Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Renewable energy resources and energy efficiency in urban development

Potentials and fields of activities of energy related urban renewal in Germany



Lars Porsche
Bundesinstitut für Bau-, Stadt- und Raumforschung
im Bundesamt für Bauwesen und Raumordnung,
Federal Institute for Research on Building, Urban Affairs
and Spatial Development, (BBSR)
Bonn, Germany

Deutscher Verband (DV)
Sustainable energy solutions in
the urban and regional context –
reflections on EU support
25.05.2011, Brussels

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Thesis

Cities and municipalities do have the potential capacity and capability to increase energy efficiency and the use of renewable energies.

But these are currently developed only to a little percentage and unsystemactically.

http://www.bbs.de/

Content

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

1. Introduction
   - Political objectives and (new) determining factors in Germany
2. Potentials and fields of activities of energy related urban renewal
   - Energetic urban renewal
   - Using renewable energies in urban areas
3. Conclusion

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Introduction

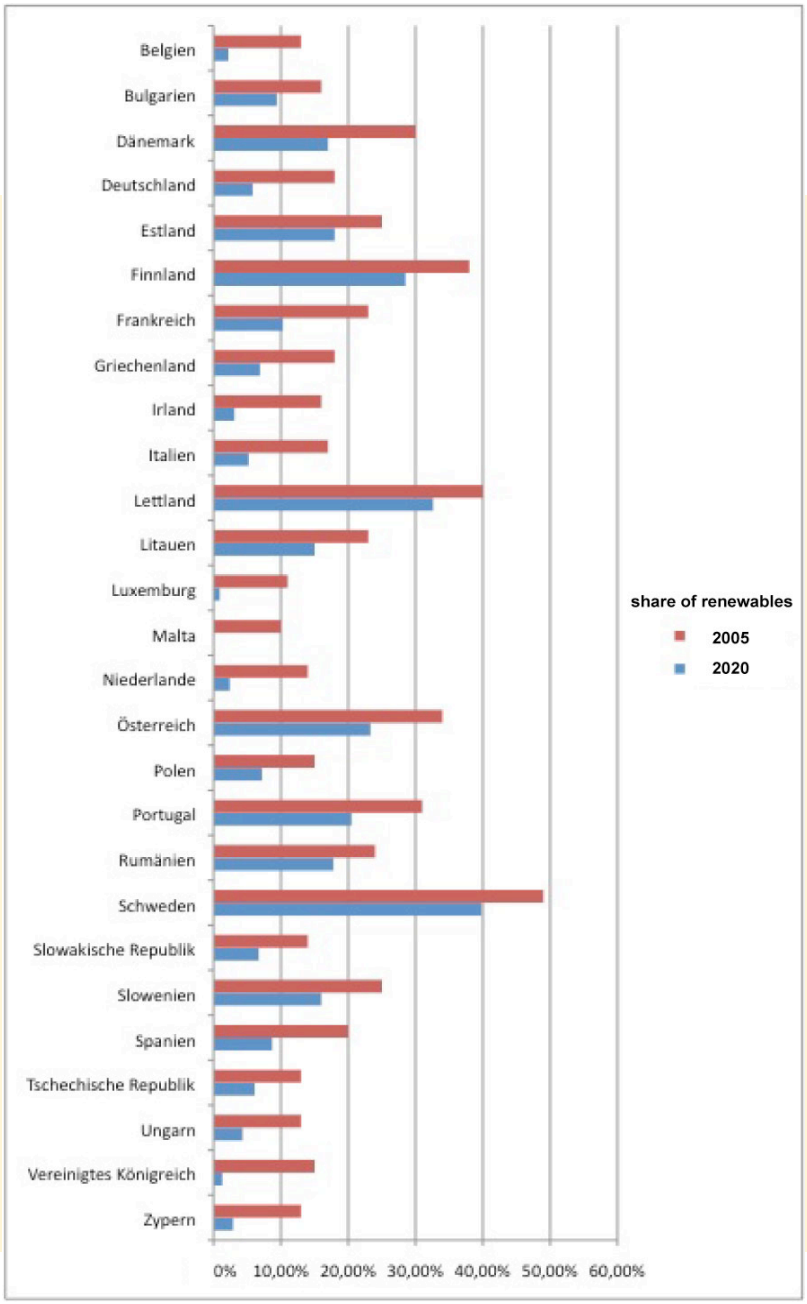
Political objectives and (new) determining factors in Germany

Excursus

Bundesinstitut für Bau-, Stadt- und Raumforschung

2020 target for the share of renewable energy in the final energy consumption of the Member States

(Article 4 of the renewable energy Directive (2009/28/EC)



Red:
Share of renewable energies (final energy consumption) 2005

Aubergine:
Share of renewable energies (final eneregy consumption) estimated for 2020

Poitical aims on the national level
Target values of the Energy Concept (2010)

Bundesinstitut für Bau-, Stadt- und Raumforschung

Achievement increase of renewable energies (gross energy consumption):

heat and power

18% of renewable energies in 2020

Further achievements:

30 % in 2030,
45 % in 2040,
60 % in 2050,

power only

35% of RE in 2020

50% in 2030,
65% in 2040,
80% in 2050,

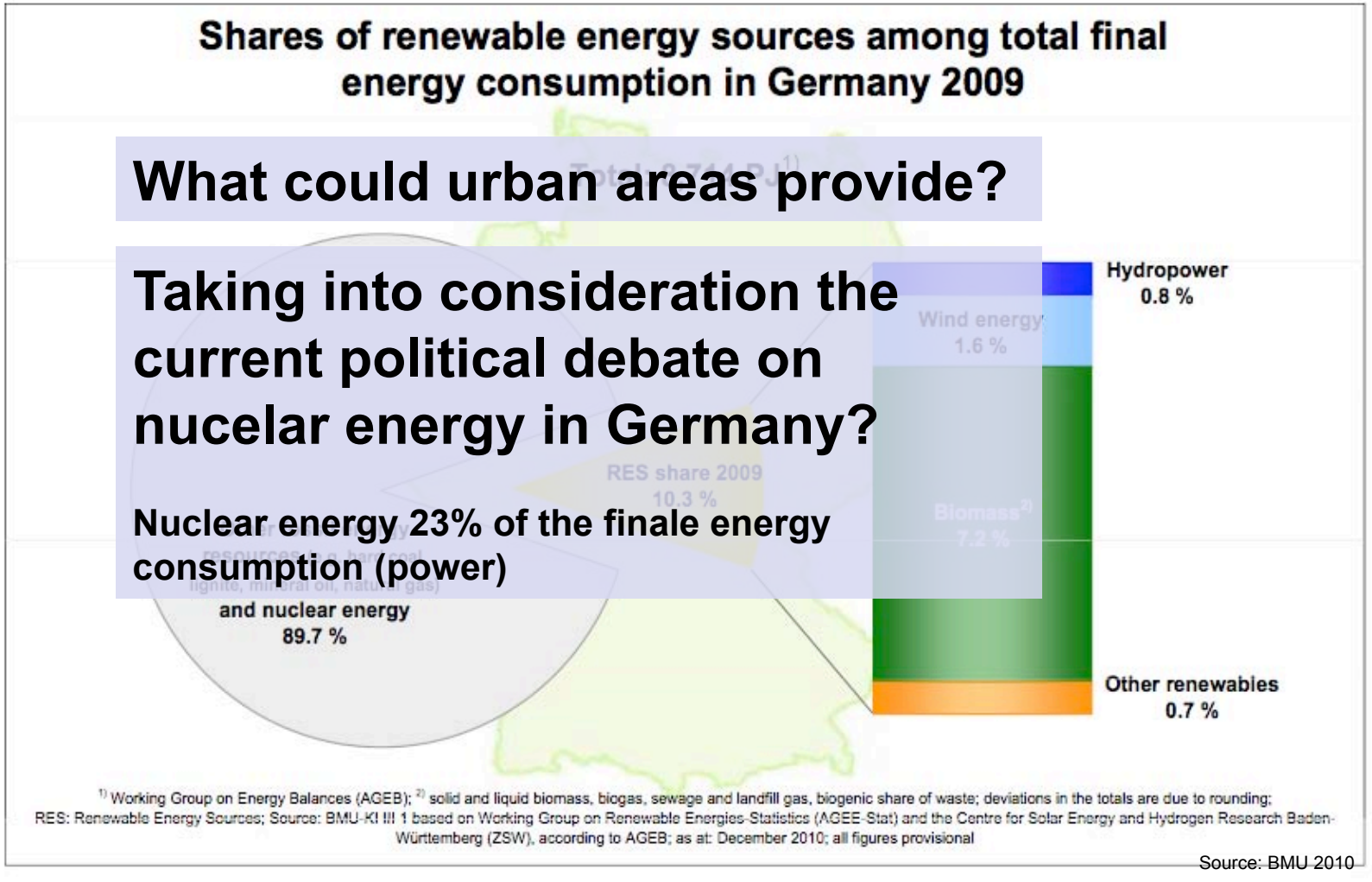
Achievement reduction of primary energy consumption

Until 2020 compared to 2008 by 20 % and until 2050 by 50 %.

Which role do municipalities play in achieving these goals?

Renewable Energies in Germany 2009

Bundesinstitut für Bau-, Stadt- und Raumforschung

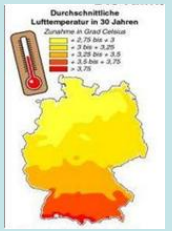


(New) Challenges for a ressource efficient urban renewal in Germany

Bundesinstitut für Bau-, Stadt- und Raumforschung

climate change

- global warming
- mitigation
- adaptation



energy

- from the „fossil“ to the „post-fossil“ age
- change of mobility

demographic change

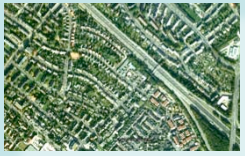
- social as well as infrastructural adaptation

economical (structural) chance

- on the way to the (blue) knowledge society and green economy

land consumption

- 30 ha - aim
- competition for land



Buildings and energy (efficiency)
The big challenge

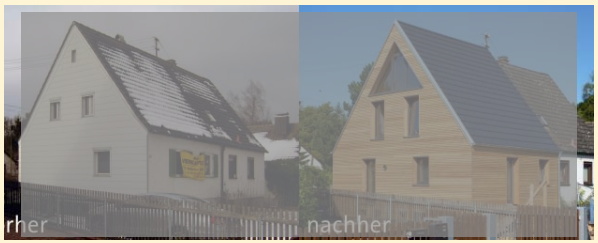
Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Inefficient existing building stock in Germany:

- **aprox. 40 % of Germany's gross energy consumption and**
- **2/3 of the CO_2- emissions.**

Thus the building stock encloses a huge potential concerning energy efficiency and reduction of CO_2-emissions.

Furthermore: <u>The rate of newly build houses is low</u> and <u>the rate of refurbished buildings</u> per year represents <u>around 1%</u> of the existing building.

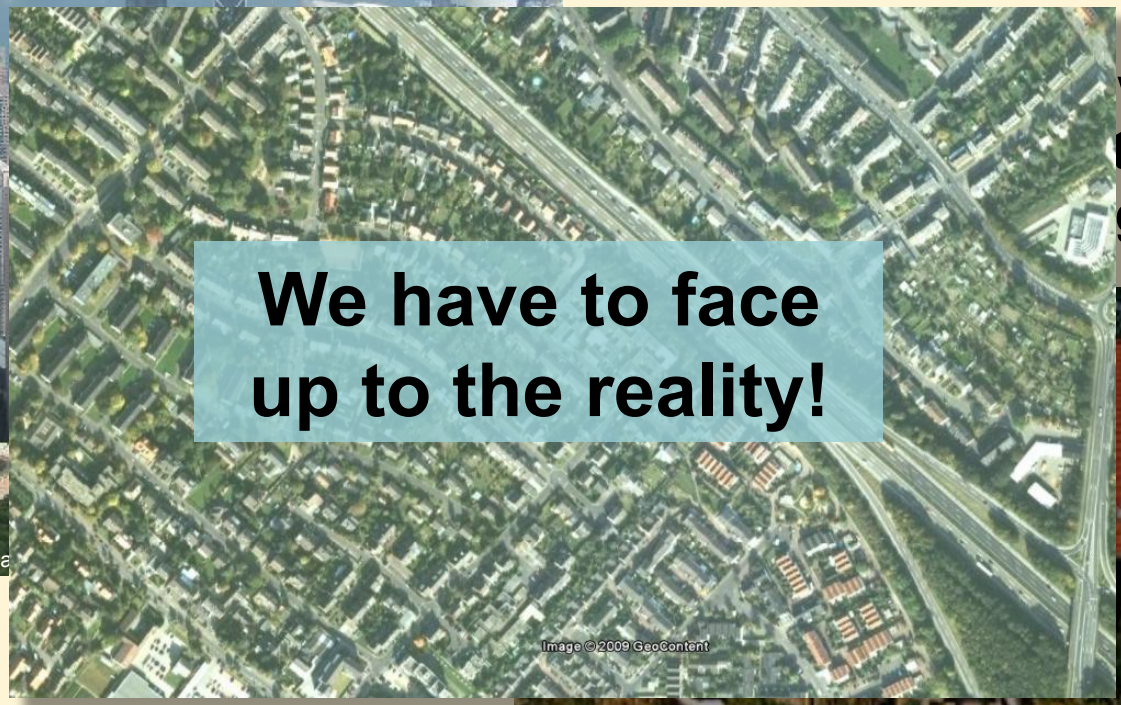


And... it is not only the buidling!

Urban development and energy (efficiency)
Between density and sprawl

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Which type is energy efficient?



We have to face up to the reality!

ws the tion of gies?

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Potentials and fields of activities of energy related urban renewal

approaches and first results

Lars Porsche,
Referat I 5, BBSR im BBR

Research Field

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

ExWoSt

Research field : **energetic urban renewal**

**(in Brandenburg and Saxony Anhalt,
incl. the city of Marburg since 2009)**

Research field for energetic urban renewal

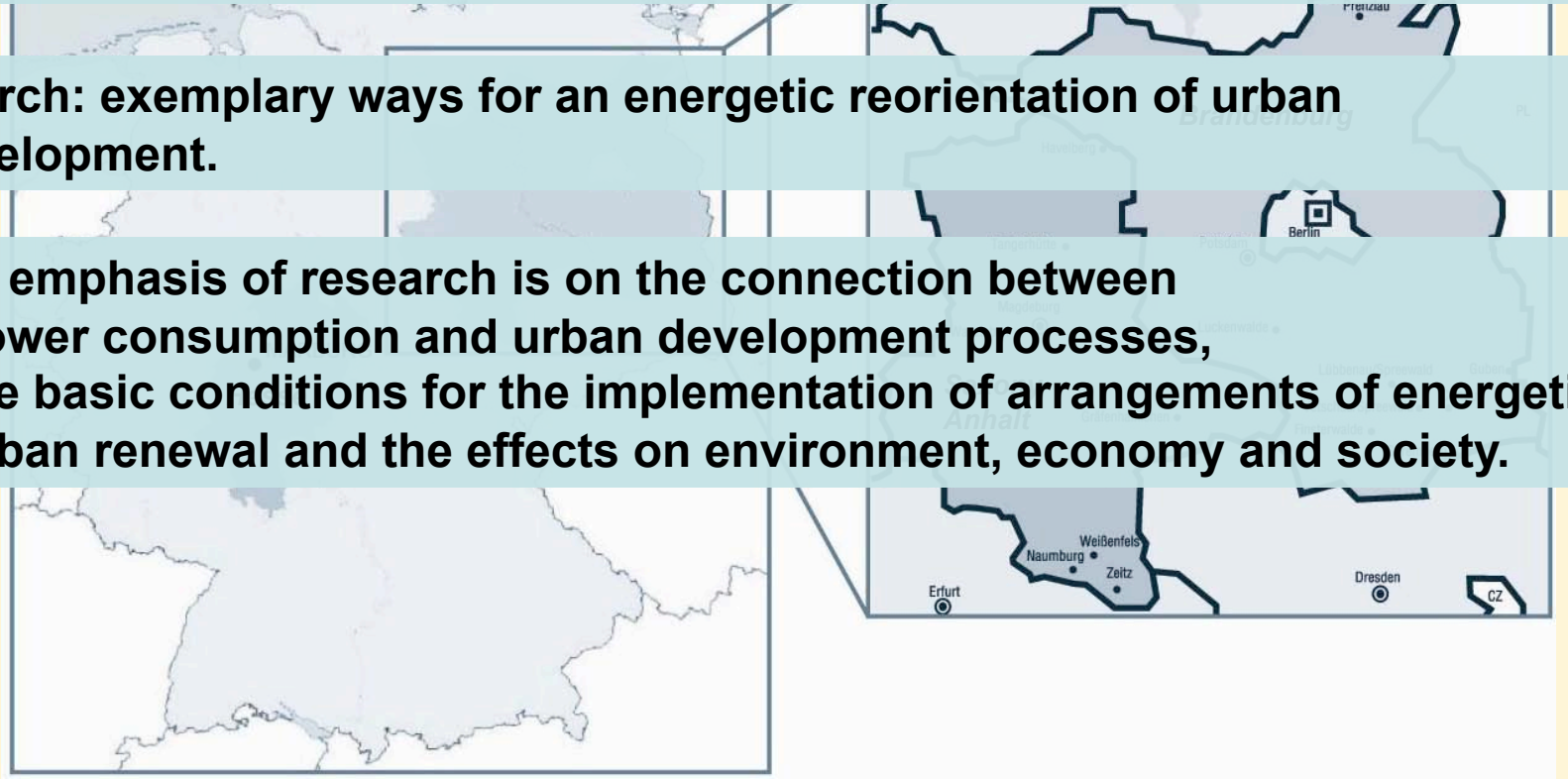
ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

Aim: to contribution to climate protection, to identify and provide recommendations for an integrated implementation of measures of energetic urban renewal.

Search: exemplary ways for an energetic reorientation of urban development.

The emphasis of research is on the connection between

- **power consumption and urban development processes,**
- **the basic conditions for the implementation of arrangements of energetic urban renewal and the effects on environment, economy and society.**



Levels of an energy and a ressource efficient urban development

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung

Energetic retrofit – demolition – „retreat“
Potentials and consequences of the existing stock

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung

What do these interventions mean for (the prevention of) the identity of places, municipalities, cities?

Quelle: W. Neußer 2009

Source: DBFZ

Quelle: W. Neußer

Quelle DBFZ 2009

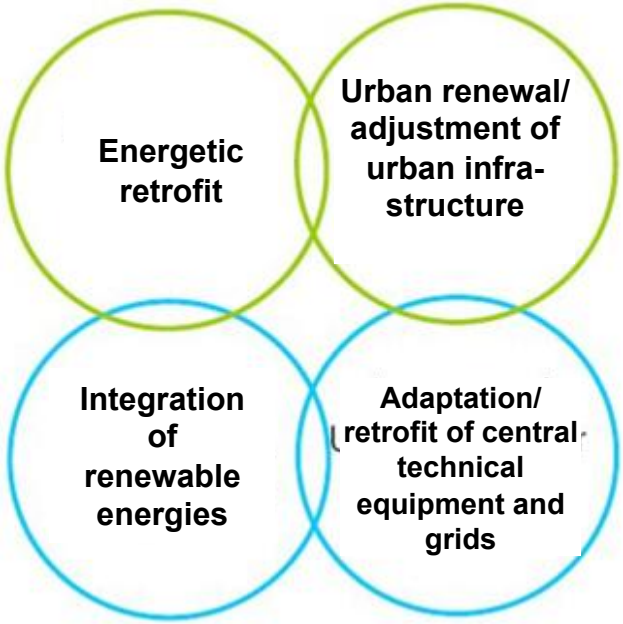
Quelle: Walter, BTU Cottbus

Pilot projects for energetic urban redevelopment

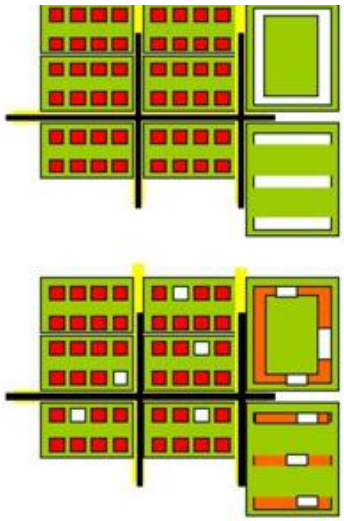
ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

Energetic urban redevelopment – and urban renewal strategies

Urban renewal strategies and fields of action (area: building and techn. infrastructure)



Blockwise deconstruction



dispersive deconstruction

Economic efficiency

Utilized capacity of infrastructure

Efficiency

Sustainability of the urban structure

Source: Koziol 2008

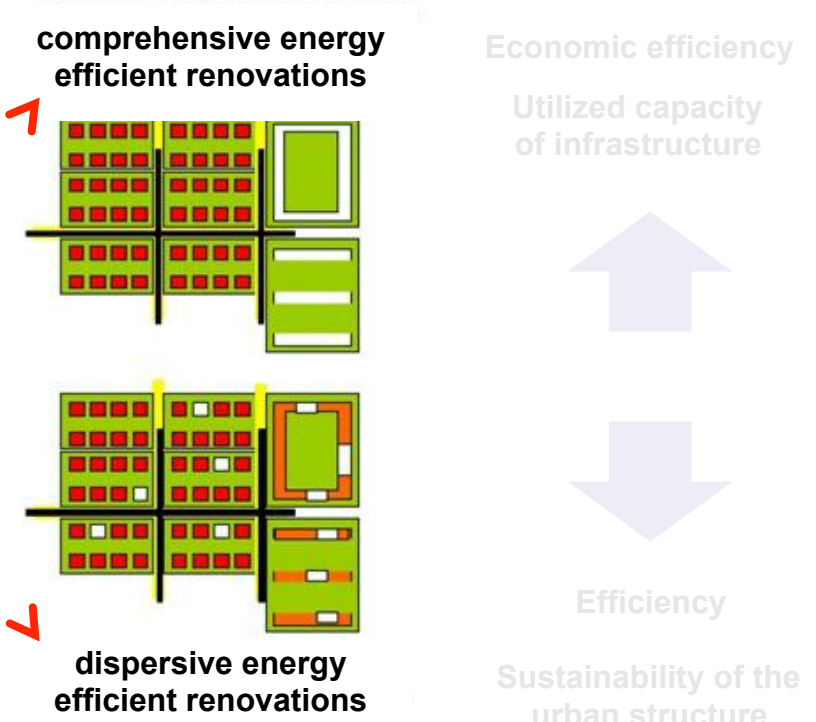
Pilot projects for energetic urban redevelopment

ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

Energetic urban redevelopment – and urban renewal strategies

Urban renewal strategies and fields of action (area: building and techn. infrastructure)

Example: energetic retrofit in existing building stock/ quarters (counts also for the old Federal States)



Source: changed, original Koziol 2008

The right course of action?

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung

Concept Orientated (top down) <-> Project Orientated (bottom-up)

Starts with a professional (urban) energy c

Selection of projects for

Realisation of single integrated projects

energy concept as part of the *(integrated) urban development concept*

Starts with single projects

professional (urban) energy concept

adjustments

Measures of the model project

ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

model city	approach		energy concept			refurb.
	project orientated	concept orientated	level residential area	level city	level inter-municipal	building, technical infra-structure
Federal State: Saxony-Anhalt						
Gräfenhainichen		■		■		
Havelberg		■		■		■
Naumburg		■		■		■
Tangerhüte		■		■		■
Wanzleben		■		■		
Weißenfels		■		■		
Zeitz		■		■		
Federal State: Hesse						
Marburg		■	■			
Federal State: Brandenburg						
Cotbus	■	■	■			■
Finsterwalde	■		■			■
Guben		■		■		■
Lübbenau	■	■	■	■	■	■
Luckenwalde	■		■			■
Prenzlau	■					■
Spremberg	■	■		■		■
Vetschau	■	■			■	■

■ Measures taken at the beginning

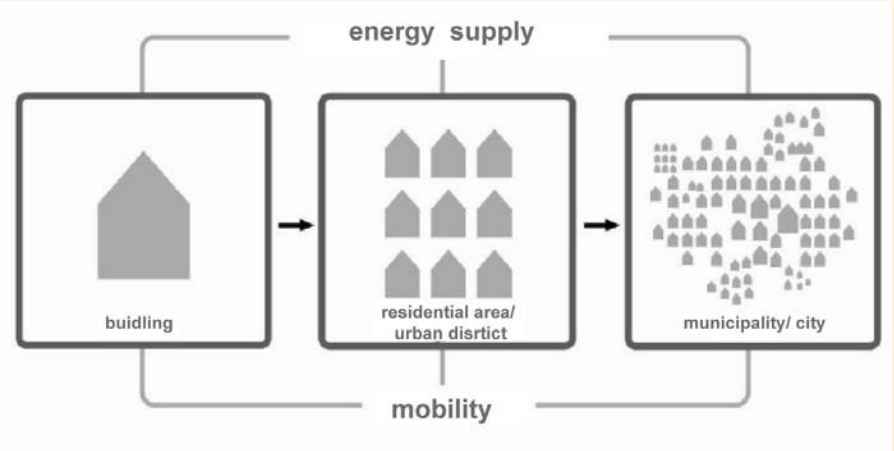
■ Measures foreseen, initiated during the operating time of the project

Intermediate results: Success – energetic urban renewal

ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

Energetic urban renewal can only be successful, if

- the topics: energy saving, increase of efficiency and the use of renewable energies are integrated,
- it is involved in an interdisciplinary urban development,
- includes a comprehensive view on the whole city/ municipality,
- technical infrastructures are included and
- it is understood as a communal task.



Source: BTU Cottbus (2011): Endbericht Modellvorhaben zur energetischen Stadterneuerung in Städten der Bundesländer Brandenburg und Sachsen-Anhalt

Intermediate results: Definition – energetic urban renewal

ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

Energetic urban renewal requires a conceptual approach / definition:

The energetic urban renewal includes the strategic development and coordination of
- energy saving measures,
- measure for the increase of energy efficiency and
- the use of renewable energies.

It is an interdisciplinary task, involving relevant stake holders and the interrelation of technical infrastructures on the level of
- the building,
- the quarter/ residential area and
- the complete city.

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

The potential of urban areas to produce energy

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

ExWoSt

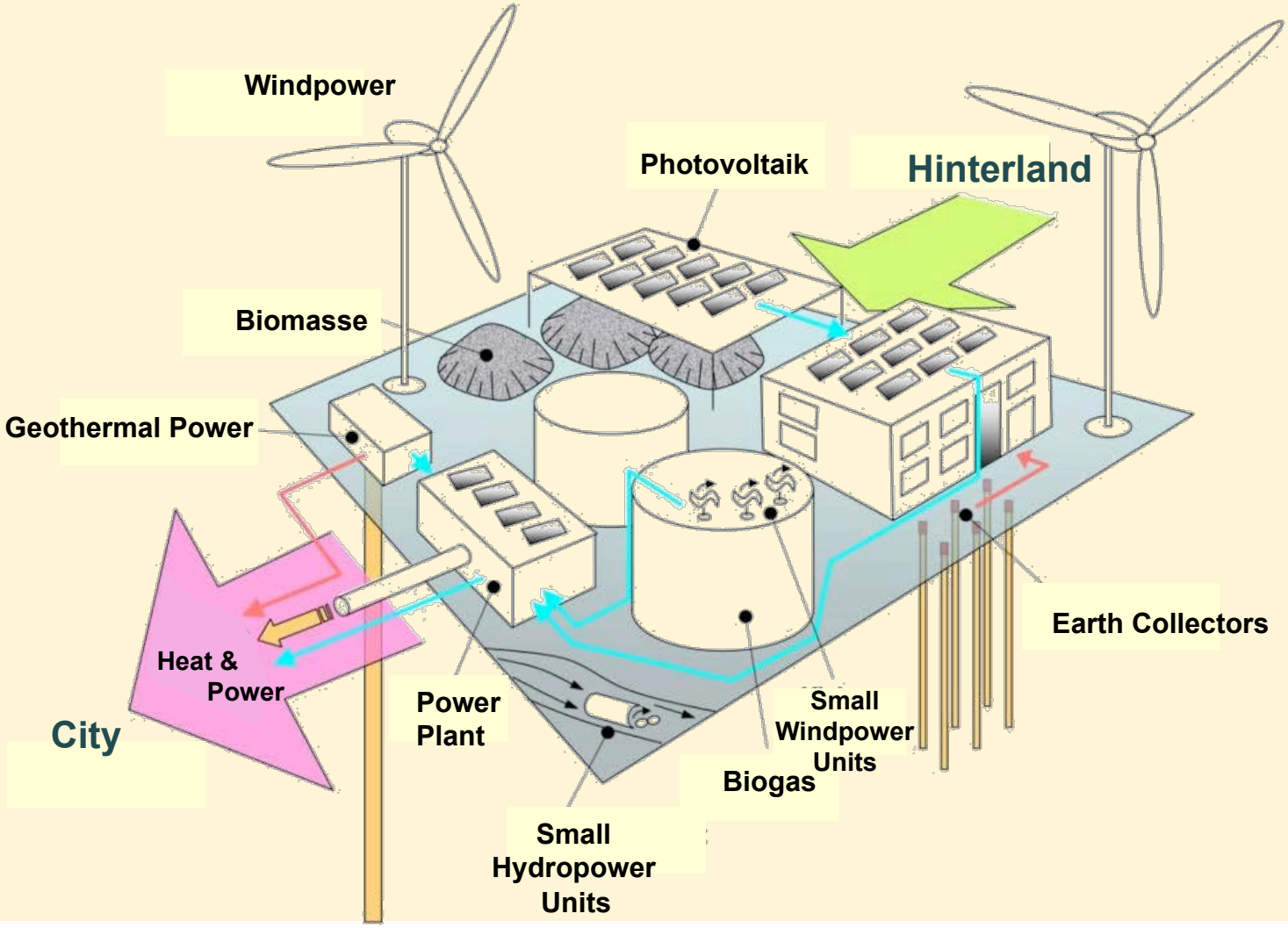
Using undeveloped urban areas and superficies for renewable energies

Lars Porsche,
Referat I 5, BBSR im BBR

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung

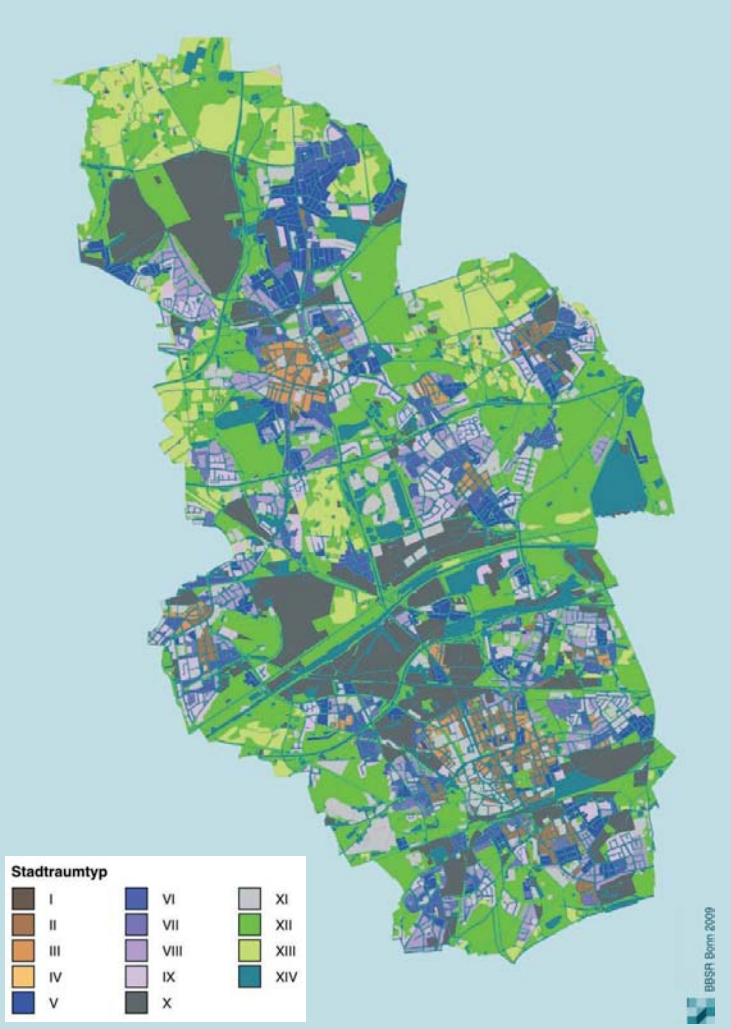
Thesis: Free space are energetically useable spaces



Example City of Gelsenkirchen

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung



Class	No	Subclass	total area in ha
Mixed types	I	Pre-industrial city / historic centre	0
	II	Building blocks of the 19th and beginning 20th century of the central city	178
	III	Post-war reconstruction (of destroyed buildings)	155
	IV	Village-like fractured structure	32
Living	V	Pre-war company housing	401
	VI	Social (subsidized) housing of the 1950s	333
	VII	High rise apartment buildings of the 1970s and prefabricated block structures (mainly former East Germany)	1222
	VIII	Apartment buildings since the 1960s	400
	IX	Private homes / residential areas (1-family homes)	563
Business	X	Business and industry	2515
Functional buildings	XI	Service buildings, office buildings, shopping malls, etc.	919
Park and green	XII	Parks, open air sports grounds, city forests, gardens, graveyards	3784
Agriculture	XIII	Crops and cattles	906
Rest	XIV		2008
			Total 12.319

Area calclulation based on GIS (gerundet) BBSR Bonn 2009

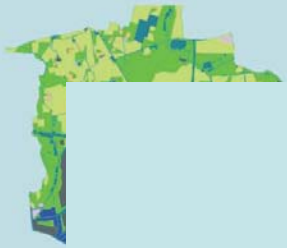
Source: BBSR, edit.: Nutzung städtischer Freiflächen für erneuerbare Energien, 2009

Lars Porsche,
Referat I 5, BBSR im BBR

Example City of Gelsenkirchen

ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung



Background for the calculation of the scenarios:

3-steps for the retrofit of a building as a precondition:
- **professional rehabilitation**
- **modern technology (for the building)**
- **using renewable energies**

(refering to DENA)

Calculations only for two energy parties :
- **households**
- **business**

			rea in ha
buildings	XI	Service buildings, office buildings, shopping malls, etc.	0
Park and green	XII	Parks, open air sports grounds, city forests, gardens, graveyards	178
Agriculture	XIII	Crops and cattles	155
Rest	XIV		32
			401
			333
			222
			400
			563
			515
			919
			3784
			906
			2008
			Total 12.319

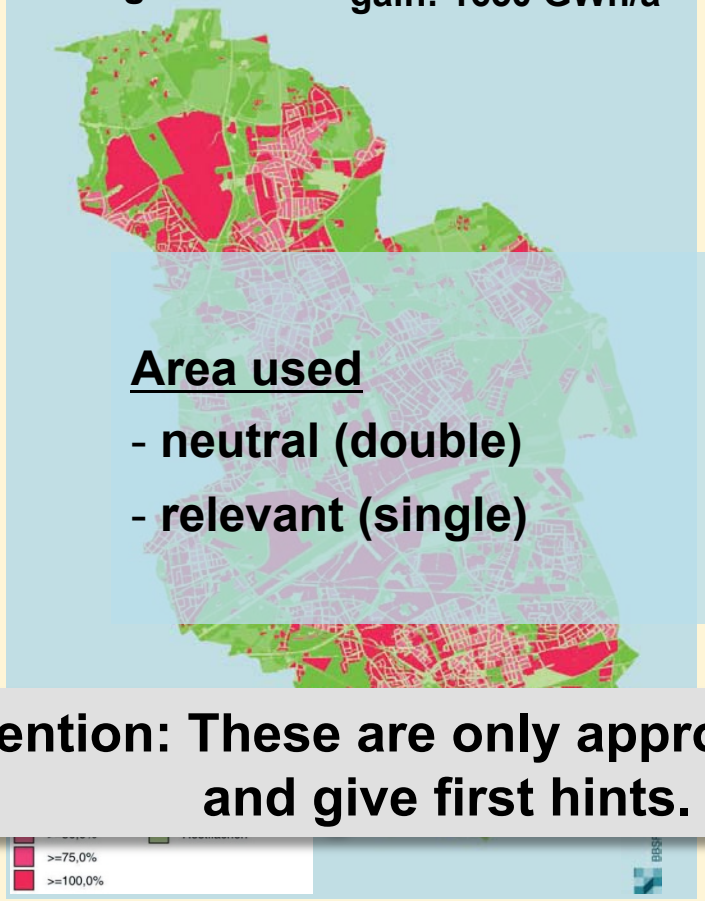
Area calclulation based on GIS (gerundet) BBSR Bonn 2009

Source: BBSR, edit.: Nutzung städtischer Freiflächen für erneuerbare Energien, 2009

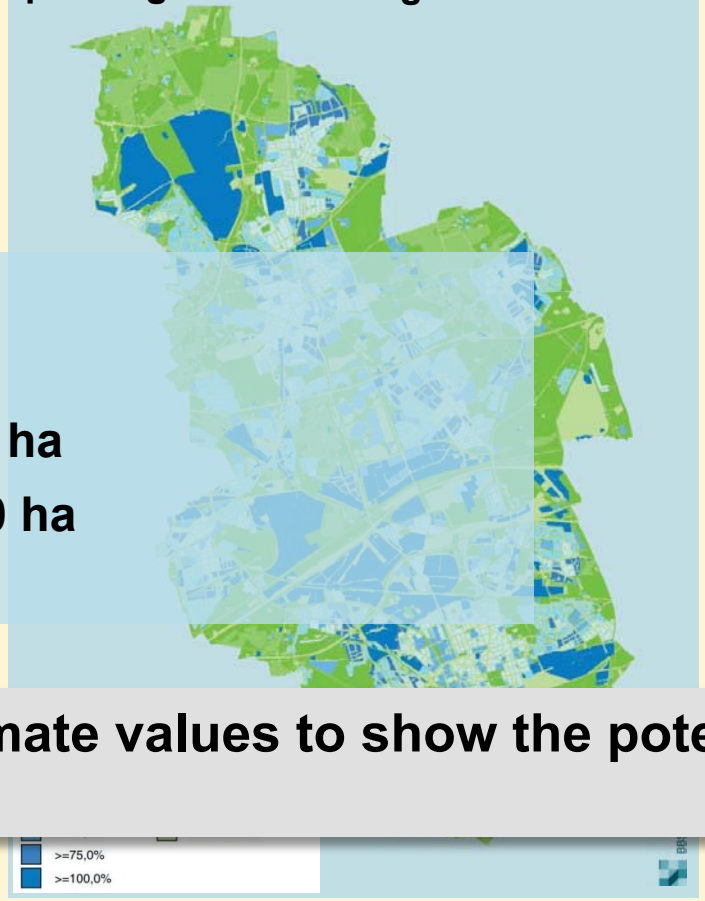
Example City of Gelsenkirchen scenario VI - flexible

ExWoSt
Bundesinstitut für Bau-, Stadt- und Raumforschung

heat generation gain: 1650 GWh/a



power generation gain: 667 GWh/a



Area used

- neutral (double) 879 ha
- relevant (single) 0 ha

Attention: These are only approximate values to show the potential and give first hints.

Example City of Gelsenkirchen scenario VI - flexible

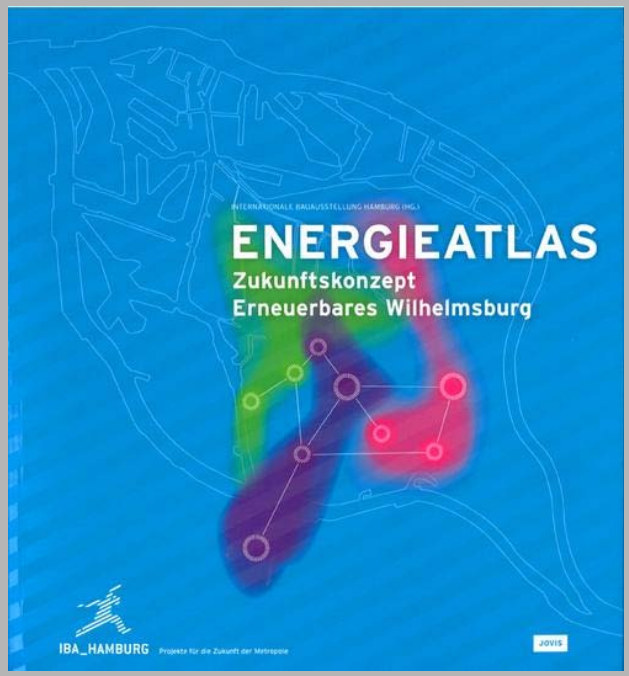
ExWoSt

Bundesinstitut für Bau-, Stadt- und Raumforschung

heat generation gain: 1650 GWh/a

power generation gain: 667 GWh/a

Further development of the methodology by the IBA Hamburg



Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Conclusion

The need for an integrated action

The need for an integrated action

Bundesinstitut für Bau-, Stadt- und Raumforschung

- **Urban development in Germany changes** – but **foremost in existing** cities, municipalities, quarters
- The **complexity** of urban development, energy efficiency, renewable energies and the protection of resources **can be solved**.


Les Halles Market, Avignon, L. Porsche,

- The paradigm of the compact and **well-greened up** city has to be **adopted** referring to be **more resources efficient!**
- **Climate protection** and **–mitigation** have to be realised within an **integrated approach** taking into consideration **the aim of a redensification.**
- The **whole city/ municipality** with its different **types of urban areas** and **spatial levels** has to be analysed and dealt with. One level or area is not enough!
- **Uncoordinated small actions** have to be avoided.

Thus...

The need for an integrated action

Bundesinstitut für Bau-, Stadt- und Raumforschung

- **Energy concepts** offer a possibility to integrate
  - more than supply and disposal infrastructure –
    - the current as well as **future challenges,**
    - **energy saving, efficiency and production,**
    - the real estate market into urban planning and development in **a sustainable and resource efficient way.**

http://de.structurae.de/structures/data index. cfm?ID=s0001474 – Mont Cenis, Herne, Germany

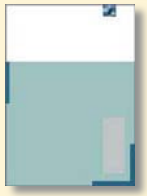
- **Integrated energy and climate concepts** have to be **integral parts of urban planning**.
- **But these have to be assisted and fostered.** Cities and municipalities can not shoulder the new task alone.
- The analysis of the spatial structure **should be obligatory element of funding and allowances.**

Publications and Internet

Bundesinstitut für Bau-, Stadt- und Raumforschung

BBSR publications:

Perspectives of Spatial Development in Germany
Eds.: BMVBS/BBR, Bonn/Berlin November 2006 (online)

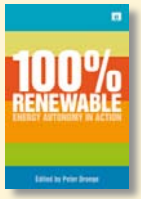


BBSR research news
The information bulletin informs in short reports about the work and research results of the BBSR (printed and online)

BBSR ExWoSt-Informationen Heft 36 (only German)
Modellvorhaben zur energetischen Stadterneuerung In den Städten der Budnesländer Brandenburg und Sachsen-Anhalt (printed and online)

www.bbsr.bund.de - > English

further publication:



100 Per Cent Renewable - Energy Autonomy in Action. Edited by Peter Droege
Chapter 15: Urban Energy Potentials: A Step towards the use of 100% Renewable Energies

Energie(effizienz) - vom Gebäude zum Quartier
IzR 9.2010

Stadtumbau - die Fortsetzung
IzR 7.2009

Zukunft städtischer Infrastruktur
IzR 5.2006

Postfossile Mobilität
IzR 8.2006

Nutzung städtischer Freiflächen für erneuerbare Energien (2009)

Erneuerbare Energien: Zukunftsaufgabe der Regionalplanung (2011)

Bundesinstitut
für Bau-, Stadt- und
Raumforschung

Lars Porsche

Bundesinstitut für Bau-, Stadt- und Raumforschung, BBSR

im Bundesamt für Bauwesen und Raumordnung

Referat I 5 „Verkehr und Umwelt“

Deichmanns Aue 31-37

53111 Bonn

Tel: +49 228 99 401 2531

E-Mail: lars.porsche[at] bbr.bund.de