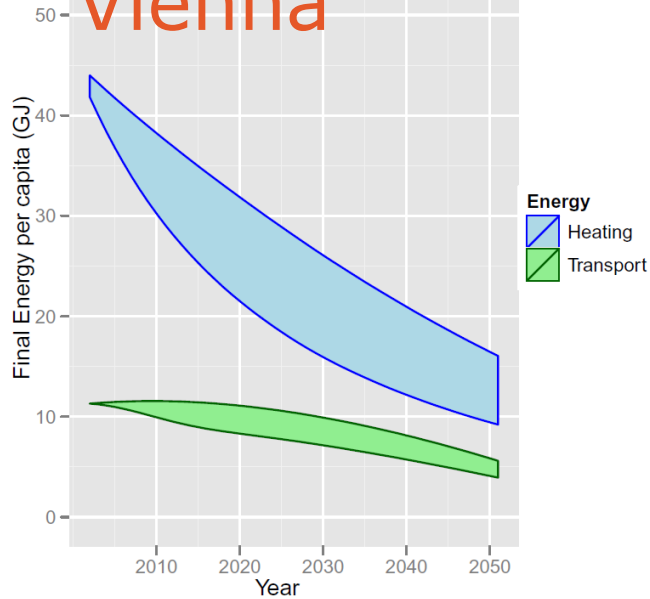
Modelling urban form and development : Impact on energy consumption for heating and transport

Vienna: Per capita energy consumption for housing and transport 2050

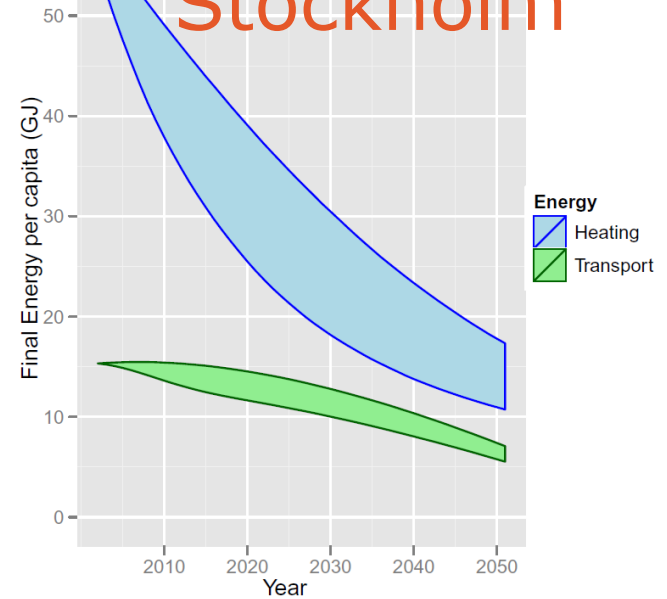


Final energy per capita heating & transport

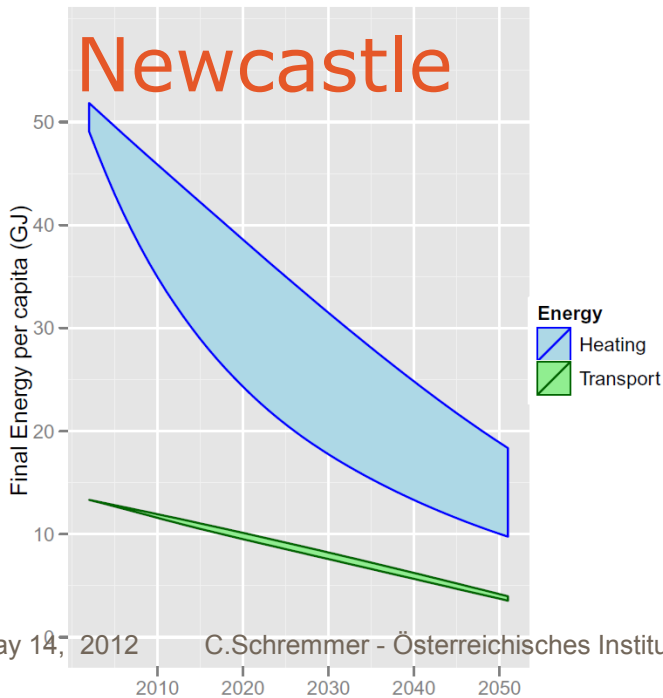
Vienna



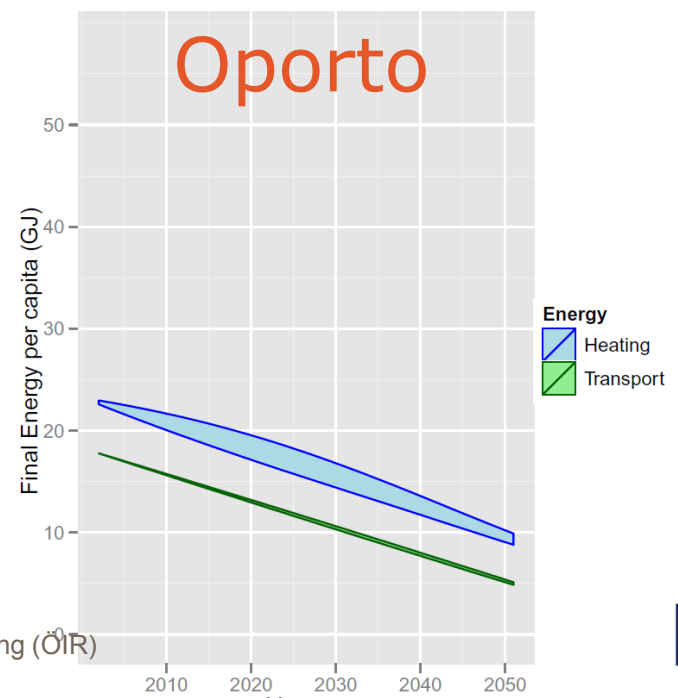
Stockholm



Newcastle



Oporto



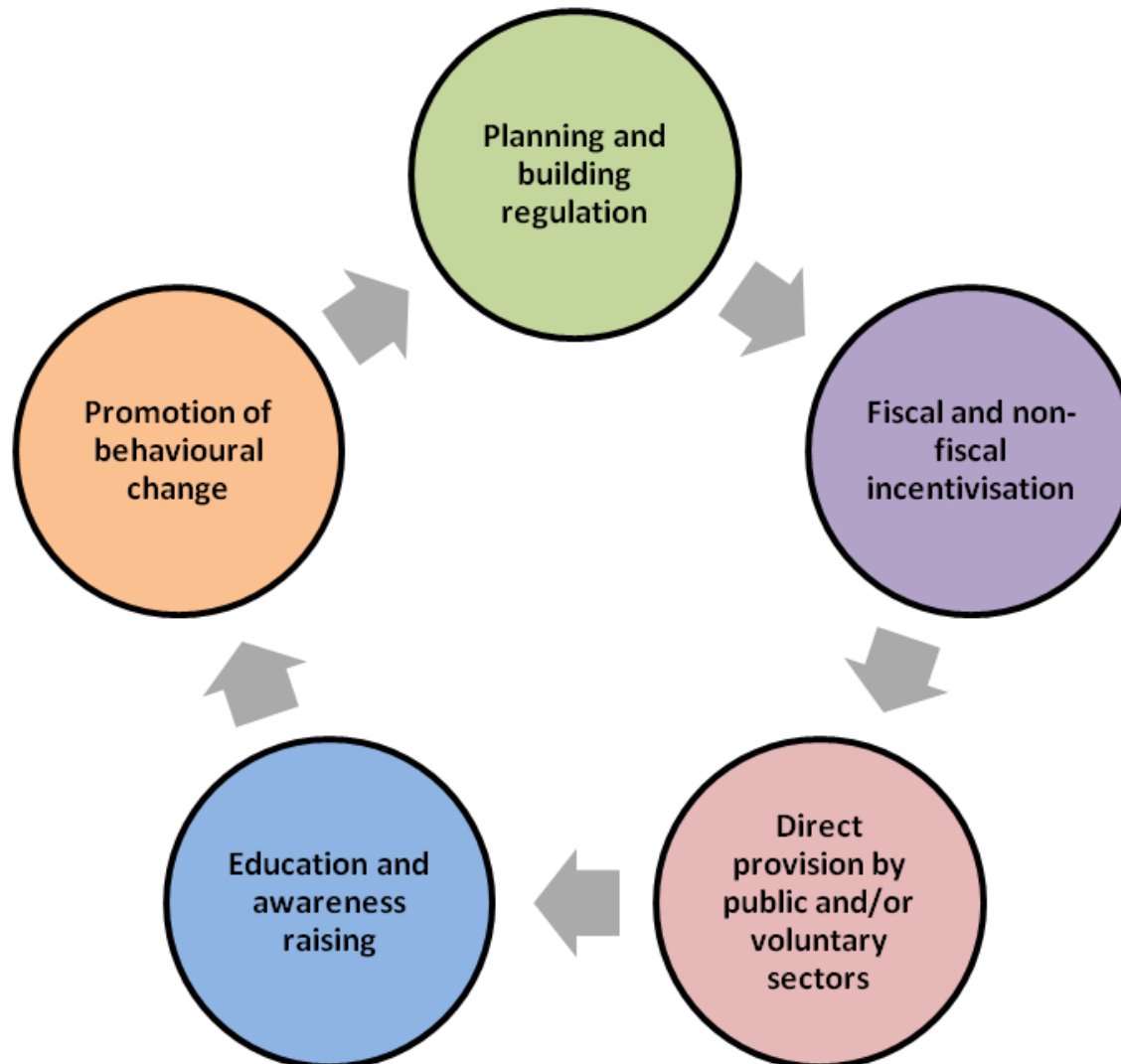


Strategies & Policies

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



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



www.sume.at

schremmer@oir.at