Smart as the New Green?
Reflections on the International Debate about Eco-Cities

Bernhard Müller

Leibniz Institute of Ecological Urban and Regional Development, Dresden, and
Technische Universität Dresden, Germany

ICT as an Enabler for Intelligent City Development:

Perspectives from Germany and China

**Session 6: The Broader Implications
for Societies in Intelligent Cities**

September 12, 2013

München

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Masdar City, Abu Dhabi
Lord Norman Foster
Zero carbon – zero waste
Total site area: 700 hectares
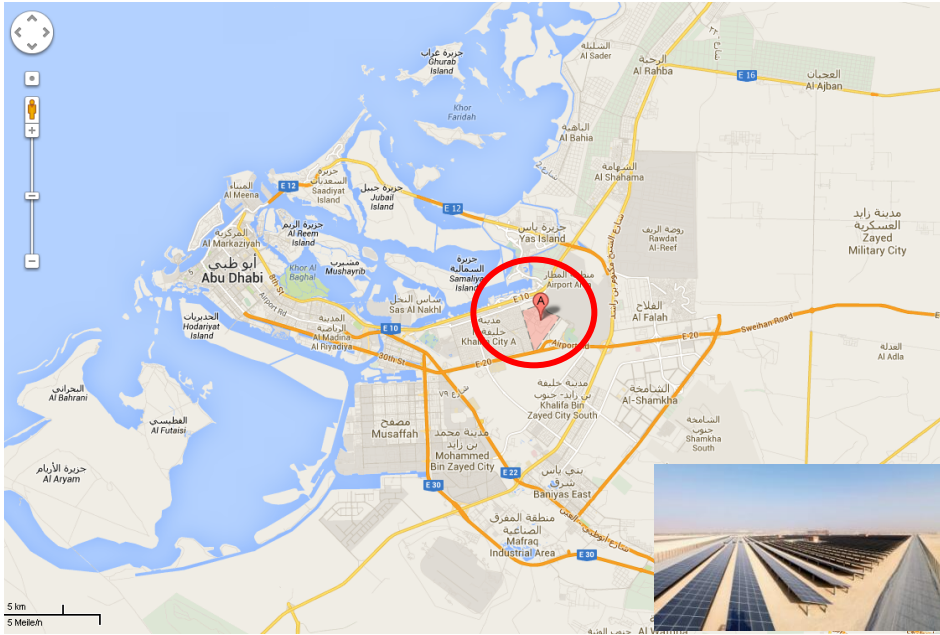3.7 million sqm Gross Floor Area (GFA)
Residential: 52%, Commercial: 38%
Retail: 2%, Community: 8%
Projected resident population: 40,000
Projected commuters: 50,000

Source: http://www.masdarcity.a

Masdar City, Abu Dhabi

Eco-city in the making
Initial cost estimate: 24 bn US$
Initial time frame: 2016; now: 2025
Initial transport concept:
Personal Rapid Transit (PRT)-Net
Research and education: Masdar
Institute of Science and Technology

Source: http://www.masdarcity.a

Urban laboratories – eco-cities flourishing worldwide

Tianjin

Sejoing

Freiburg

Portland

Vancouver

Dongtan

Songdo

Linz

Seattle

Toronto

Nanjing

Graz

Masdar

Changodar

Curitiba

Yinggehai

Kopenhagen

Dahej

Oslo

Caofeidian

Gothenburg

Manesar Bawal

Chengdu

Shendra

Chongqing

Urban laboratories

Eco-City

Urban laboratories

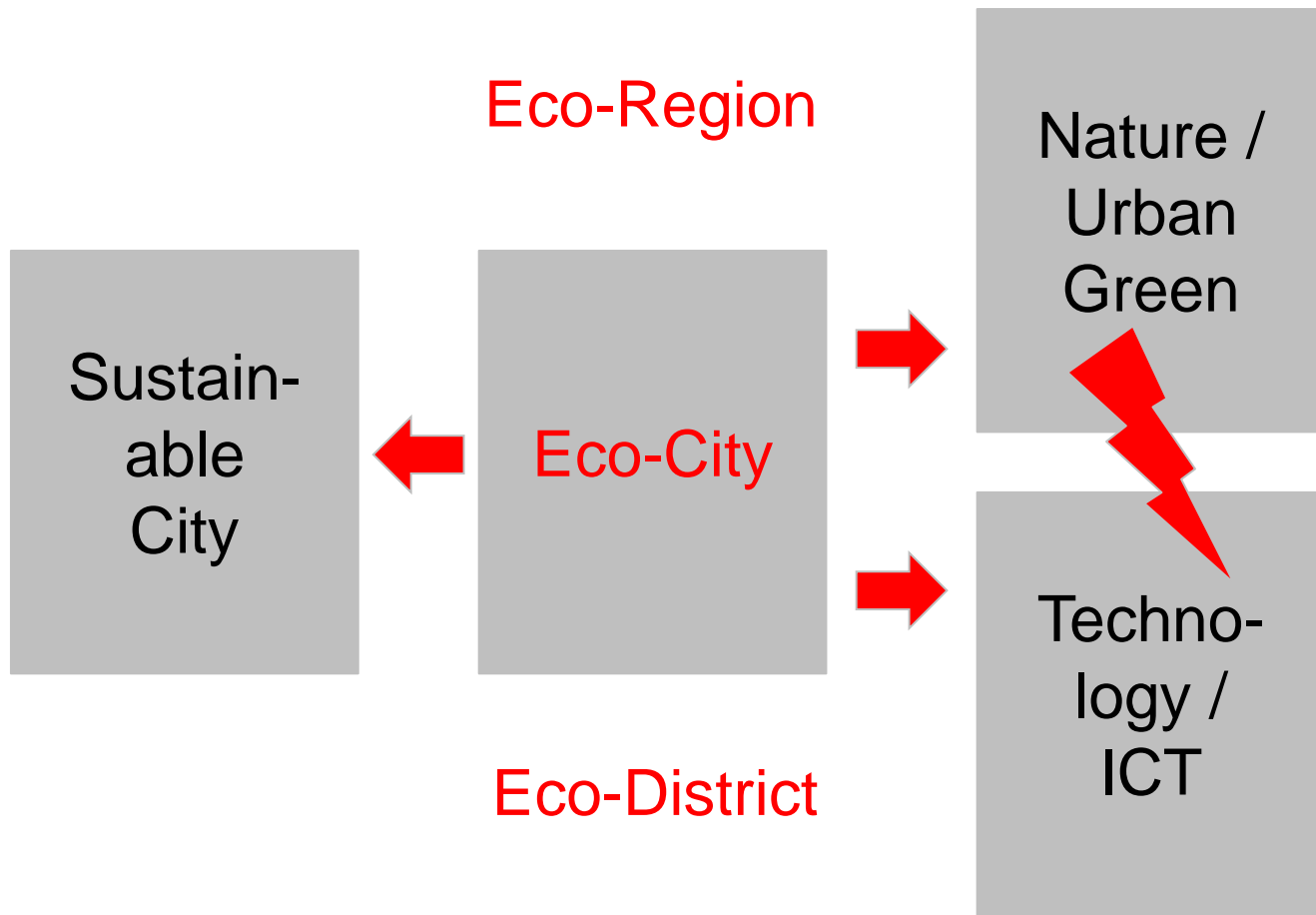Eco-Region

Eco-City

Eco-District

Urban laboratories

Urban laboratories

Eco-Region

Eco-City

Eco-District

Sustain-able City

Nature / Urban Green

Techno-logy / ICT

What do I want to talk about?

- Ambiguity of the eco-city

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- Ambiguity of the eco-city
- Eco-city and sustainability

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- The broader view:
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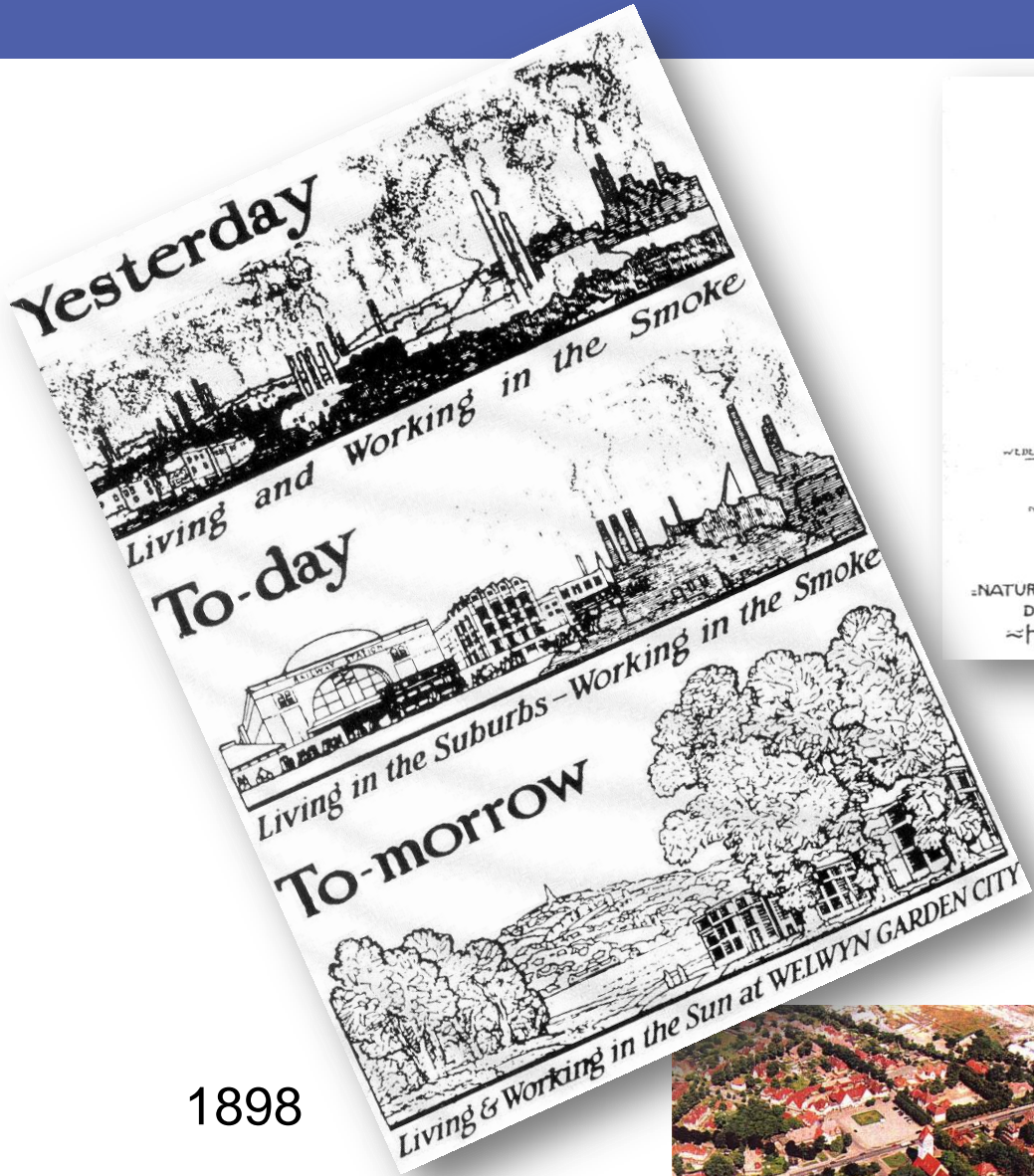
What do I want to talk about?

- Ambiguity of the eco-city
- Eco-city and sustainability
- The broader view:
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- Perspectives - outlook

What do I want to talk about?

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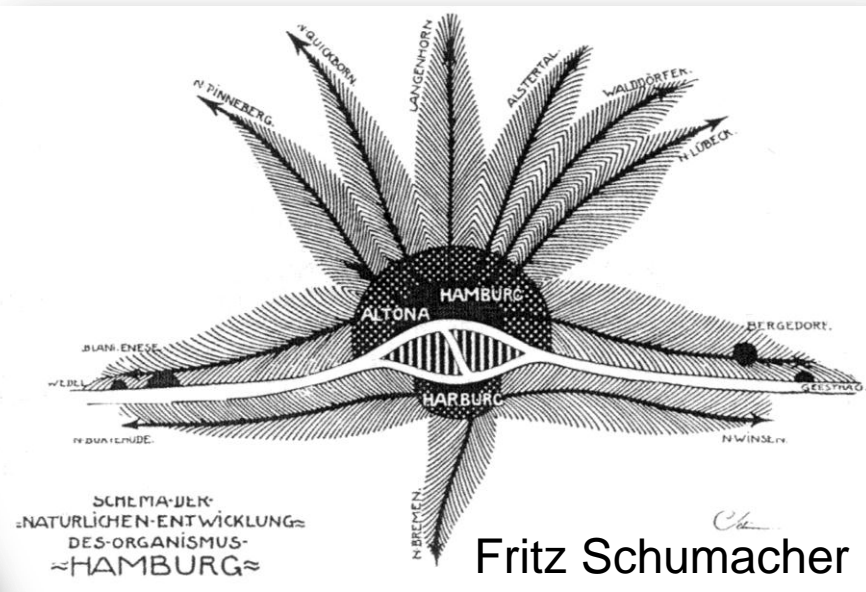
- Perspectives - outlook

Ambiguity - What is an eco-city?

- "The term Eco City is relatively new, but it is based upon concepts that have existed for a long time" (Roseland 1997)
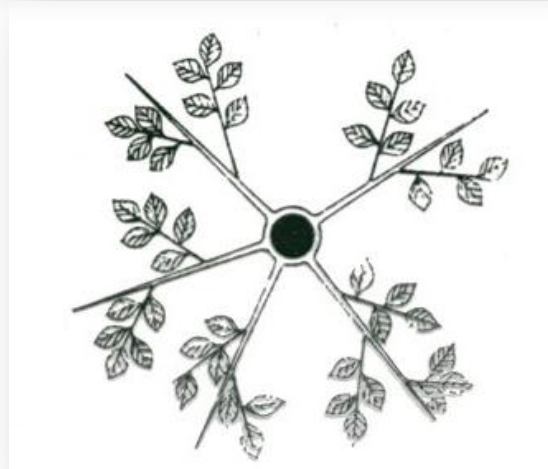
Yesterday

Living and Working in the Smoke

To-day

Living in the Suburbs - Working in the Smoke

To-morrow

Living & Working in the Sun at WELWYN GARDEN CITY

1898

Gardencity of Marga

SCHEMA-DER-
=NATURLICHEN-ENTWICKLUNG=
DES-ORGANISMUS-
~HAMBURG~

Fritz Schumacher

Wilhelm Seidensticker

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Regional Development

Yesterday
Living and Working in the
To-day
Living in the Suburbs—Wor
To-morrow
Living & Working in

1898

Gardencity of Marga

ecocities

Rebuilding Cities in Balance with Nature

REVISED EDITION
Richard Register

Richard Register
(2006)
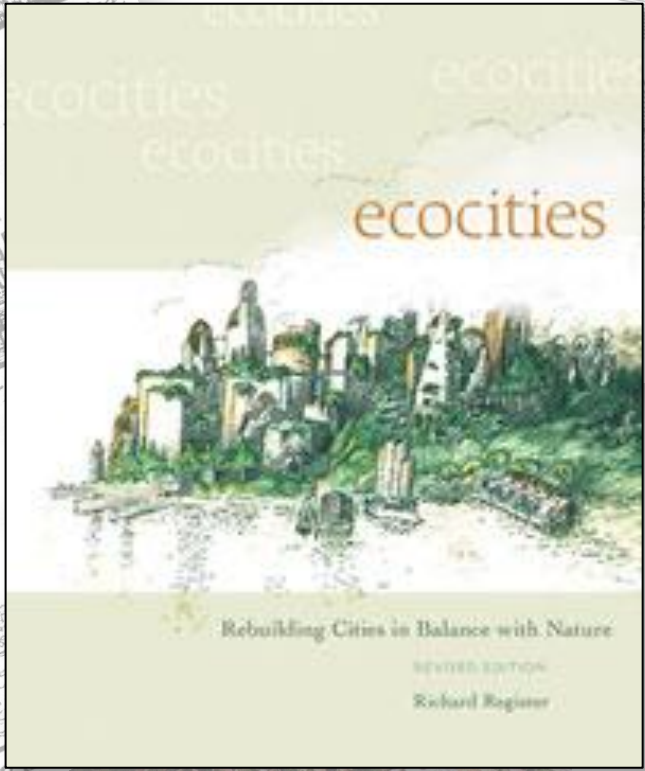
Fritz Schumacher

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Ambiguity - What is an eco-city?

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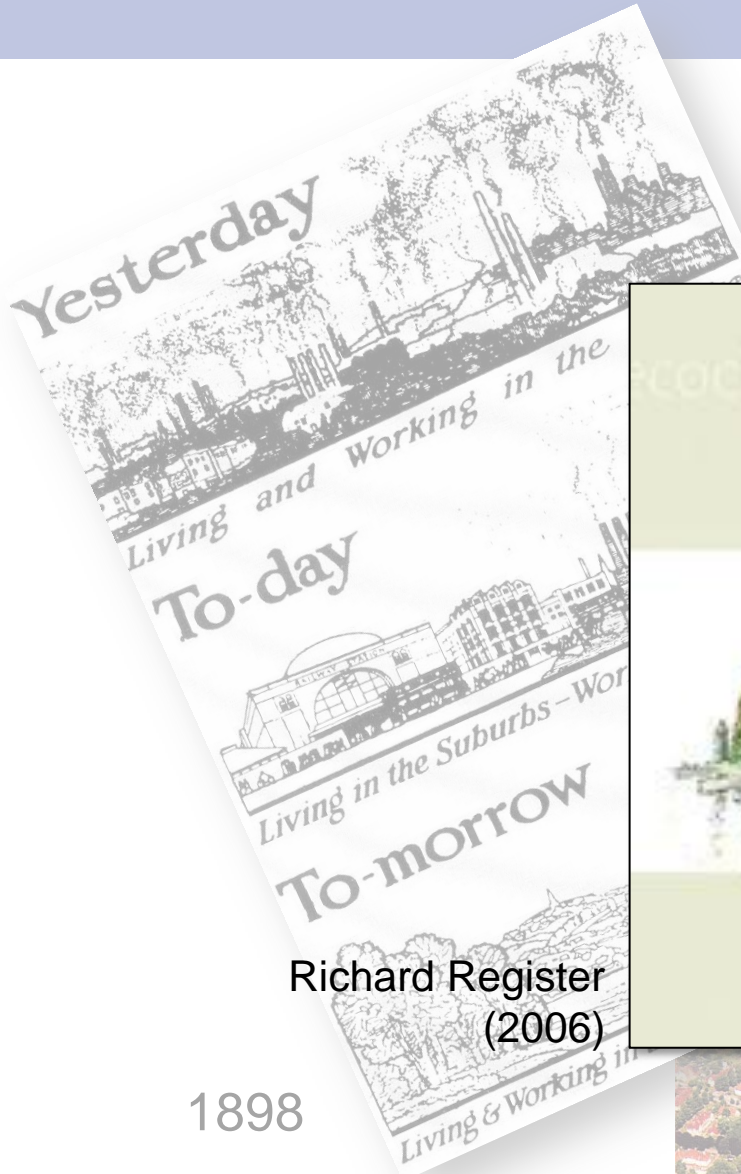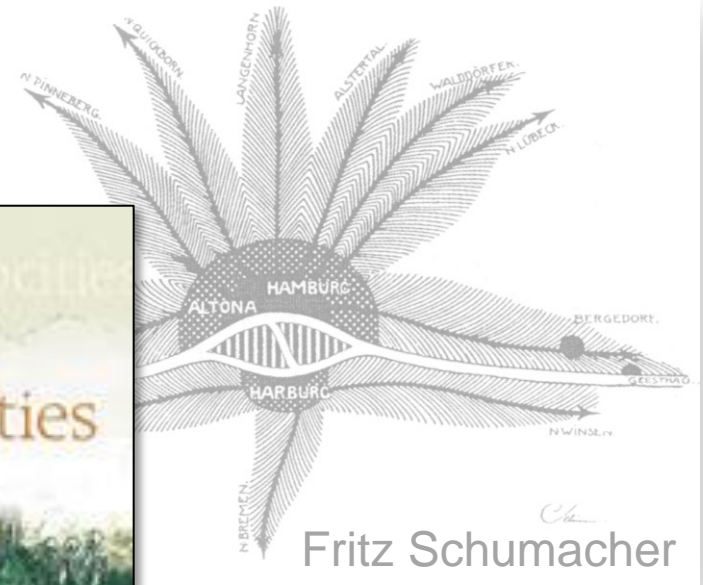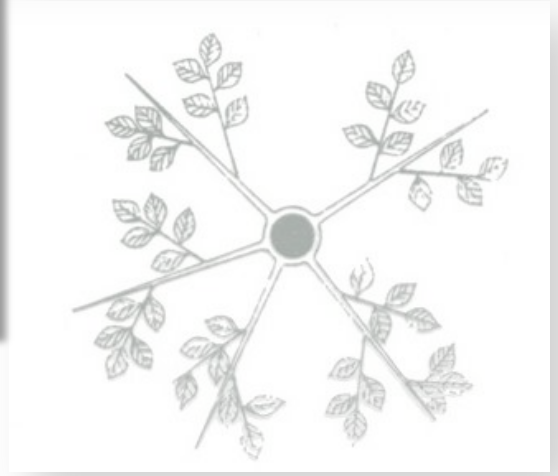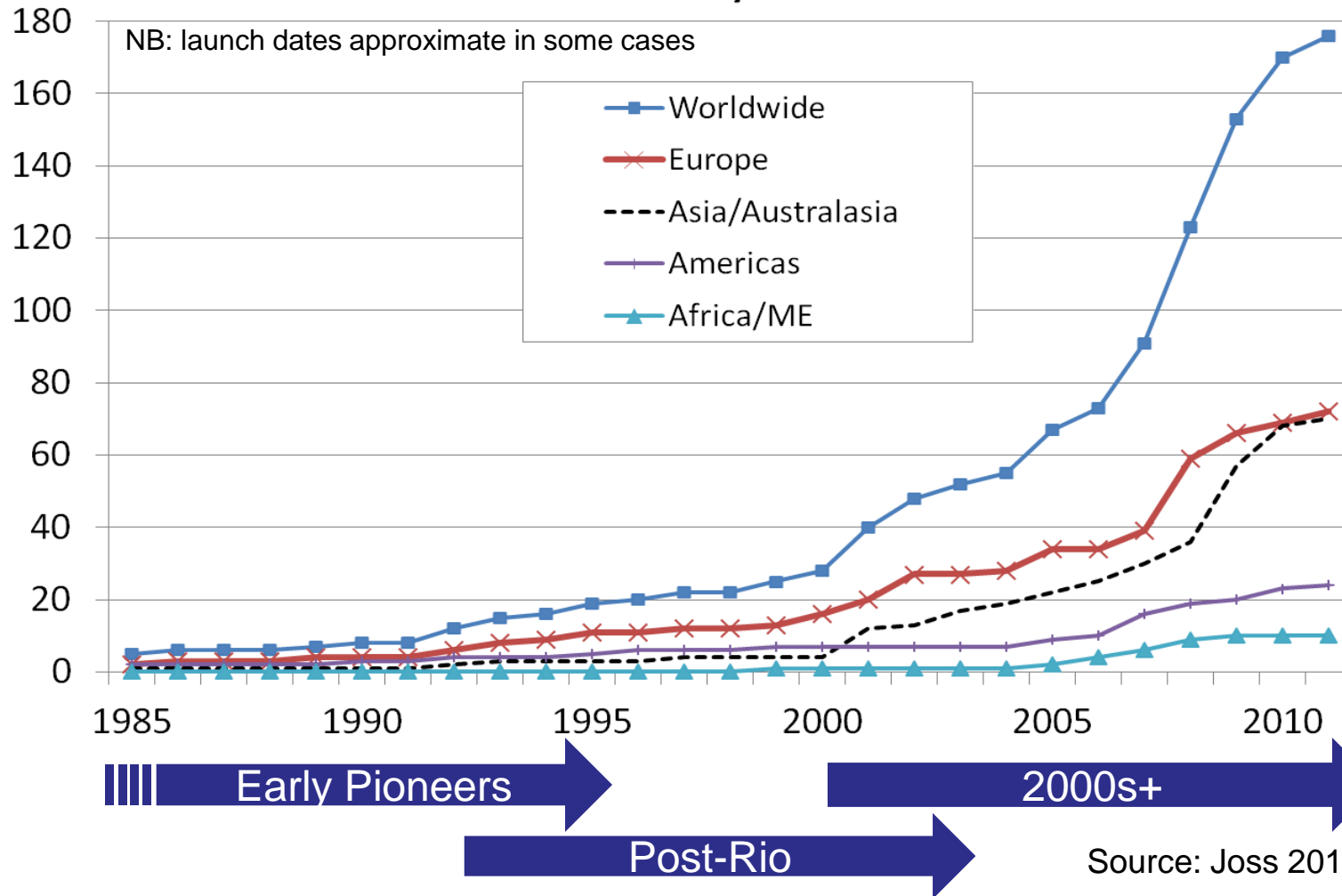
- "Eco-Cities have moved from a relatively loosely defined concept with only few, mainly experimental pilots, to a multitude of concrete, practice led initiatives" (Joss 2010)

The global rise of eco-cities as urban laboratories

number

Total launched by each date

NB: launch dates approximate in some cases

Legend:
- Worldwide
- Europe
- Asia/Australasia
- Americas
- Africa/ME

Early Pioneers

Post-Rio

2000s+

Source: Joss 2013

Ambiguity of the eco-city - Historical perspective

1975   NGO Urban Ecology Berkeley: "rebuild cities in balance with nature" – in part: reaction to urban sprawl

1987   Richard Register "Eco City Berkeley": rebuilding city ecologically

1990   I Eco City World Summit (Berkeley): shaping cities based on ecological principles

1992   United Nations "Earth Summit" (AGENDA 21)

1992   David Engwicht "Towards an Eco-City – calming the traffic"

1997   NGO Urban Ecology Berkeley:
        "its mission is to create ecological cities following 10 principles …"

2000s   Peak oil, energy, climate change

2008   Masdar City – start of construction

2013   X Eco City World Summit (Nantes)

Principles for creating eco-cities

1. Revise land use priorities to create compact, diverse, green and vital mixed communities near transportation facilities
2. Revise transportation priorities to favour bicycle and foot over autos
3. Restore damaged urban environments (creeks, wetlands)
4. Create affordable, safe, convenient and racially and economically mixed housing
5. Nurture social justice and create improved opportunities for women, people of colour and disabled
6. Support local agriculture, urban greening projects and community gardening
7. Promote recycling, innovative appropriate technology and resource conservation while reducing pollution and hazardous waste
8. Work with business to support ecologically conscious economic activity
9. Promote voluntary simplicity and discourage excessive consumption of material goods
10. Increase awareness of the local environment and bioregion through activist and educational projects

Source: Urban Ecology 1996

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Technology?

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Movements influencing eco-cities

1.   Appropriate technology

2.   Community development

3.   Social ecology

4.   Green movement

5.   Bioregionalism

6.   Sustainable development

Source: Roseland 1997

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Sustainability Frameworks

1713 – 300 years of sustainability discussion

Sustainability Frameworks

1713 – 300 years of sustainability discussion

Hans von Carlowitz (1713)
Since 1711 Chief Mining Officer responsible for forestry in Saxony

Sustained supply of wood for mining
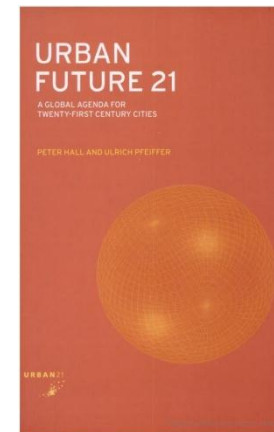
Sustainability Frameworks

1713 – 300 years of sustainability discussion

1992 – Rio Conference

1994 – Aalborg Charter

2000 – Urban 21

2007 – Leipzig Charter

(Source: Agentur für Stadtentwicklung 2007)

Leipzig Charter on Sustainable European Cities (2007)

I. Making greater use of integrated urban development policy approaches

Implementation oriented participatory integrated urban development programs

Strategies for action:
- Creating high quality public spaces
- Modernizing infrastructure networks
- Improving energy efficiency
- Proactive innovation and educational policies

Leipzig Charter on Sustainable European Cities (2007)

II. Special attention to deprived neighborhoods

Social cohesion and integration as a goal

Strategies for action:
- Pursuing strategies for upgrading the physical environment
- Strengthening the local economy and local labor market
- Proactive education and training policies for children and young people
- Promotion of efficient and affordable housing

Leipzig Charter on Sustainable European Cities (2007)

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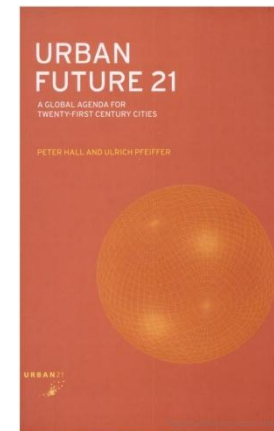**1994 – German Constitution / Basic Law**

1998 – Building and Spatial Planning Laws

2000 – Urban 21

2007 – Leipzig Charter

(Source: Agentur für Stadtentwicklung 2007)

National Council for Sustainable Development (since 2001, 15 members)

National Council for Sustainable Development (since 2001, 15 members)

Potentials of elderly
in development

New ways of energy provision

Resources efficient construction

Reduction of "consumption" of
space for urban development
and transportation

…

National Sustainability Strategy (since 2002; latest update 2012)

Assessment Reports ("Indicator Reports", since 2006, every 2 years)

Germany: Competition for sustainability

Opening the debate in the 1990s: **„Cities of the future"**
(in 4 model cities, 7 reference cities, tests in 50 further cities)

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Five dimensions related to urban planning / development:
- Land management
- Mobility
- Environment
- Housing
- Economy

Germany: Competition for sustainability

Opening the debate in the 1990s: **„Cities of the future"**
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Five dimensions related to urban planning / development:
- Land management
- Mobility
- Environment
- Housing
- Economy

Characteristics
- Oriented towards integrated urban planning / development
- "Top-down": Assessment of local sustainability
- Government driven

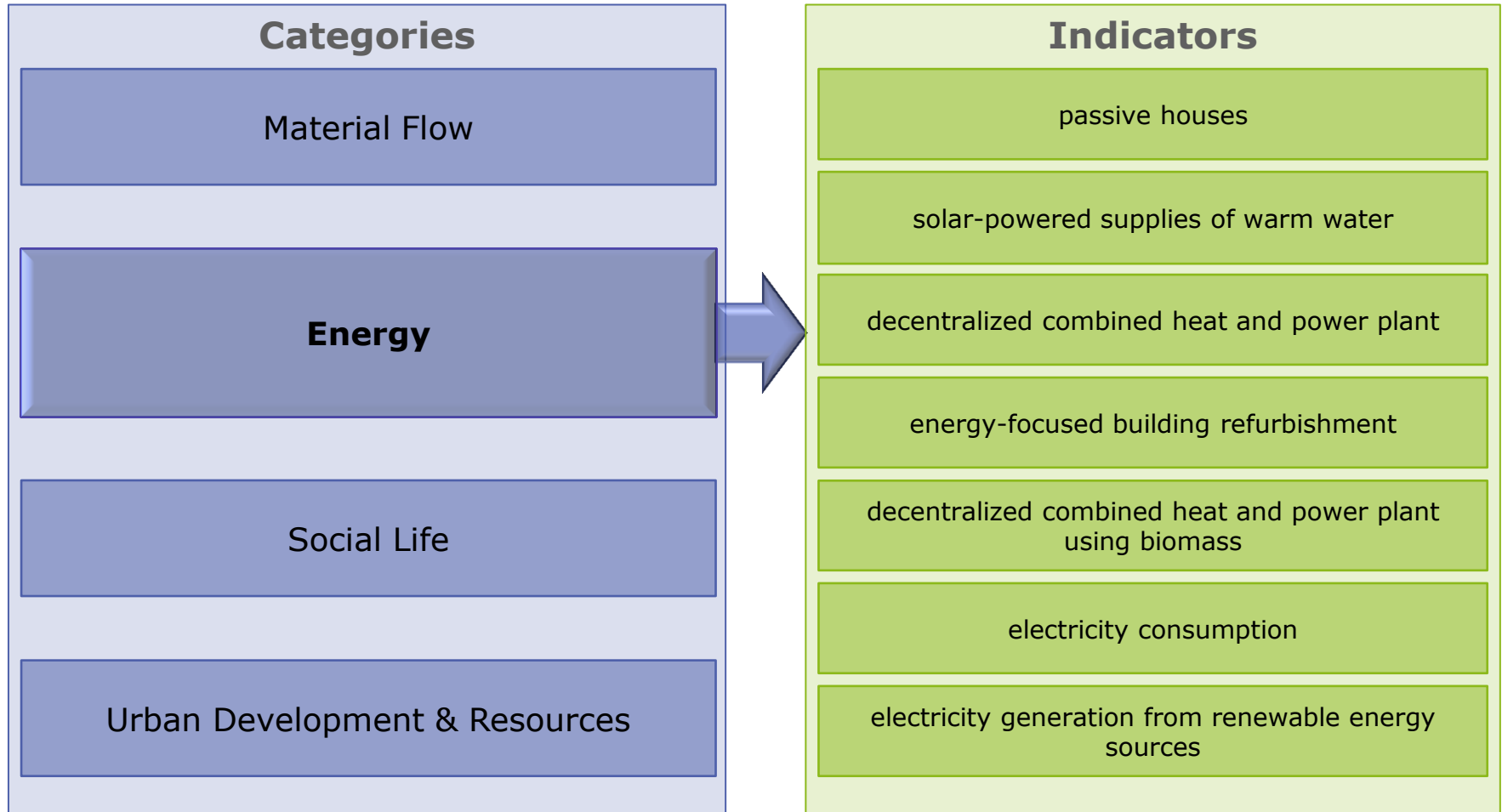| 12 Standard indicators (relatively easily accessible)	12 Additional indicators (relatively difficult to collect)
Land management Area for settlements and transport purposes Intensity of land use Protected area Re-use of derelict/waste land	**Land management** Relation of urban development area within/outside of existing built-up area Mobilisation of new development areas within existing built-up area
Mobility Kilometers driven by buses and trains/trams Car density	**Mobility** Length of bikeways network Modal split: use of cars in the city Settlement area accessible by public transport Safety / victims of accidents
Environment Non-recycled garbage Consumption of drinking water	**Environment** CO2 emissions Energy consumption
Housing Relocation from suburbia Financial support of individuals for housing	**Housing** Basic supply Burglary / housebreaking
Economy Unemployment rate Number of commuters	**Economy** "Consumption" of space to provide employment Structure of local economy

Sets of Indicators and Evaluation Tools for Cities

In Germany (selection)

- „Cities of the Future" („Städte der Zukunft", Federal Gvt. initiative)

- **North Rhine–Westphalia: Indicators for Sustainable Development (regional comparison of cities)**

- **„Zukunftsfähige Kommune" (DUH)** (Future oriented municipality)

(Source: Energieagentur NRW 2006)

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North Rhine–Westphalia: Indicators for Sustainable Development

Categories

- Material Flow
- **Energy**
- Social Life
- Urban Development & Resources

Indicators

- passive houses
- solar-powered supplies of warm water
- decentralized combined heat and power plant
- energy-focused building refurbishment
- decentralized combined heat and power plant using biomass
- electricity consumption
- electricity generation from renewable energy sources

(Source: Energie Agentur 2006)

Application of NRW-Indicators

City	Indicators	City	Indicators
Aachen	none	Lippstadt	none
Ahlen	none	Löhne	none
Arnsberg	none	Mettmann	none
Bielefeld	**municipal environmental budgeting**	**Münster**	**synthesis of 3 different indicator systems**
Bonn	**DUH- Indicators**	Minden	none
Dorsten	none	Neunkirchen-Seelscheid	none
Dortmund	none	Oer-Erkenschwick	none
Düren	**synthesis of 3 different indicator systems**	Remscheid	none
Gelsenkirchen	none	Rheinisch-Bergischer Kreis	none
Gütersloh	**indicator set developed by municipality**	Schwelm	none
Herdecke	none	Sendenhorst	none
Ladbergen	none	Siegen	none
Lemgo	none		

Comparability!

Indicator Systems

- municipal environmental budgeting
- DUH-Indicators
- Synthesis of different systems
- indicator set developed by municipality
- no indicators
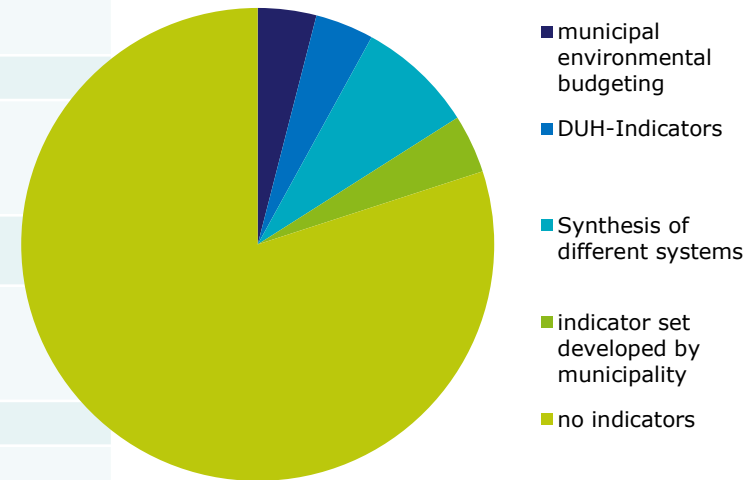
(Source: Plappert 2012)

DUH-Indicators „Zukunftsfähige Kommune"

Categories	Aspects	Indicators

Categories
- Welfare
- **Environment and Resource Effenciency**
- Social Justice
- Economic Effenciency

Aspects
- Trees on Settlement Area
- Presence of House Martins (*Delichon urbica*)
- **Environmental and Resource-Saving Energy Production**
- Choice of Means of Transport
- Usage of Drinking Water
- Waste
- Land Use Designation
- Protected Nature
- **Low energy input**
- Quality of Rivers
- Economical Land Consumption

Indicators
- Installed capacity of wind power*
- Installed capacity of photovoltaic*
- Installed capacity of water power*
- Area of solar-thermal plants*
- Energy production of CHP plants (electricity)*
- Installed capacity of biomass (heat)*
- Installed capacity of biomass (electricity)*
- Energy production of CHP plants (heat)*
- Energy consumption of municipal properties*
- Private electricity consumption*

* per inhabitant

(Source: DUH 2004)

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Monitoring with DUH-Indicators
City of Bonn, Germany

- Objective: making sustainable development measurable

- 4 guiding categories
  - welfare
  - social justice
  - environment and resource efficiency
  - economic efficiency

- Monitoring since 2002

(Source: ECS 2012)

Solar Energy (PV)
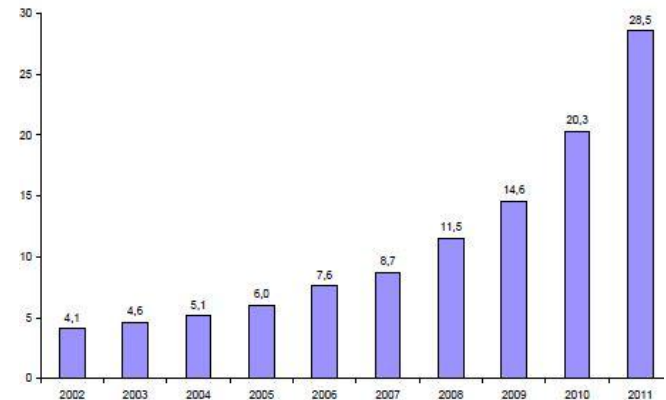
Definition: Installed power kWh per 1,000 inhabitants

(Source: City of Bonn 2012)

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Rather isolated contests for sustainability and competitiveness

Urban / regional issues

- Cities of the future
- Socially integrative city
- Urban transformation East/West
- …

Innovation / technology

- Bioregio
- Innoregio
- Health regions of the future
- Energy efficient city
- …
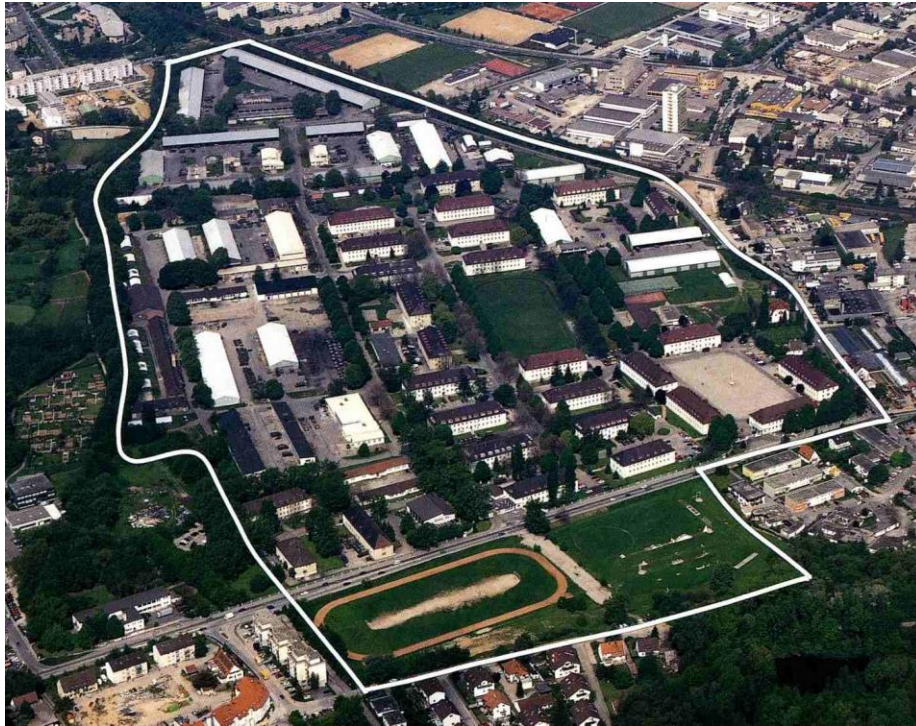
However, …

Freiburg-Vauban 1992

Freiburg-Vauban 2006

Example of a Bottom-Up Process: Vauban, Freiburg, Germany

- Area formerly in military use
- 1990 initiative founded by citizens
- 1992 – 1999 transition phase

Emphasis on:

- a strongly car reduced mobility concept
- the creation of a neighbourhood of short distances
- installation of local heat
- social integration
- priority of private and cooperative groups over investors

(Source: Vauban 2012)

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New technological solutions almost everywhere
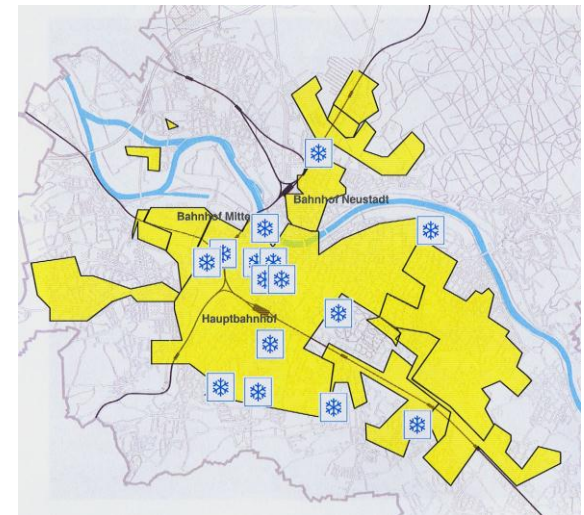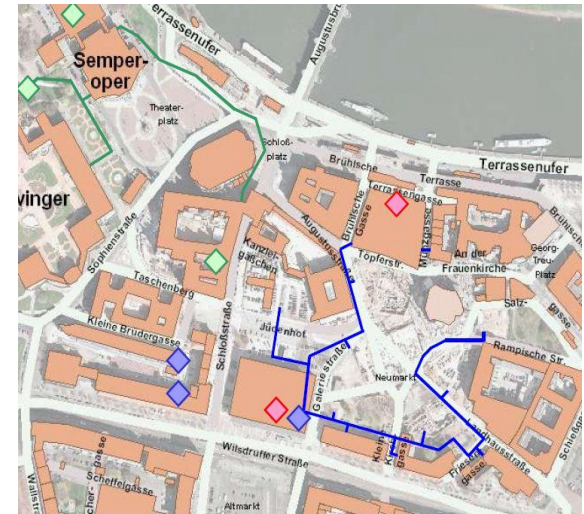
Dresden:
Energy concept,
district cooling,
groundwater
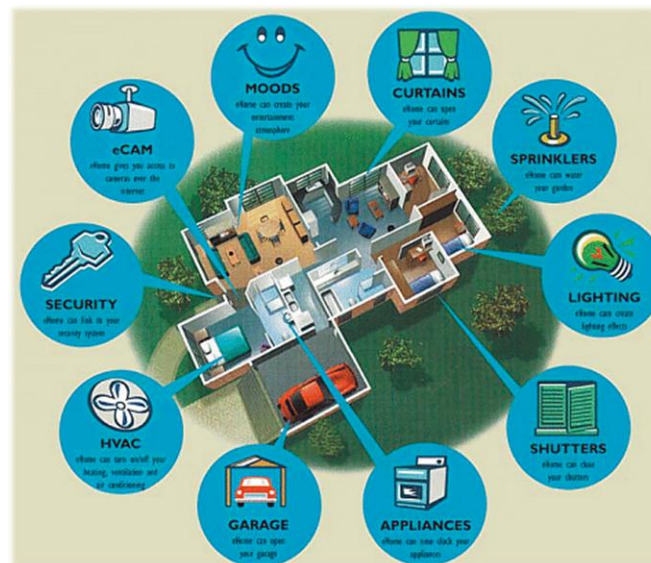
Demographic change: Ambient assisted living

Demographic change:
Ambient assisted living
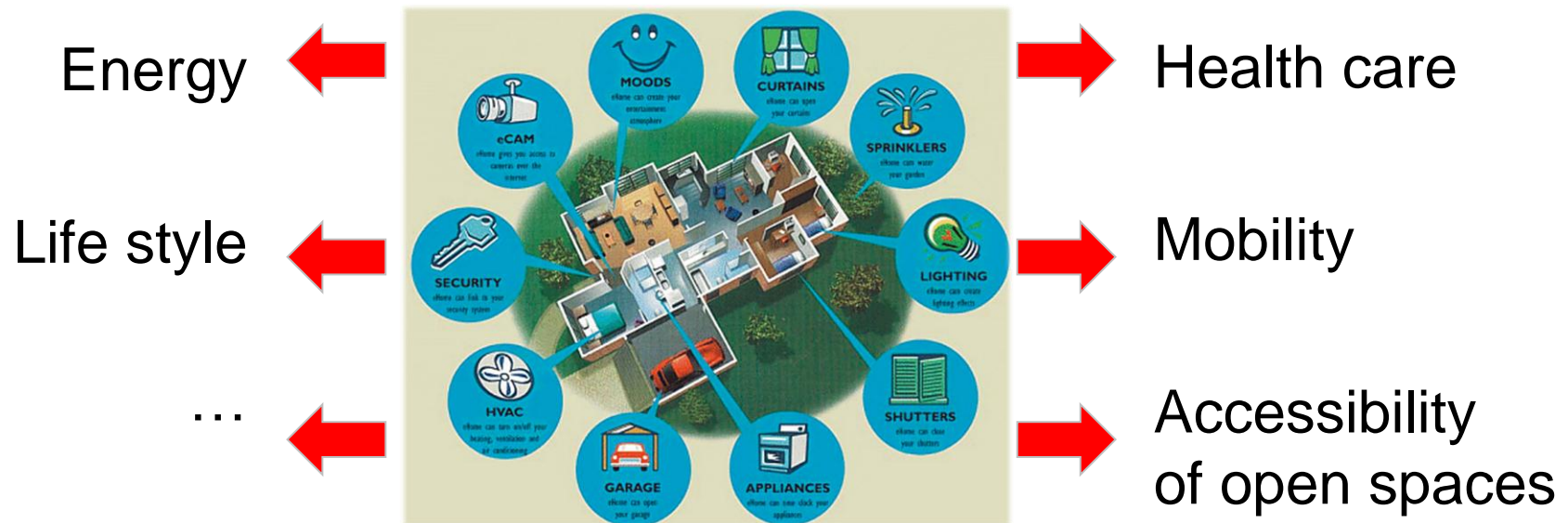
Energy

Life style

…

Health care

Mobility

Accessibility
of open spaces

Demographic change:
Ambient assisted living

Energy

Life style

…
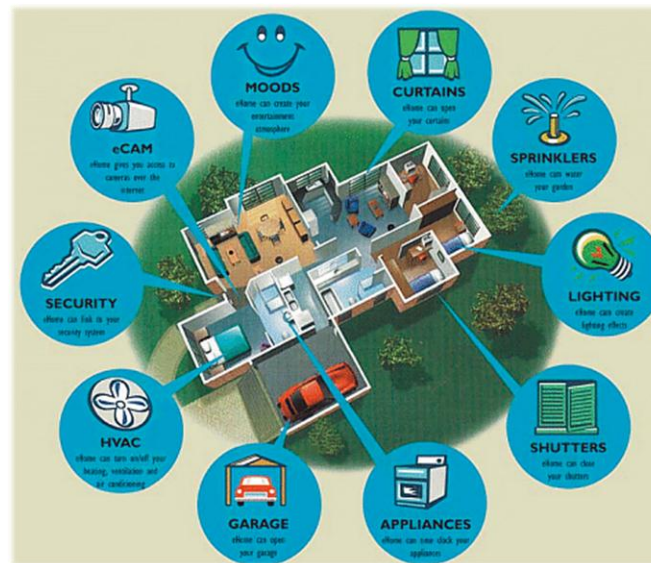
Health care

Mobility

Accessibility
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Ageing sensitive urban development

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Sets of Indicators and Evaluation Tools for Cities

In the EU (selection)

- URBAN AUDIT (Eurostat – comparing 321+36 cities, more than 250 indicators in 9 domains)

Cities participating in the Urban Audit and Large City Audit data collection 2006/2007

- Urban Audit cities
- Large City Audit cities

Source: Urban Audit
© EuroGeographics Association, for the administrative boundaries
Cartography: Eurostat — GISCO, 05/2008
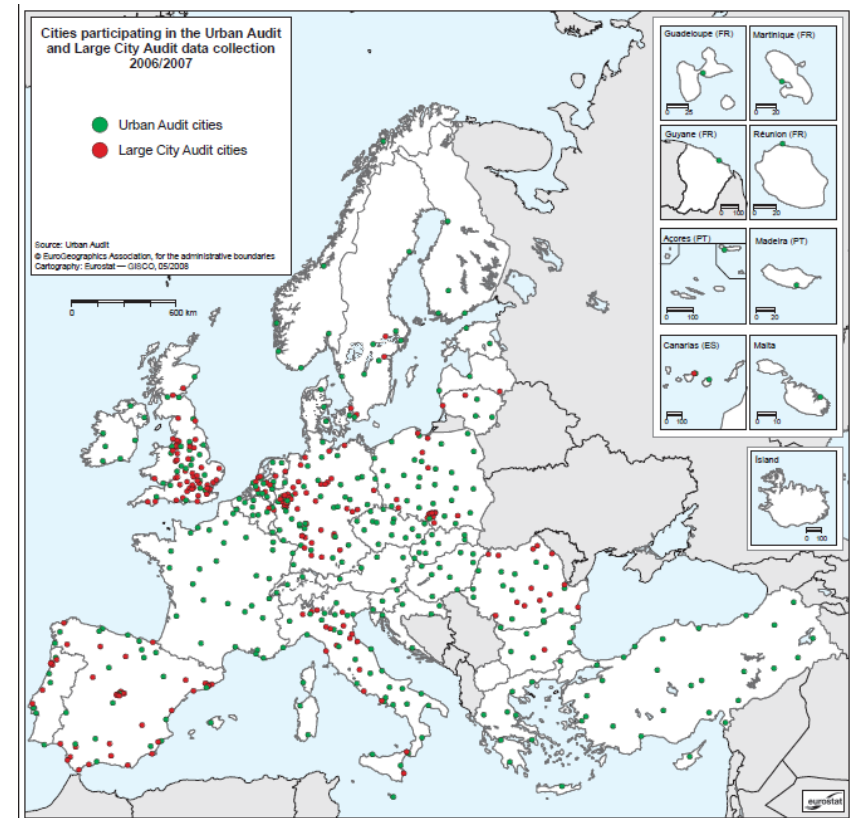
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- **European Common Indicator Initiative (GD Environment, since 1999)**

Cities participating in the Urban Audit and Large City Audit data collection 2006/2007

● Urban Audit cities
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© EuroGeographics Association, for the administrative boundaries
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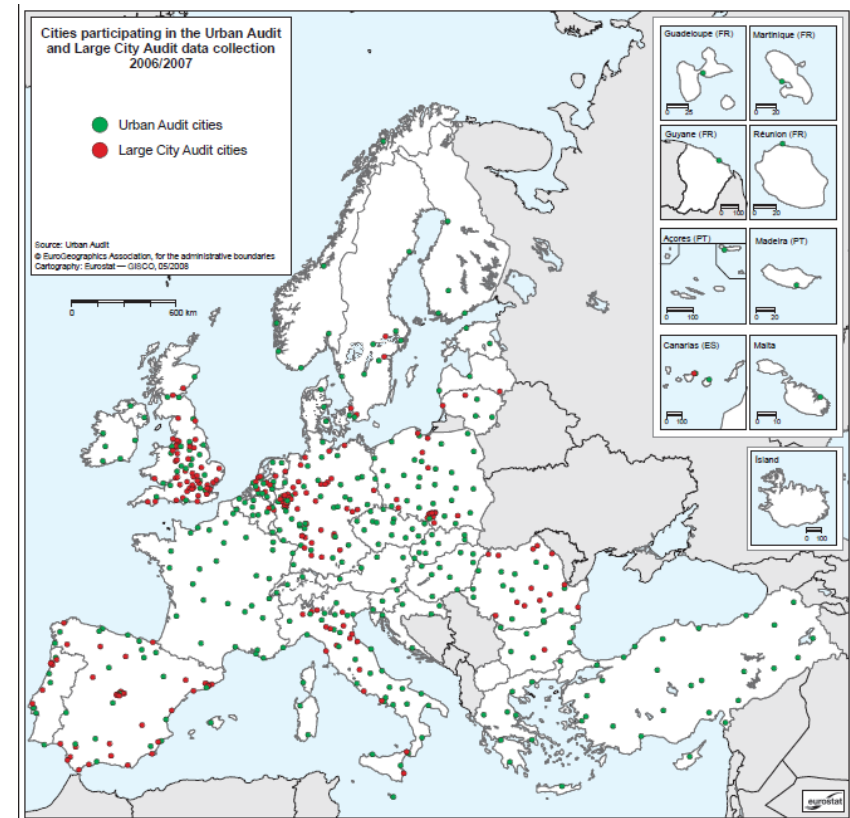
European Common Indicators Initiative (GD Environment)

10 Indicators

- Products promoting sustainability
- Children´s journeys from and to school
- **Local contribution to global climate change**
- Availability of local public open areas and services
- Citizens' satisfaction with the local community
- Noise pollution
- Quality of local ambient air
- Sustainable land use
- Local mobility and passenger transportation
- Sustainable management of the local authorities and local businesses

CO_2 emissions
due to local energy consumption

CH_4 emissions
due to local waste management activities

(Source: European Commission 2002)

Initiated in 2007 by a small group of stakeholders from real estate and building sectors

Membership 2012: 1050

"Unique knowledge platform"

Certification system for new development areas
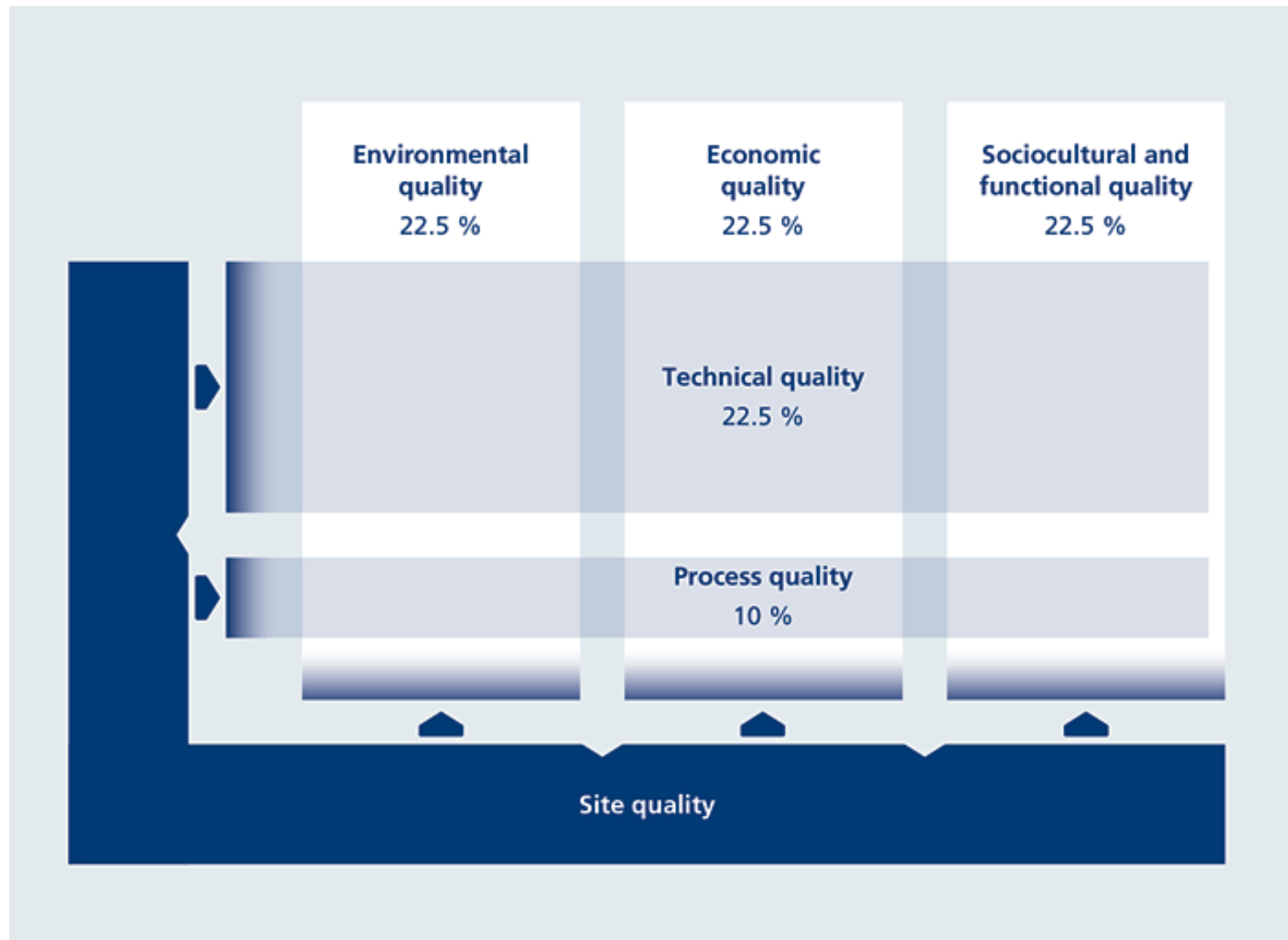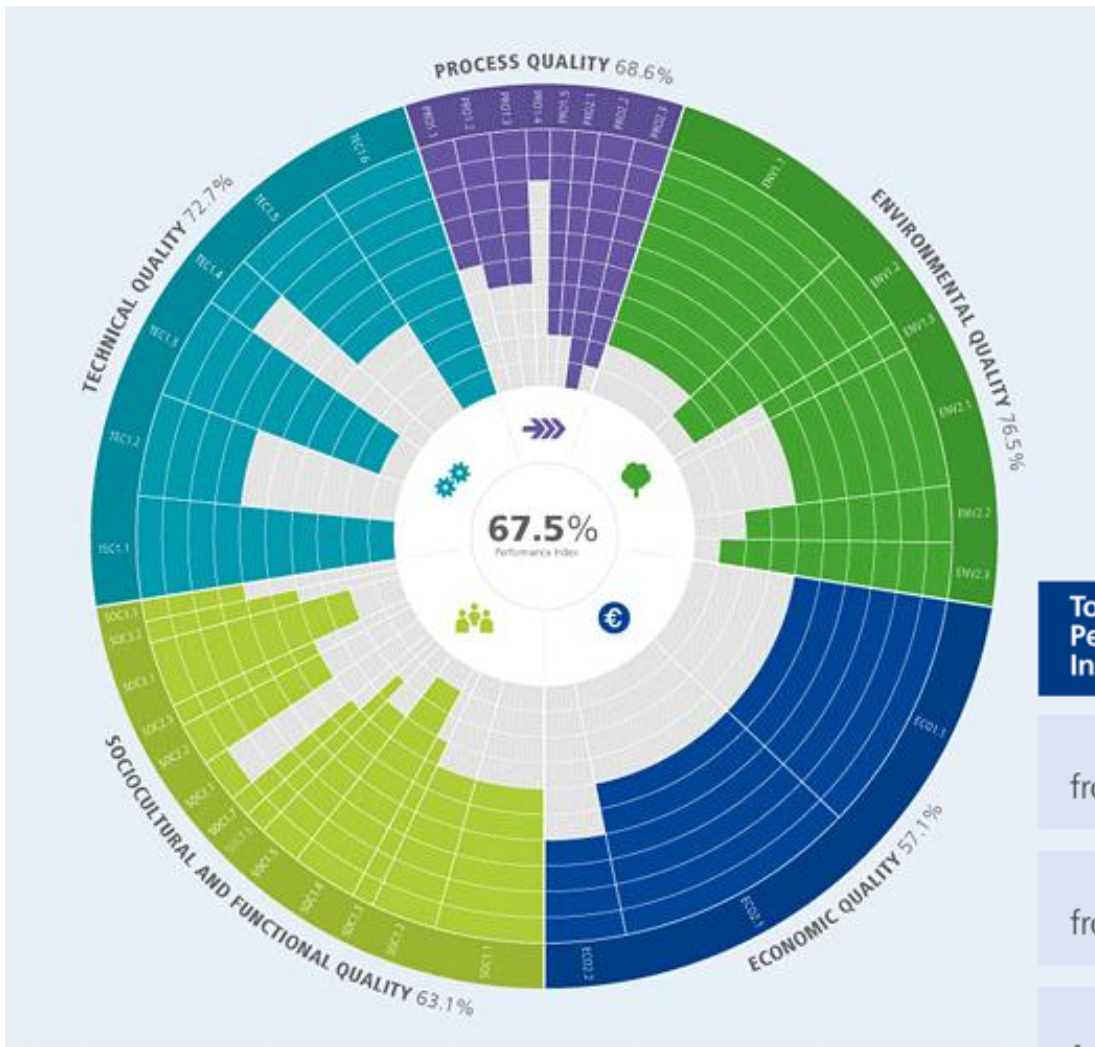
Total Performance Index	Nominal Performance Index	Awards	
from 50%	35%	Bronze	DGNB
from 65%	50%	Silver	DGNB
from 80%	65%	Gold	DGNB

CORE CATALOG FOR BUILDINGS

CORE CATALOG FOR URBAN DISTRICTS

🌳 Environmental Quality

Core Catalog for Buildings
- Life Cycle Assessment
- Local Environmental Impact
- Environmentally Friendly Material Production
- Primary Energy Demand
- Drinking Water Demand and Wastewater Volume
- Land Use

Core Catalog for Urban Districts
- Life Cycle Assessment
- Water and Soil Protection
- Change in City District Climate
- Biodiversity and Interaction
- Consideration of Possible Environmental Impacts
- Land Use
- Total Primary Energy Demand and Renewable Primary Energy
- Energy-Efficient Development Structure
- Infrastructure with Low Resource Consumption, Groundwater Management
- Local Food Production
- Water Cycle

€ Economic Quality
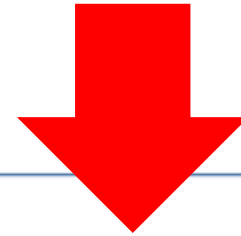
- Building-Related Lifecycle Costs
- Value Retention, Suitability for Third Party Use

- Lifecycle Costs
- Fiscal Effects on Municipality
- Value Retention
- Efficient Use of Space

👥 Sociocultural and Functional Quality

- Thermal Comfort
- Indoor Air Quality
- Acoustic Comfort
- Visual Comfort
- User Influence on Building Operation
- Quality of Outdoor Spaces
- Safety and Security
- Handicapped Accessibility
- Efficient Use of Floor Area
- Suitability for Conversion
- Public Access
- Cycling Convenience
- Design and Urban Planning Quality through Competition
- Integration of Public Art
- Site Features

- Social and Functional Diversity
- Social and Labour Infrastructure
- Objective / Subjective Security
- Quality of Open Areas in Public Spaces
- Noise Protection
- Proportion of Open Areas
- Handicapped Accessibility
- Occupancy Flexibility and Development Structure
- Adaptation to Urban Development Plan
- Urban Planning Design
- Use of Existing Buildings
- Public Art

⚙ Technical Quality
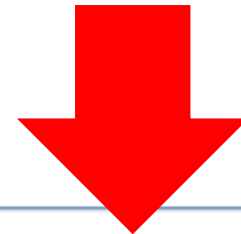
- Fire Prevention
- Indoor Acoustics and Sound Insulation
- Building Envelope Quality
- Backup Capacity of Technical Building Systems
- Ease of Cleaning and Maintenance
- Resistance to Hail, Storms, and Flooding
- Ease of Dismantling and Recycling
- Pollution Control
- Noise Emission Control

- IT and Communication Infrastructure
- Energy Technology
- Waste Management
- Rainwater Management
- Dismantling, Sorting, and Recycling of the Infrastructure
- Maintenance, Servicing, Cleaning
- Quality of Transport Systems
- Quality of Road Infrastructure
- Quality of Public Transport Infrastructure
- Quality of Cycling Infrastructure
- Quality of Pedestrian Infrastructure

➜>> Process Quality
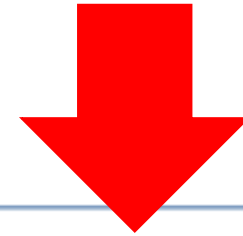
- Comprehensive Project Definition
- Integrated Planning
- Comprehensive Building Design
- Sustainability Aspects in Tender Phase
- Documentation for Facility Management
- Environmental Impact of Construction Site / Construction Process
- Construction Quality Assurance / Quality Control Measures
- Systematic Commissioning

- Participation
- Concepts Developed in Competitive Bids
- Integrated Planning
- Community Involvement
- Controlling
- Environmental Impact of Construction Site / Construction Process
- Marketing
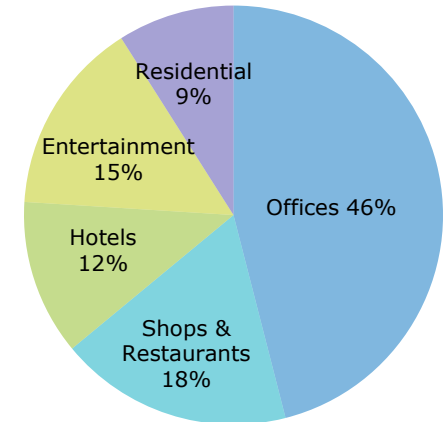- Quality Assurance and Monitoring

Example of a DGBN-Urban Area: Potsdamer Platz, Berlin, Germany
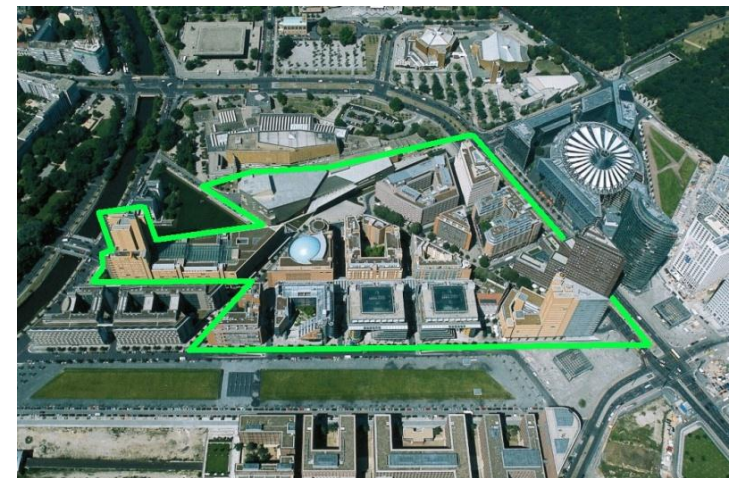

(Source: greenIMMO 2011)

- Regeneration project of a brownfield into a mixed use development (1993 – 1998)

- Area: 68,000 sqm

- 400 companies, 10,000 jobs and 370 residential units

Residential 9%
Entertainment 15%
Hotels 12%
Shops & Restaurants 18%
Offices 46%
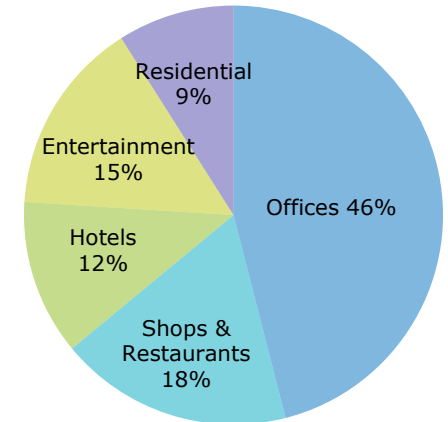
(Source: SEB 2011)

Sustainable energy and environmental concept:

- healthy and environmentally suitable building materials

- low energy consumption (e.g. ventilation systems instead of air conditioning)

- minimized pollutant emission

- rainwater management (e.g. 50,000 sq m green roofs, rainwater is reused in toilets)

(Source: Drees & Sommer 2011)

TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

Leibniz Institute of Ecological Urban and Regional Development

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SILVER!

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However:

- Too early to judge – international orientation
- Orientation of new urban areas – what about existing ones? What about retrofitting?

What do I want to talk about?

- Ambiguity of the eco-city
- Eco-city and sustainability
- The broader view:
  eco-city certification schemes

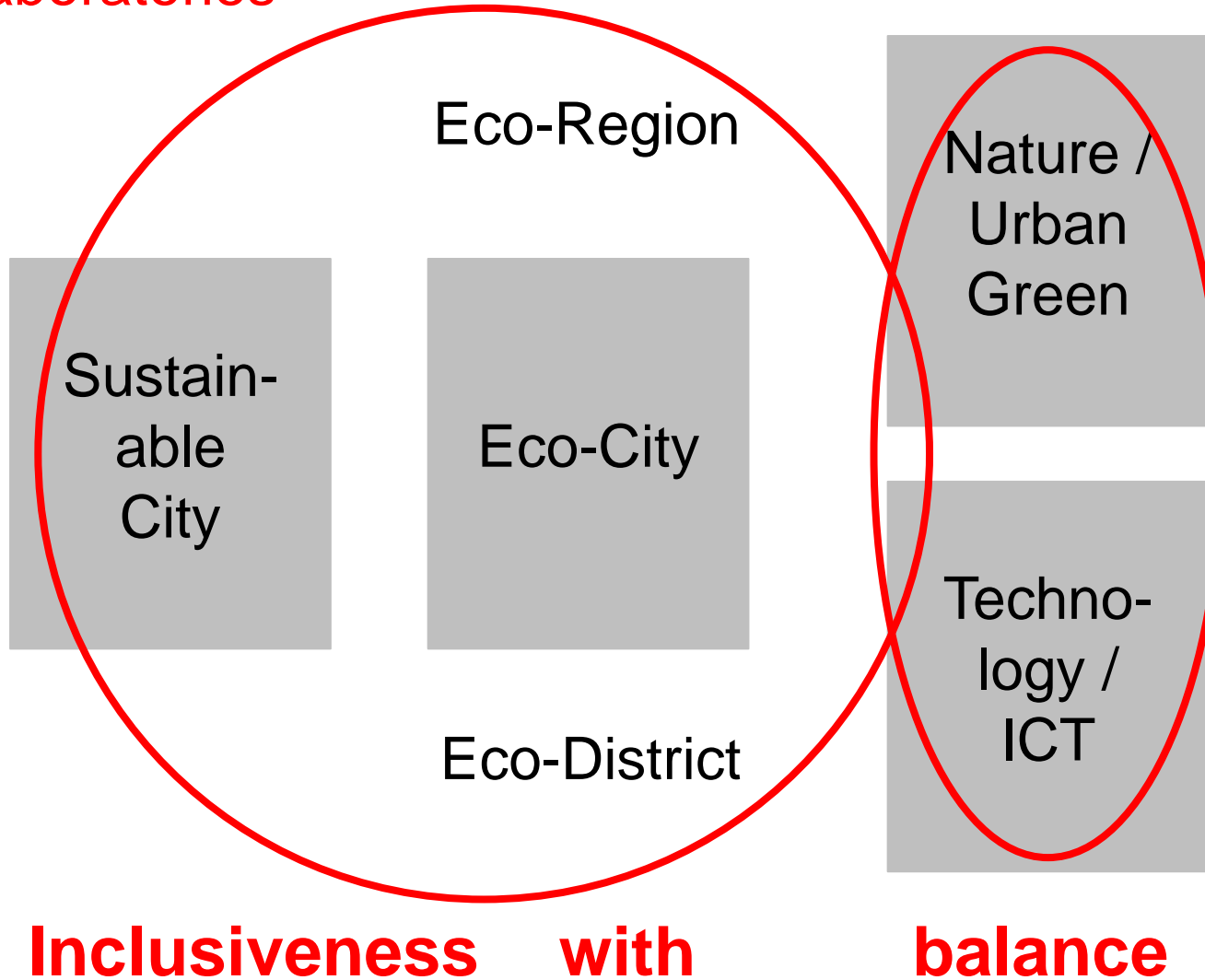- **Perspectives - outlook**

Perspectives - Outlook

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Urban laboratories
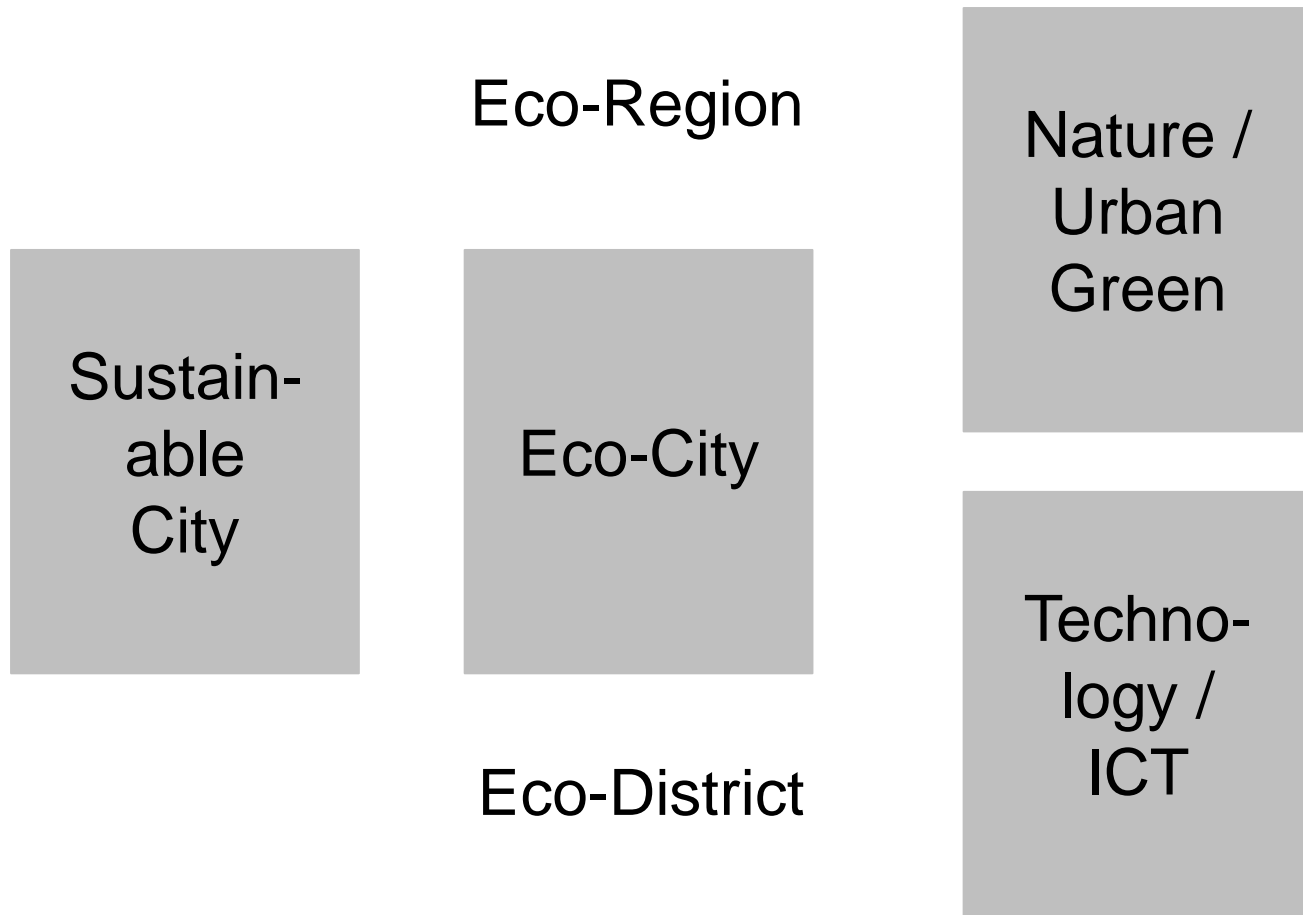
Eco-Region

Sustain-
able
City

Eco-City

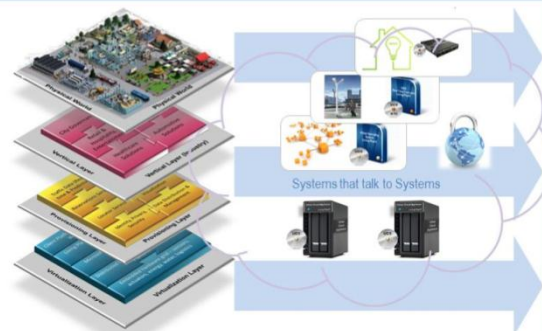Nature /
Urban
Green

Eco-District

Techno-
logy /
ICT

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"The development of smart cities in future is a crucial commercial opportunity."
"We are entering a phase when everything becomes connected, from healthcare to transportation,"

Steve Lewis, LivingPlan IT, BBC, 4 May 2012

-> Need to bring 'eco-tech-city' into question & develop alternative discourses

Source: Joss 2013

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- Industrie 4.0 is a big chance and challenge for urban development

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TASKS AND OPPORTUNITIES

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SCIENCE AND ENGINEERING

Forschungsunion
Wirtschaft und Wissenschaft
begleiten die Hightech-Strategie

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Securing the future of German manufacturing industry

Recommendations for implementing the strategic initiative INDUSTRIE 4.0

Final report of the Industrie 4.0 Working Group

April 2013

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- Industrie 4.0 is a big chance and challenge for urban development
- We need a closer link between urban development policies and smart technologies policies
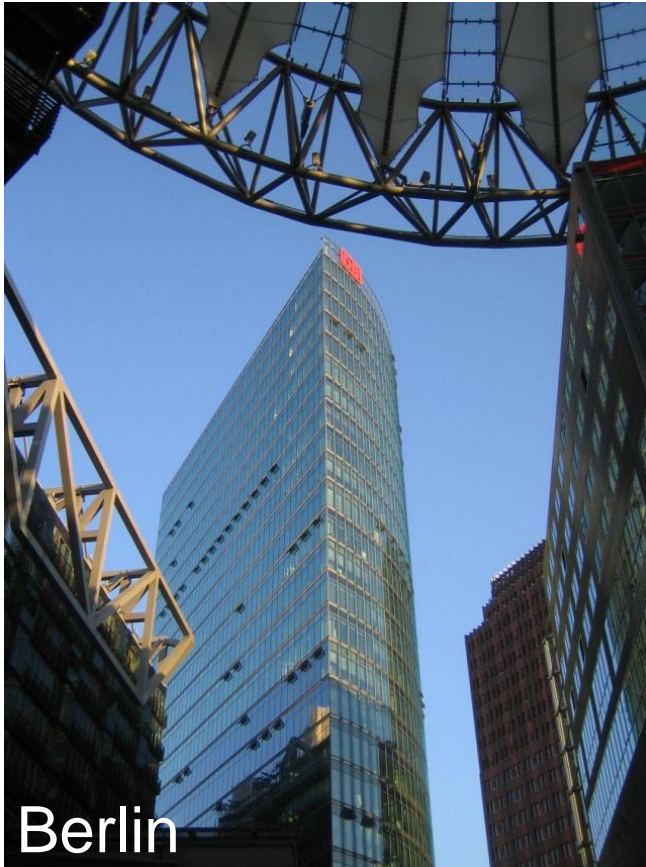
Perspectives - Outlook

Aspects to consider:

Perspectives - Outlook

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- New urban districts versus retrofitting cities?

We are strong: sustainability schemes regarding new developments
We are weak: sustainability approaches regarding the existing cities

Berlin

Görlitz

Perspectives - Outlook

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- New urban districts versus retrofitting cities?
- Eco-islands versus integrated urban and regional development?

The eco-city …

… and polluting industries in the hinterland

Perspectives - Outlook

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… may turn into
ruins of tomorrow

Dreams of today …

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- The role of urban planning in the future?

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**In city development,
smart is *not* the new green –
but it can be an important element of it!**

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Thank you very much for your attention!

Bernhard Müller
www.ioer.de
b.mueller@ioer.de