energiewende ruhr

7 June 2016 – mobil.TUM Munich

Simulation of the potentials for energy and climate efficient mobility by implementing measures to reduce the modal share of car use in the Ruhr Metropolitan Region

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LUIS

Wuppertal Institut

S&W

STIFTUNG MERCATOR

Regional Mode Shift in the Ruhr Region
Structure

1. Objective and methodology

2. Description of measures
   and preliminary modelling results

3. Conclusion and further steps

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Framework to Implement Energy Transition (‚Energiewende') at Local Authorities of the Ruhr Area

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- Funded by: Stiftung Mercator
- Duration: 11/2012 – 12/2016
- Targets: Analysis of
  - Implementation possibilities for climate protection and energy transition at local and regional scale
  - Barriers, conflicts of interests, options
- Project consortium:

Wuppertal Institut

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INSTITUTE FOR ADVANCED STUDY IN THE HUMANITIES

technische universität dortmund

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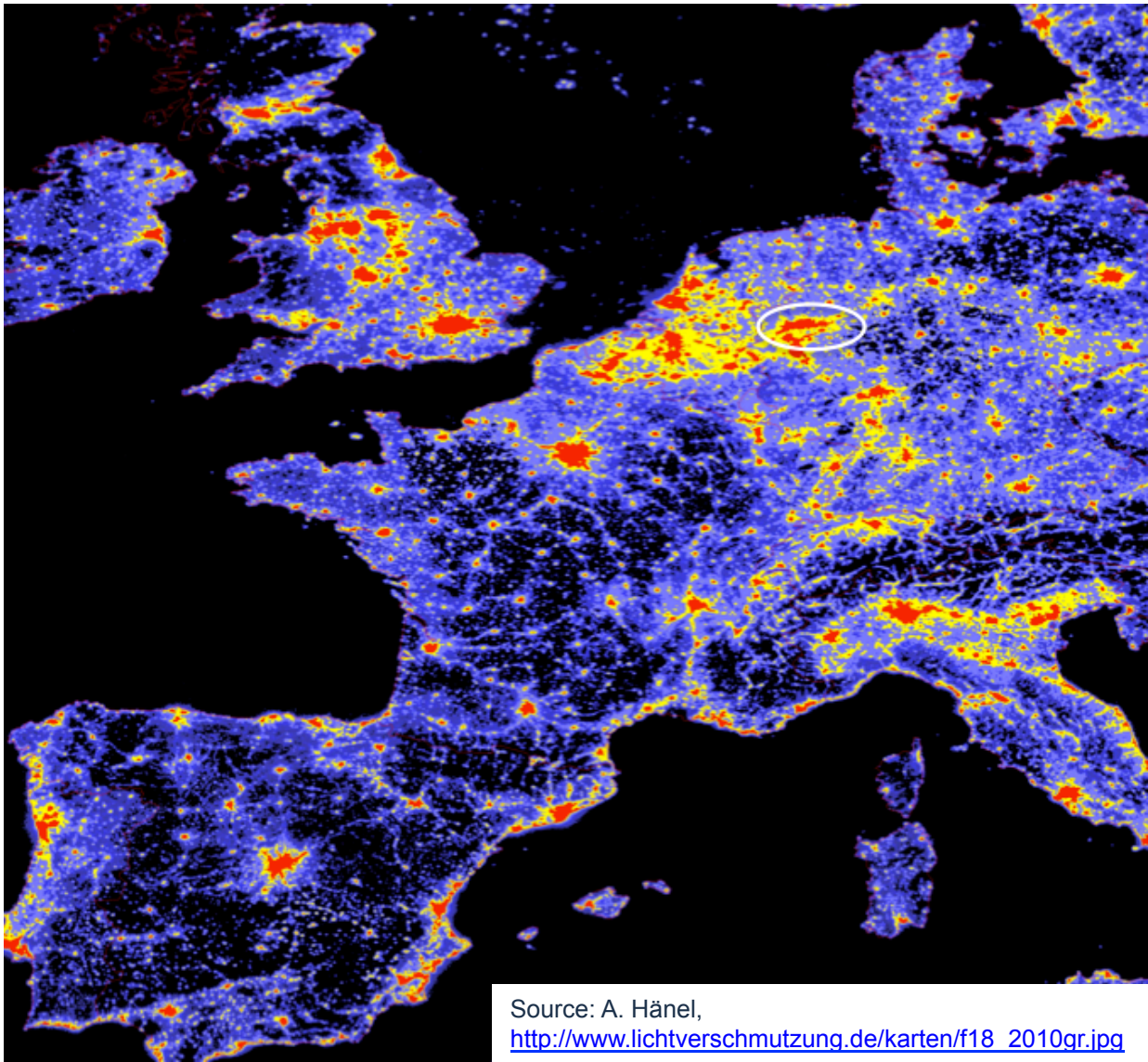
S&W

Ruhr Metropolitan Region

- 5.3 million inhabitants
- One of the larges agglomeration areas in Europe
- Polycentric settlement structures
- Industrial past (coal and steel)



Source: A. Hänel, http://www.lichtverschmutzung.de/karten/f18_2010gr.jpg

Energy transition and climate protection
Targets

Energy transition

- Transition to a fossil free energy system (phase out of nuclear energy until 2022)
  - Decrease of energy consumption
  - Increase of renewable enregies

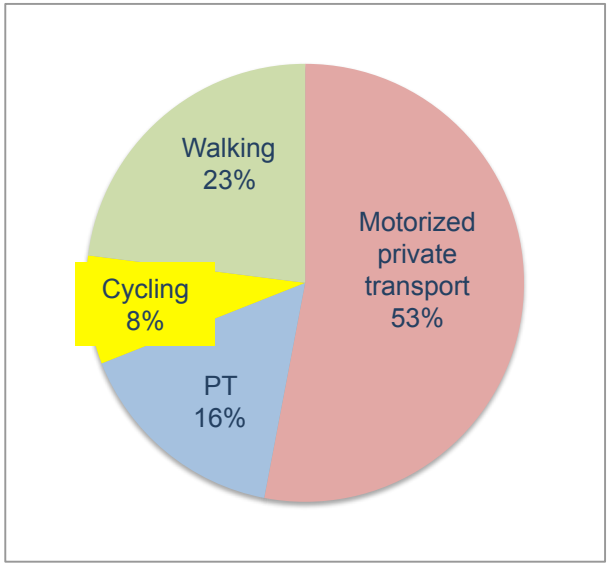
Climate protection

- Germany:
  - -40% CO2 until 2020 compared to 1990
  - -80 to -95% until 2050 compared to 1990
- North Rhine-Westphalia:
  - -25% CO2 until 2020 compared to 1990 (Climate Protection Law)
  - At least -80% until 2050 compared to 1990

Sub-project „Regional Mode Shift“
Baseline Modal Share (2012)

- Problem Situation in Transport (Germany 2010):
  - 28% of final energy consumption
  - 20% of CO_2-emissions
- Main drivers:
  - aviation,
  - freight transport,
  - motorized private transport
- Ruhr Region: 53% of trips by motorized private transport
- Politics: Current policy approaches focus mainly on small scale measures
- Obstacle: i.a. missing impact analyses and prognoses of measures

Modal Share in the Ruhr Region (2012)



Source: Sagolla, Winfried (2012): Nahverkehr – Lokales Verkehrswesen. In: Memorandum zur Bewerbung der Metropole Ruhr als „Grüne Hauptstadt Europas 2015“, p. 64.

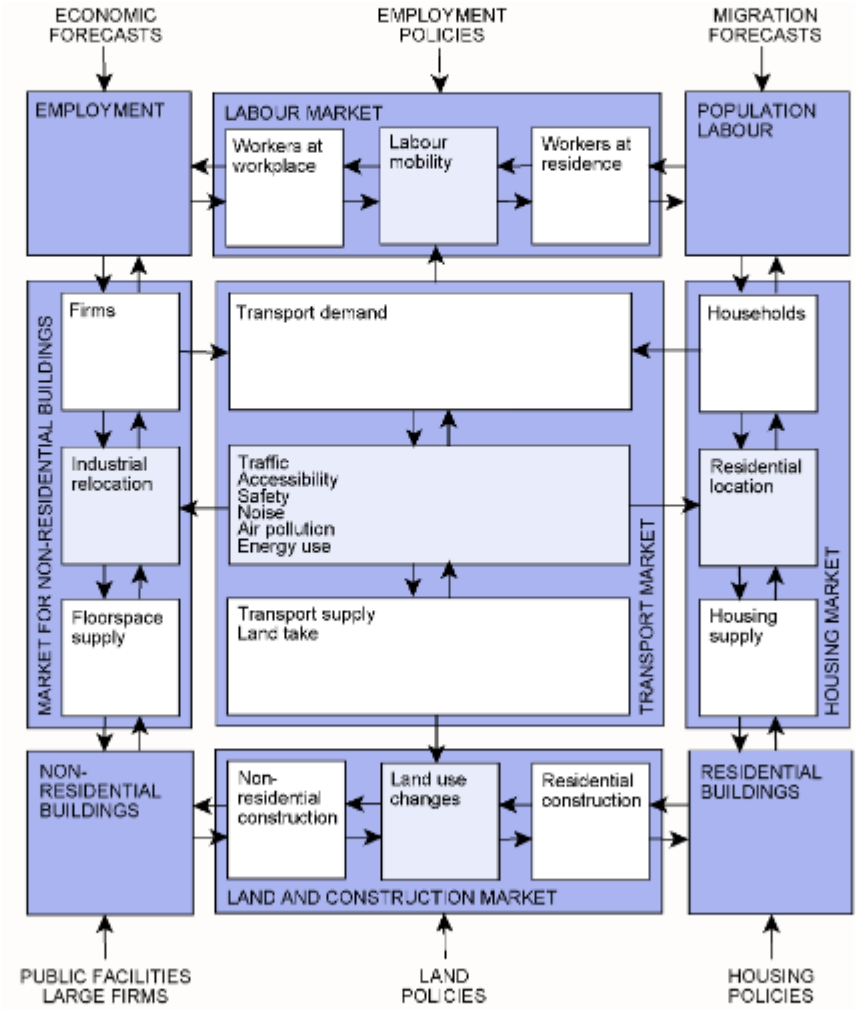
Sub-project „Regional Mode Shift“
Objective and approach

- Objective: analysis of
  - Potentials to shift traffic from motorized private transport to environmentally friendly transport modes
  - Potentials to reduce energy consumption and CO_2-emissions
- Approach:
  - Combination of push- und pull-measures (urban and transport planning)
  - Ambitious and extensive measures
  - Measures in the field of action of local and regional actors
- Methodology:
  Modelling in the scenario model „Cities and Climate Change – Ruhr Region 2050“ from Spiekermann & Wegener

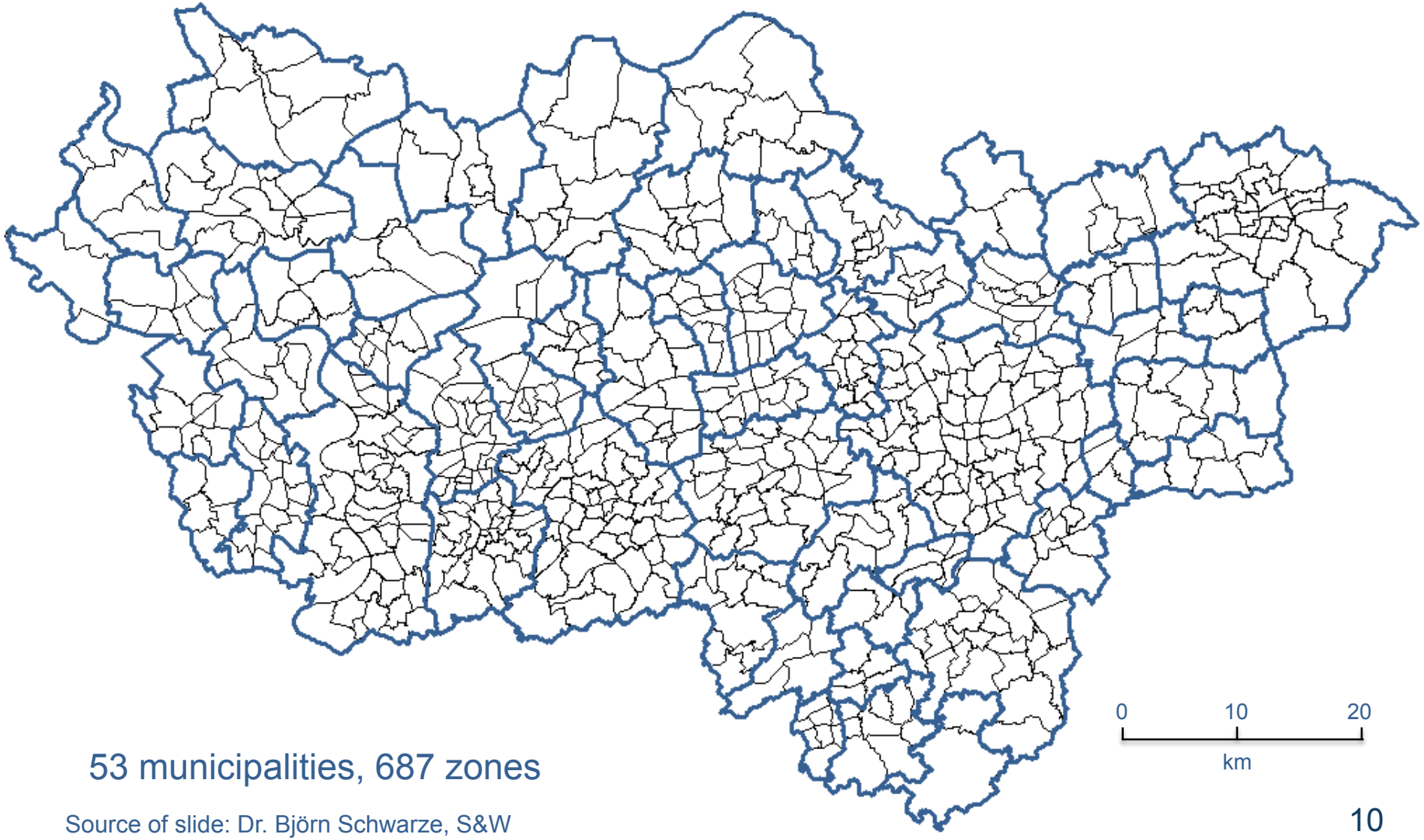
Scenario model „Cities and Climate Change - Ruhr Region 2050“ from Spiekermann & Wegener

- Forecast period: 1990-2050
- Simulation model of intraregional location and mobility decisions by
  - industry and companies
  - residential developers
  - households

  and the resulting
  - migration patterns
  - travel patterns
  - construction activities
  - land-use development
- Consideration of interdependencies, positive und negative synergies
- Prognoses and backcasting: Which effects
  - could be epected?
  - would be necessary to reach the goals?



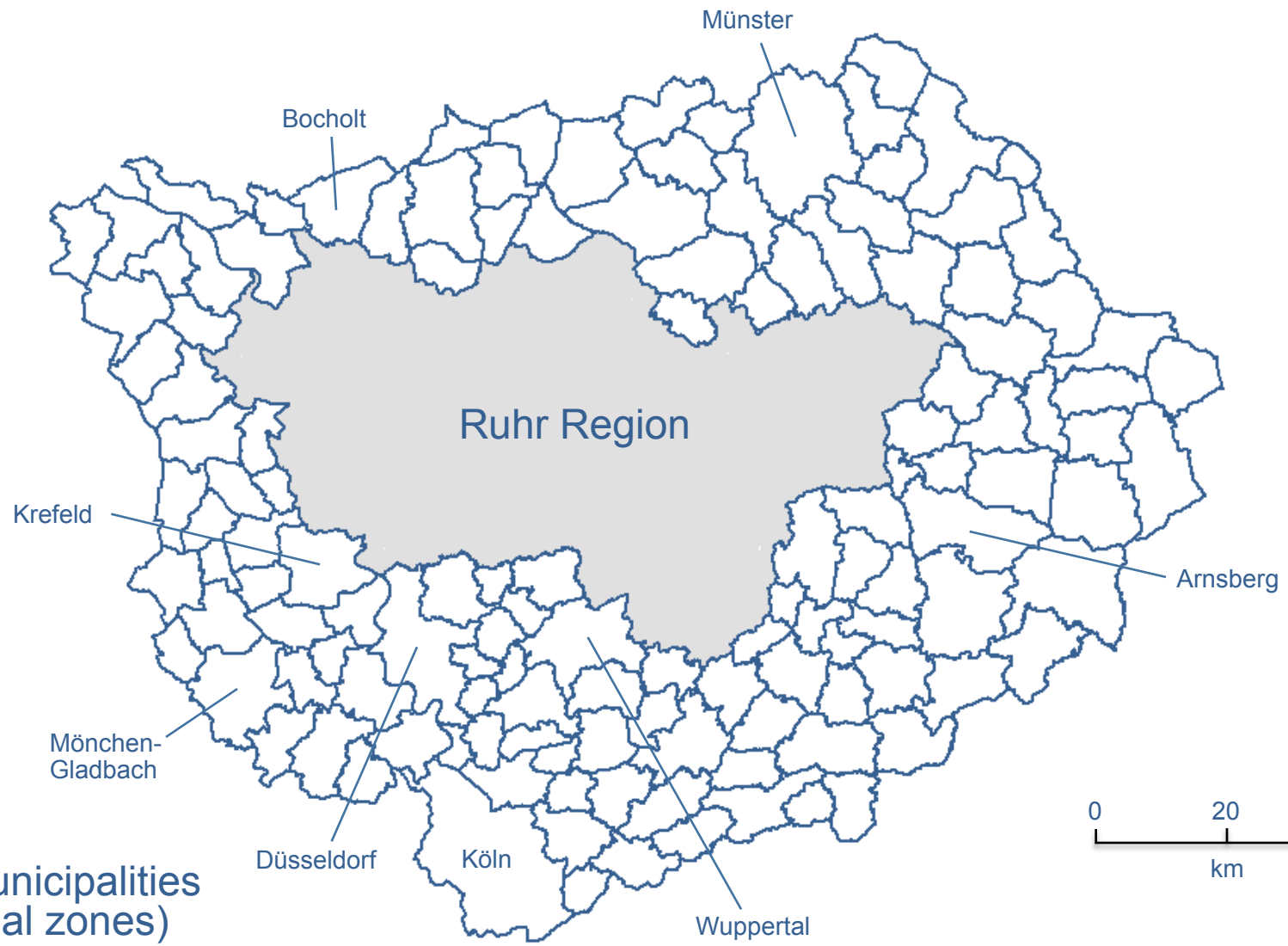
Research area
Modelling zones of the Ruhr Region



53 municipalities, 687 zones

Source of slide: Dr. Björn Schwarze, S&W

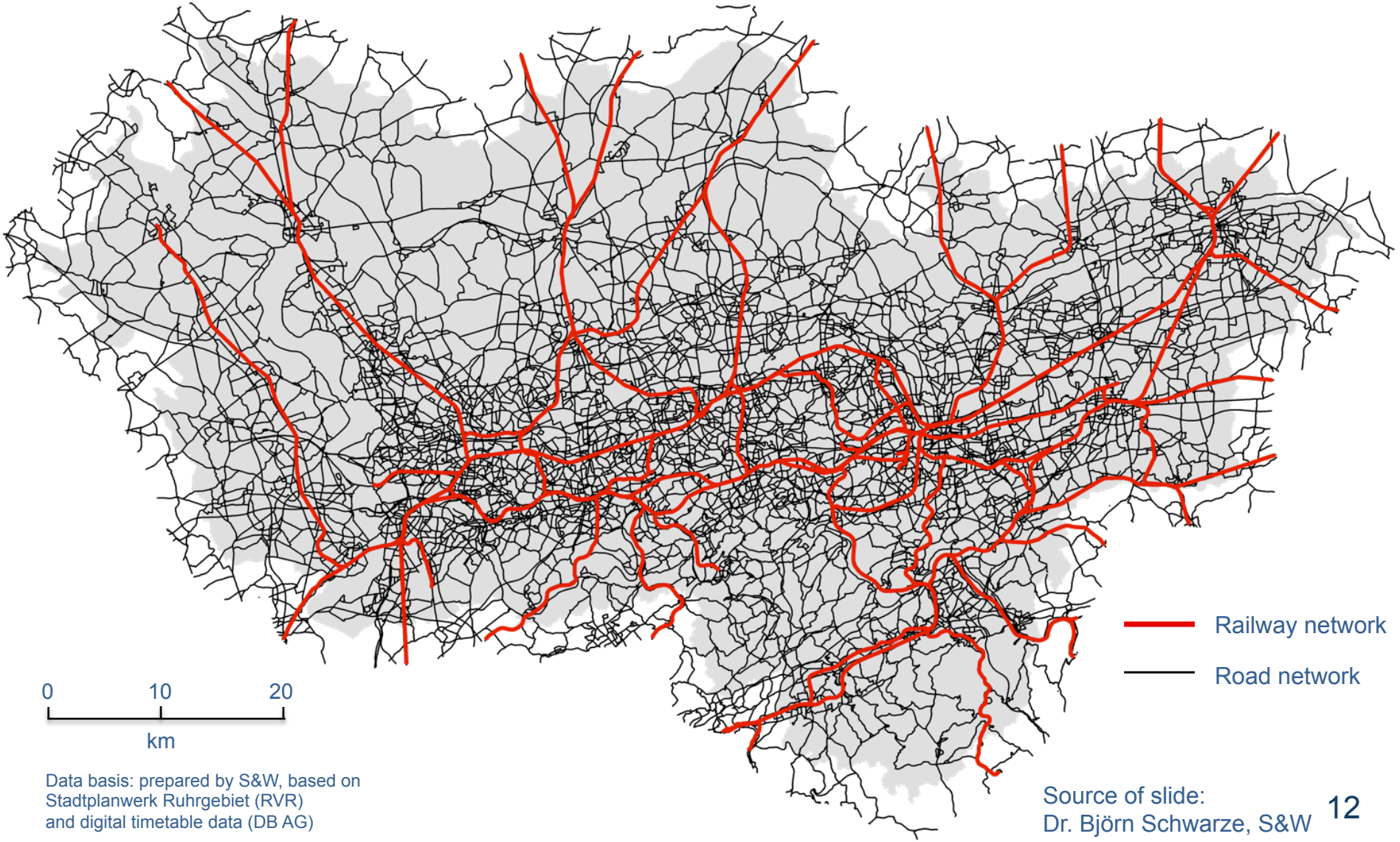
Research area
External zones



134 municipalities
(external zones)

Source of Slide: Dr. Björn Schwarze, S&W

Research area
Multi modal transport network



Data basis: prepared by S&W, based on
Stadtplanwerk Ruhrgebiet (RVR)
and digital timetable data (DB AG)

Source of slide:
Dr. Björn Schwarze, S&W

Model data

Parameters and data

1. Demographic parameters (e.g. age, sex, nationality)
2. Household parameters (e.g. composition and number of households)
3. Housing parameters (ageing of the housing stock)
4. Technical parameters (e.g. regulations on the provision of parking space, road capacity, petrol consumption per car-kilometer)
5. Monetary parameters (e.g. income parameters of households: budgets for housing, transport, savings, other purposes; cost parameters: prices in housing and transport markets, e.g. costs of petrol, car ownership, parking fees, public transport fares)
6. Preference parameters (attractiveness indicators for sites and dwellings)
7. Transport parameters (mean transport expenditures per household, parking costs, petrol prices, costs of owning a car, travel time, parking search time, car occupancy, proportion of driving license holders)

Regional data (employment, immigration, outmigration), zonal data (population, labour force, unemployment, households, land use), network data (links and lines for road network, PT, walking, cycling)

Source: Wegener, Michael (2011): The IRPUD Model, http://www.spiekermann-wegener.com/mod/pdf/AP_1101_IRPUD_Model.pdf p. 45ff

Transport submodel

Calculation

The transport submodel

- calculates 4 kinds of travel types
    1. Work trips
    2. Shopping trips
    3. Services/ social trips
    4. Educational trips
- for 4 socioeconomic groups
- for 4 different modes of transport
    1. Cars/ motorcycles
    2. Public Transport
    3. Cycling
    4. Walking

The transport submodel determines a user-optimum set of flows where car ownership, trip rates and destination, mode and route choice are in equilibrium subject to congestion in the road network.

Source: Wegener, Michael (2011): The IRPUD Model, http://www.spiekermann-wegener.com/mod/pdf/AP_1101_IRPUD_Model.pdf p. 6

Source: Wegener, Michael (2011): The IRPUD Model, http://www.spiekermann-wegener.com/mod/pdf/AP_1101_IRPUD_Model.pdf p. 16

Transport submodel

Results

The transport submodel provides information on (inter alia)

- Number of trips (per capita/per household)
- Shares of transport modes
- Trip length
- Travel time
- Travel costs
- Car ownership

- → energy consumption
- → CO2-emissions
- Further environmental effects are possible to calculate (e.g. air quality, noise)

Source: Wegener, Michael (2011): The IRPUD Model, http://www.spiekermann-wegener.com/mod/pdf/AP_1101_IRPUD_Model.pdf p. 51ff

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Scenarios
Transport scenarios

Measures		Energy prices	
		+1% p.a.	+4% p.a.
Car	**Taxes/fees (incl. regional road toll Ruhr Region*)**	A41	B41
	Increased energy efficiency of the vehicle fleet	A42	B42
	Redistribution of road space	A43	B43
	Extensive speed limits	A44	B44
	Extensive parking management	A45	B45
	Extensive carsharing offer	A46	B46
PT	PT network expansion	A51	B51
	PT increased service frequencies	A52	B52
	Introduction of a ‚citizen ticket ‘	A53	B53
Cycling	Bicycle ‚highway ‘ system in the Ruhr Region	A61	B61
	Broad promotion of cycling	A62	B62
Walking	**Broad promotion of walking**	A71	B71

*in addition, a climate zone Ruhr Region shall be modelled

= pull-measure = push-measure

Scenarios

- Baseline scenario (BAU)
- Measure scenarios for
  - pull-measures
  - push-measures
- Combined measure scenarios (pull- und push-strategies)

→ Reference year: 2010

Measures (pull)
Incentives to use environmentally friendly transport modes

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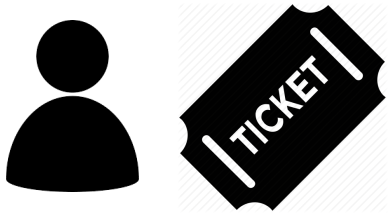
Pull measures modelled:

- Increased service frequencies in PT:
Doubling of frequencies

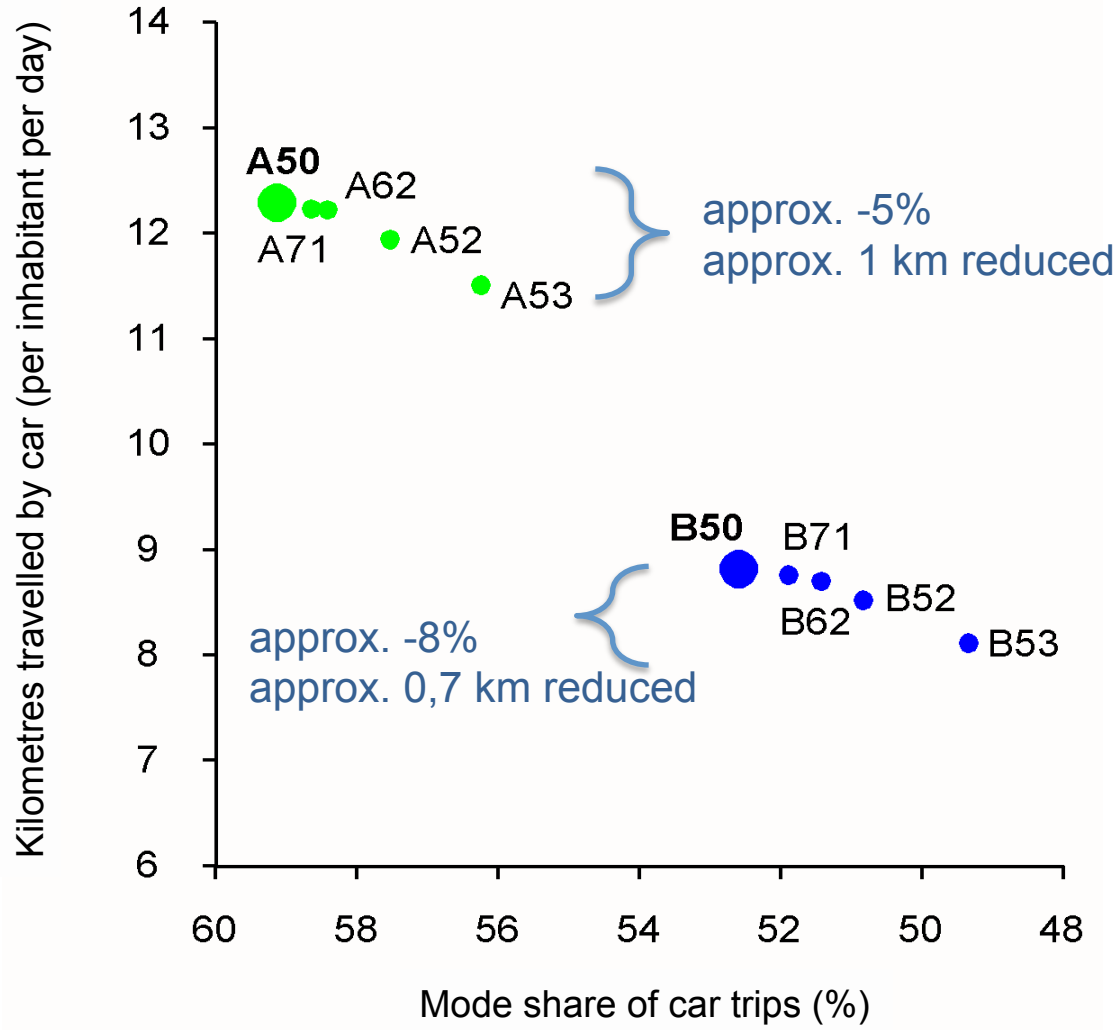
- Introduction of a ‚citizens ticket': Each household has to pay for PT a monthly fare of 70€ (35€ for low income households) (reference year 2015). PT can then be used without buying an extra ticket.



- Broad promotion of cycling:
Cycling speed increases from 10 to 15 km/h.

- Broad promotion of walking: Walking distances shorten by 25% due to better walking connections.

Measures
Incentives (pull) – preliminary results



A Low energy prices

B High energy prices

50 Baseline scenario

52 PT Increased frequencies

53 Citizens ticket

62 Faster cycle paths

71 Shorter footpath

Preliminary results

Measures (push)
Restrictions against car traffic

Push measures modelled:

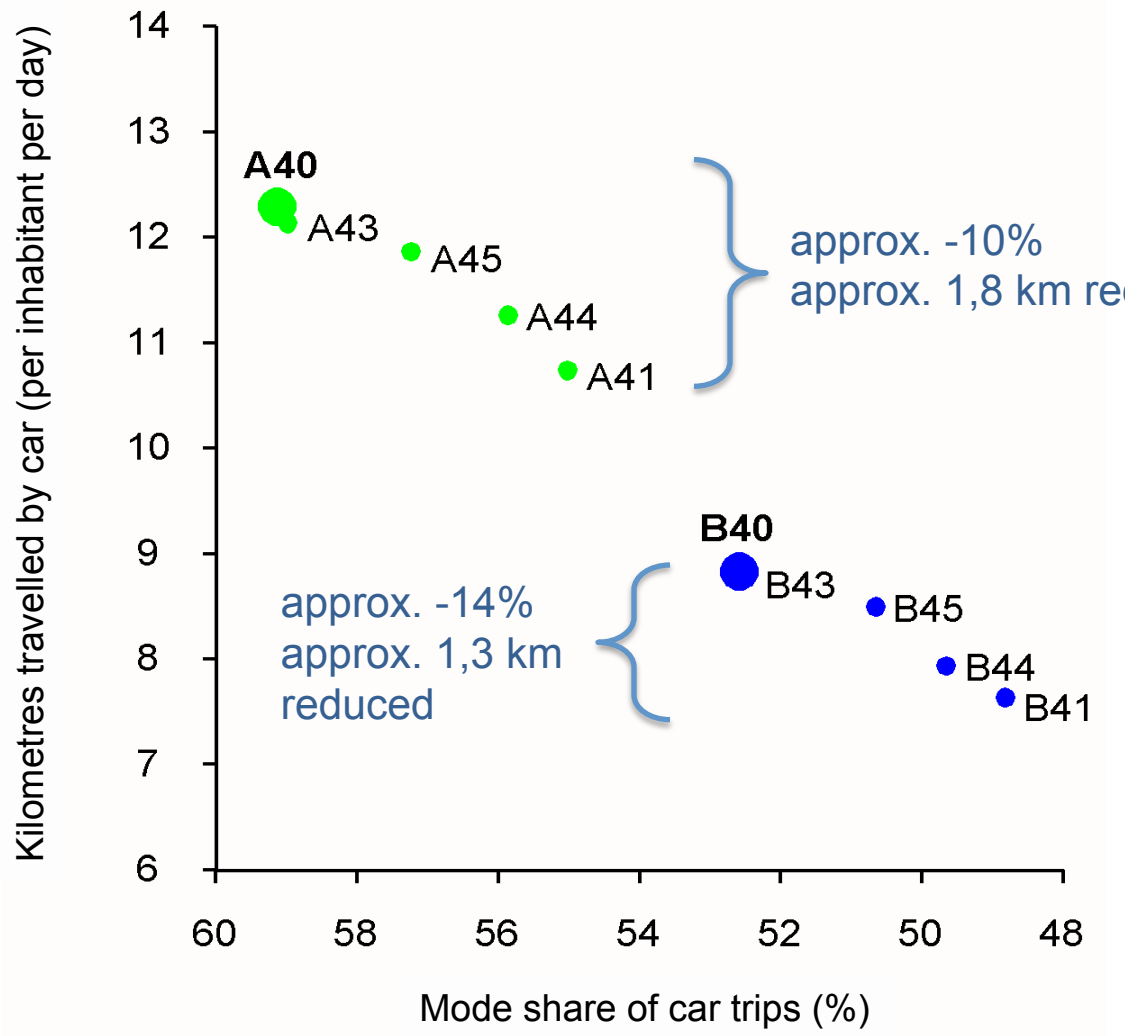
- Regional toll Ruhr Region: Annual fee of 100€ for each private car in the Ruhr Region (about 175€ in 2015).

- Redistribution of road space: All highways with 6 lanes and all urban roads with four lanes are reduced by two lanes.

- Extensive speed limits: Maximum speed of 30 km/h on all streets.

- Extensive parking management: Costs for parking increase by 1,8 for all inner-city destinations.

Measures
Restrictions (push) – preliminary results



- A Low energy prices
- B High energy prices

40 Baseline scenario
41 Regional toll
43 Redistribution
44 Speed limits
45 Parking management

Preliminary results

Measures
Combined strategies (push & pull)

- A81/B81: Regional toll Ruhr Region (A41/B41)
  Citizens ticket (A53/B53)

„Costs“

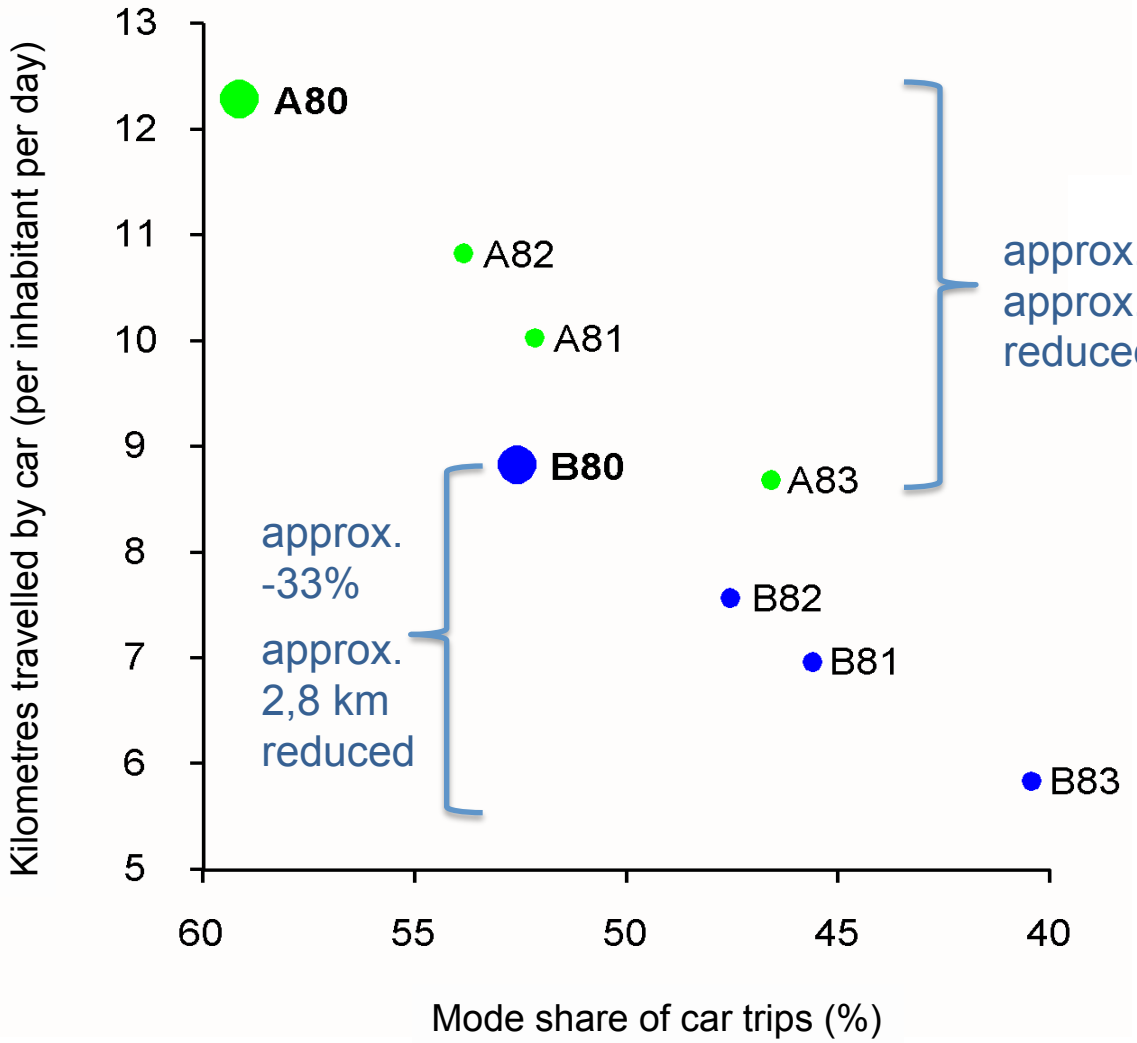
- A82/B82: Speed limits (A44/B44)
  Increased frequencies (A52/B52)

„Time“

- A83/B83: Regional toll Ruhr Region (A41/B41)
  Speed limits (A44/B44)
  Increased frequencies (A52/B52)
  Citizens ticket (A53/B53)

„Costs & time“

Measures
Combined strategies (push & pull) – preliminary results



A Low energy prices

B High energy prices

80 Baseline scenario

81 Regional toll 41
Citizens ticket 53

82 Speed limits 44
Increased frequencies 52

83 Regional toll 41
Speed limits 44
Increased frequencies 52
Citizens ticket 53

Preliminary results

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Conclusions

- There are notable reduction potentials, if land and transport planning measures are implemented in a combined and extensive manner in the entire Ruhr Region
- Push measures are more successful then pull measures
- There are additional reduction potentials if several measures are implemented in combination

Next steps

1. Completion of the model for the time period 1990-2050
2. Modeling of single measures and measure combinations
3. Backcasting scenarios
4. Analysis and discussion of results

Final Conference
3 November 2016, Essen

Thank you
for your attention!

Save the date !

Konferenz

Die Energiewende regional gestalten

3. November 2016

Essen
SANAA-Gebäude

Weitere Informationen erhalten Sie in den nächsten Wochen.

Die Kommunen des Ruhrgebietes stehen vor der anspruchsvollen Aufgabe, die Energiewende lokal umzusetzen und einen Beitrag zu den Klimaschutzzielen auf Bundes- und Landesebene zu leisten. Die regionale Gestaltung der Energiewende muss vor dem Hintergrund einer sich tiefgreifend verändernden Wirtschaftsstruktur, Raumnutzung, Altersstruktur und dem sich wandelnden Sozialgefüge in der Region erfolgen.

Das *„Rahmenprogramm zur Umsetzung der Energiewende in den Kommunen des Ruhrgebiets"* befasste sich drei Jahre lang damit, die unterschiedlichen Problemlagen zu analysieren und geeignete Lösungsansätze und Handlungsoptionen für regionale und kommunale Akteure zu identifizieren. Die Analysen aus den Teilprojekten des Rahmenprogramms formulieren eine Zielvision für die Umsetzung der Energiewende in der Region und zeigen richtungsweisende Entscheidungspunkte auf dem Weg dorthin auf. **Diese Bausteine einer Energiewende-Roadmap** werden auf der Konferenz präsentiert und mit Stakeholdern aus der Region diskutiert.

www.energiewende-ruhr.de

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