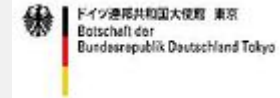




ドイツ語圏日本学術振興会研究者同窓会



Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Transport and Mobility – Challenges for the Future
(September 13-15, 2010, Tokyo)

Land Use Pattern and Transport for a Post Carbon Society

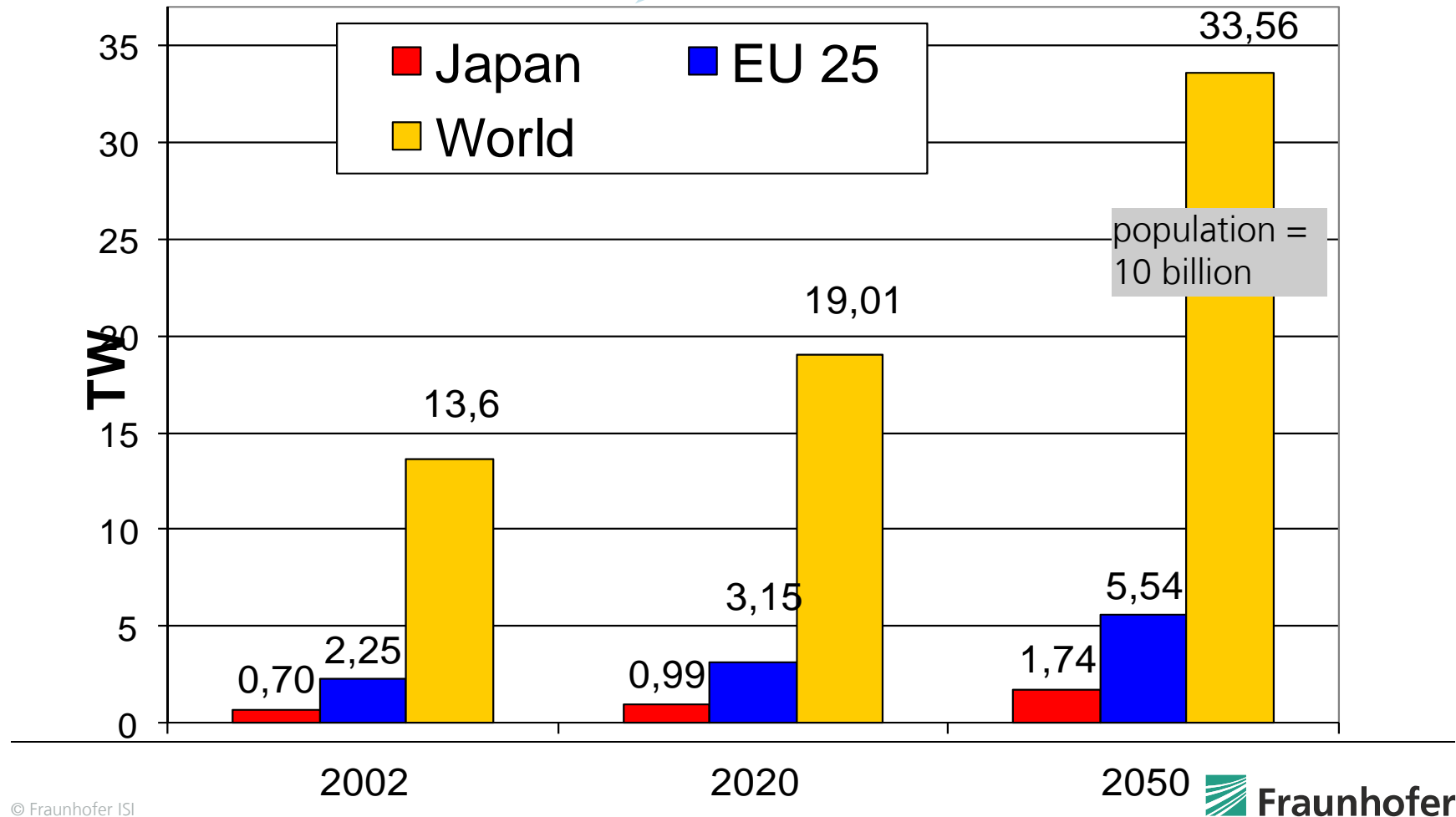
Dr. Stefan Klug
Fraunhofer ISI
Institute Systems and Innovation Research
(Karlsruhe)

INTRODUCTION

taken from presentation from
Arnulf Jäger-Waldau at Symposium
„Urban Planning – Sustainable Cities“
(12th Sept. 2005)



Total Primary Energy Supply



INTRODUCTION



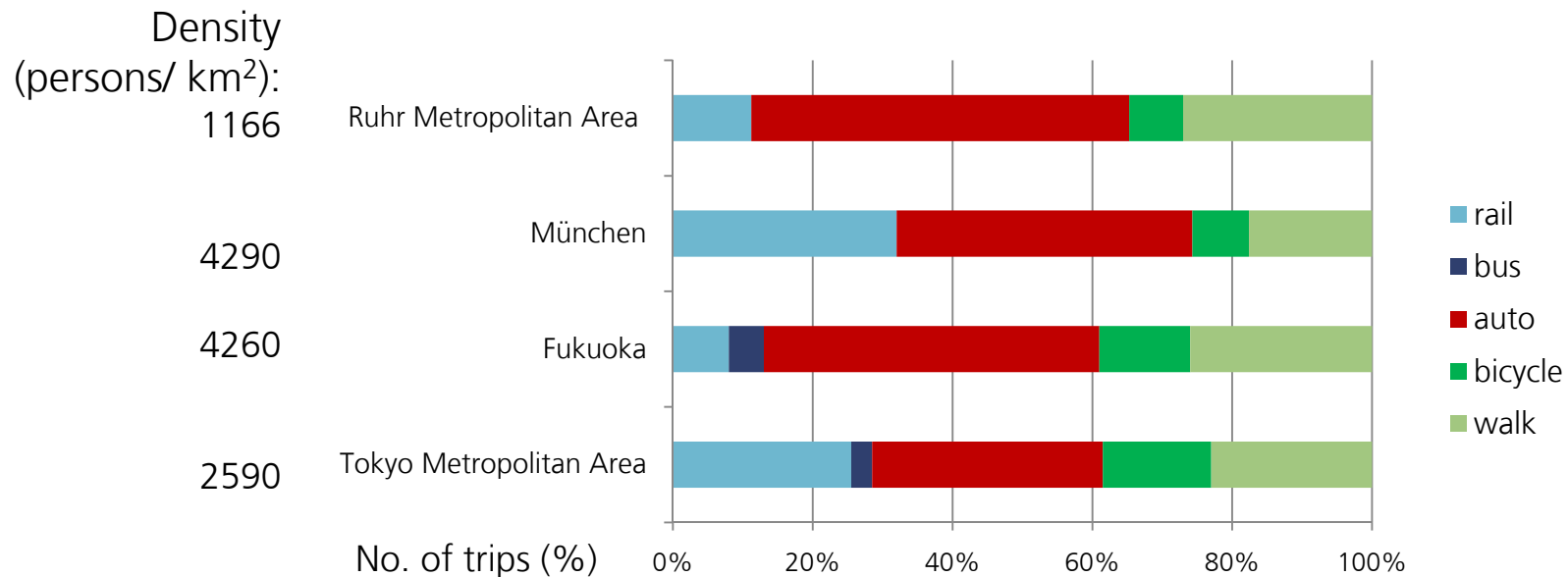
Rise of the modern city is built on mobility
⇒ evolution from medieval city to sprawling agglomerations has only be possible with first the **railway** and later the **automobiles**
(Wegener 2010)



INTRODUCTION



⇒ transport is arguably the single biggest issue for environmental debates relating to **urban form** (Jenks/ Burton/ Williams 1996)



INTRODUCTION



Land use pattern

Transport

⇒ accounts for 1/3 of all final energy consumption in the EU
 ...and its share is growing

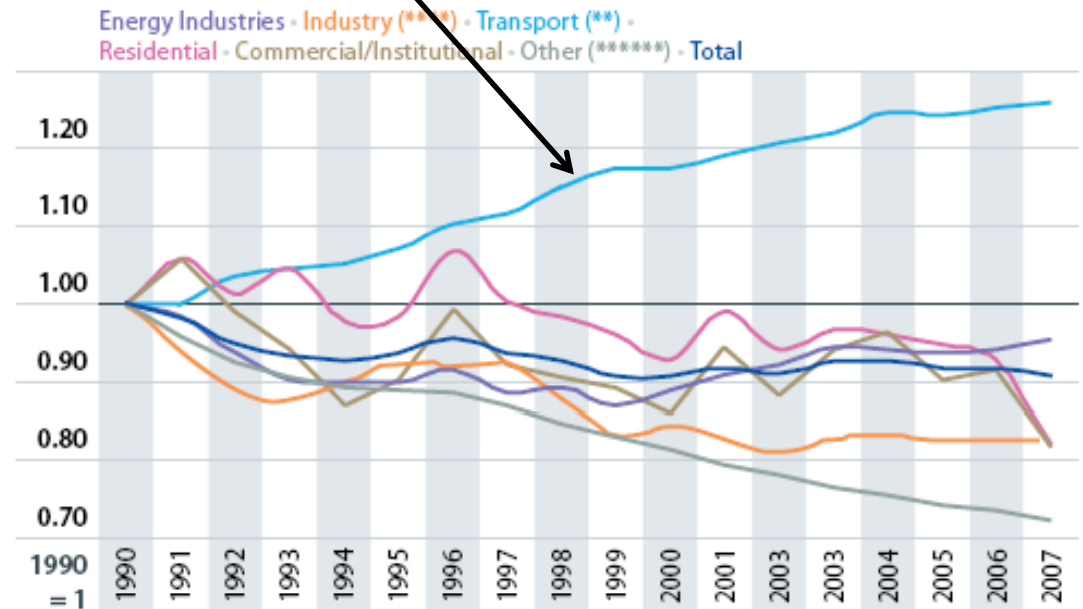
land resources for renewable energy

- bioenergy (biomass)
- hydropower
- windpower
- solarpower
- geothermie
- etc.

urban form

Urban Design (bldg. form etc.)

density



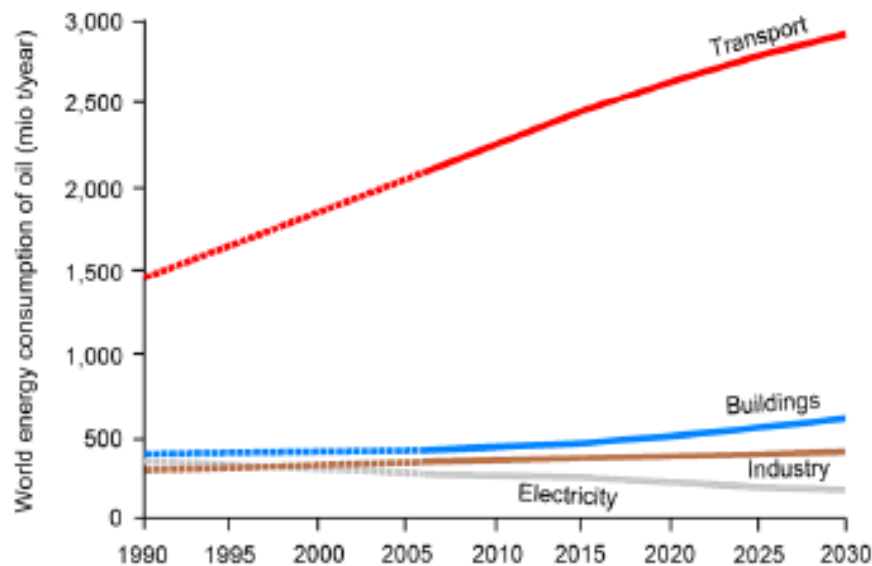
GHG emissions by sector (EU-27)
 (Mio tonnes CO₂ equivalent)

ENVIRONMENTAL CONSEQUENCES: ENERGY USE



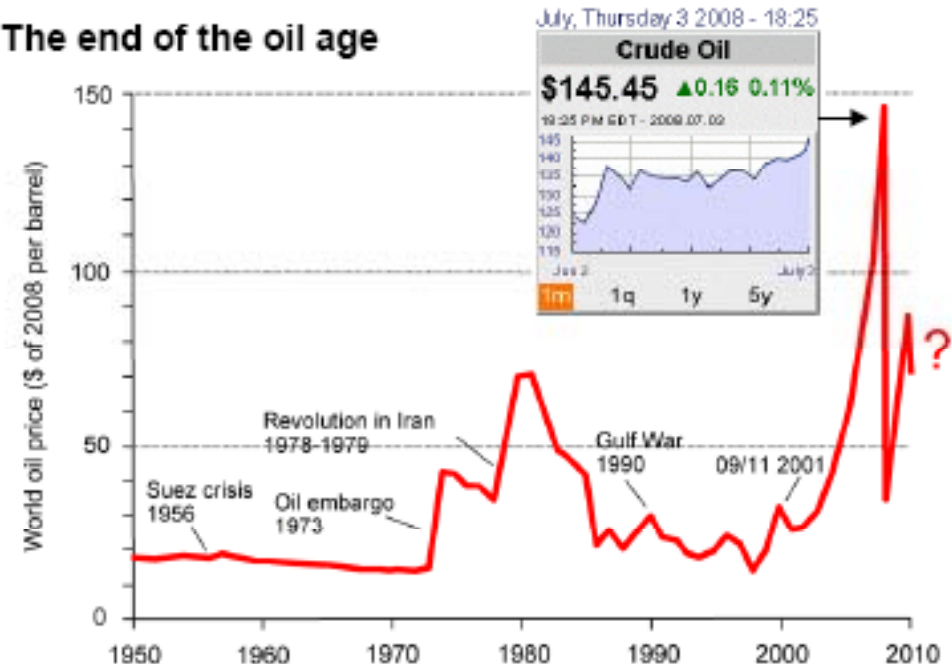
Growing consumption \Rightarrow „Peak Oil“

World energy consumption of oil (1990-2030)



Quelle: OECD/IAE (2008, 506)

The end of the oil age



18

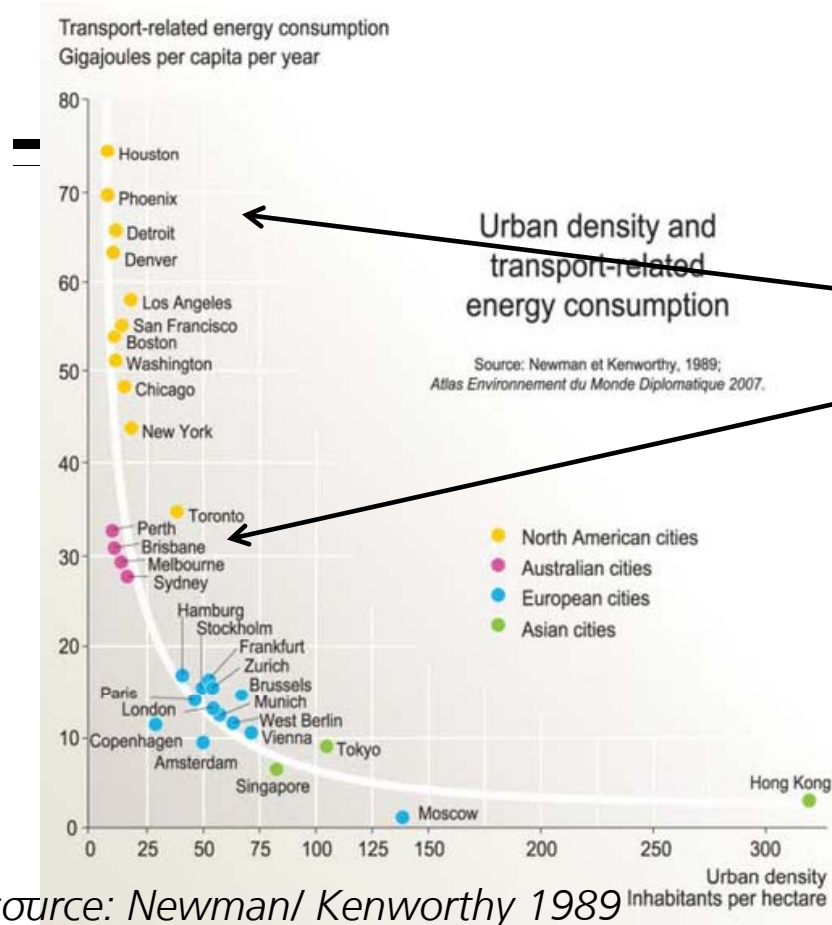
source: Wegener 2010

© Fraunhofer ISI

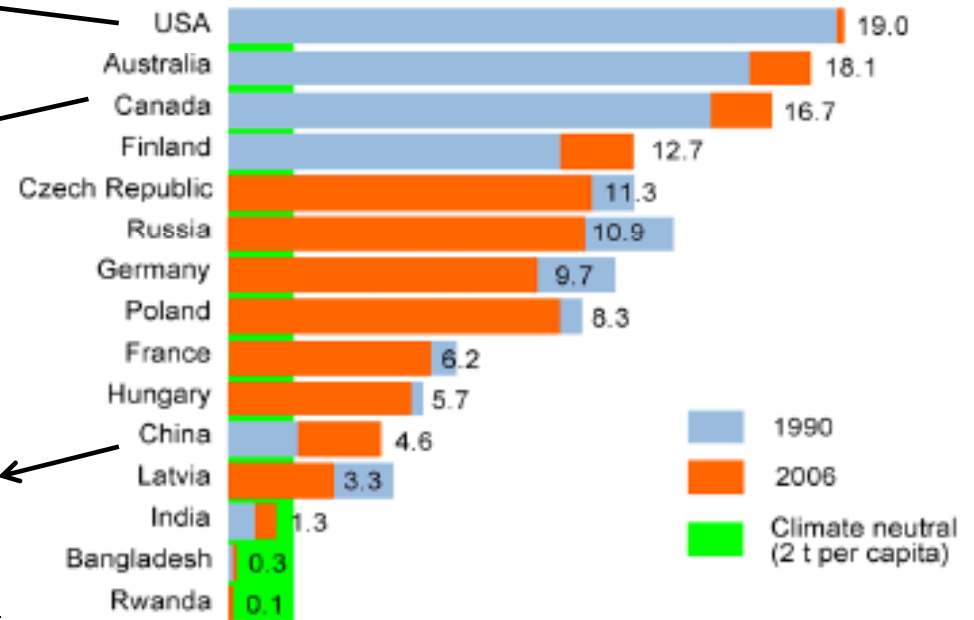
ENVIRONMENTAL CONSEQUENCES



Urban density and emissions



CO₂ emissions per capita 1990-2006 (t)

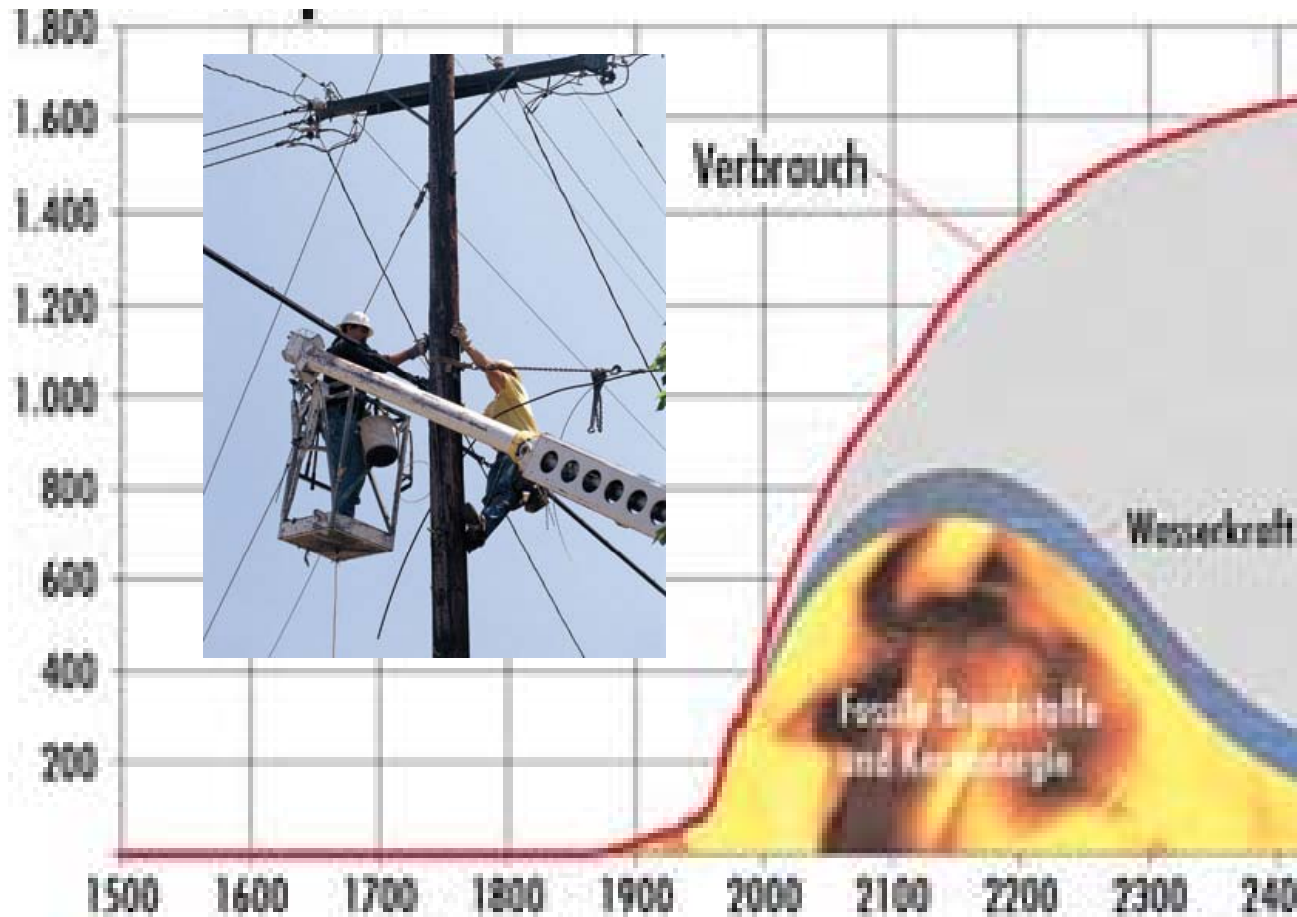


source: Newman/ Kenworthy 1989

ENVIRONMENTAL CONSEQUENCES



World Energy Demand (Exajoule)

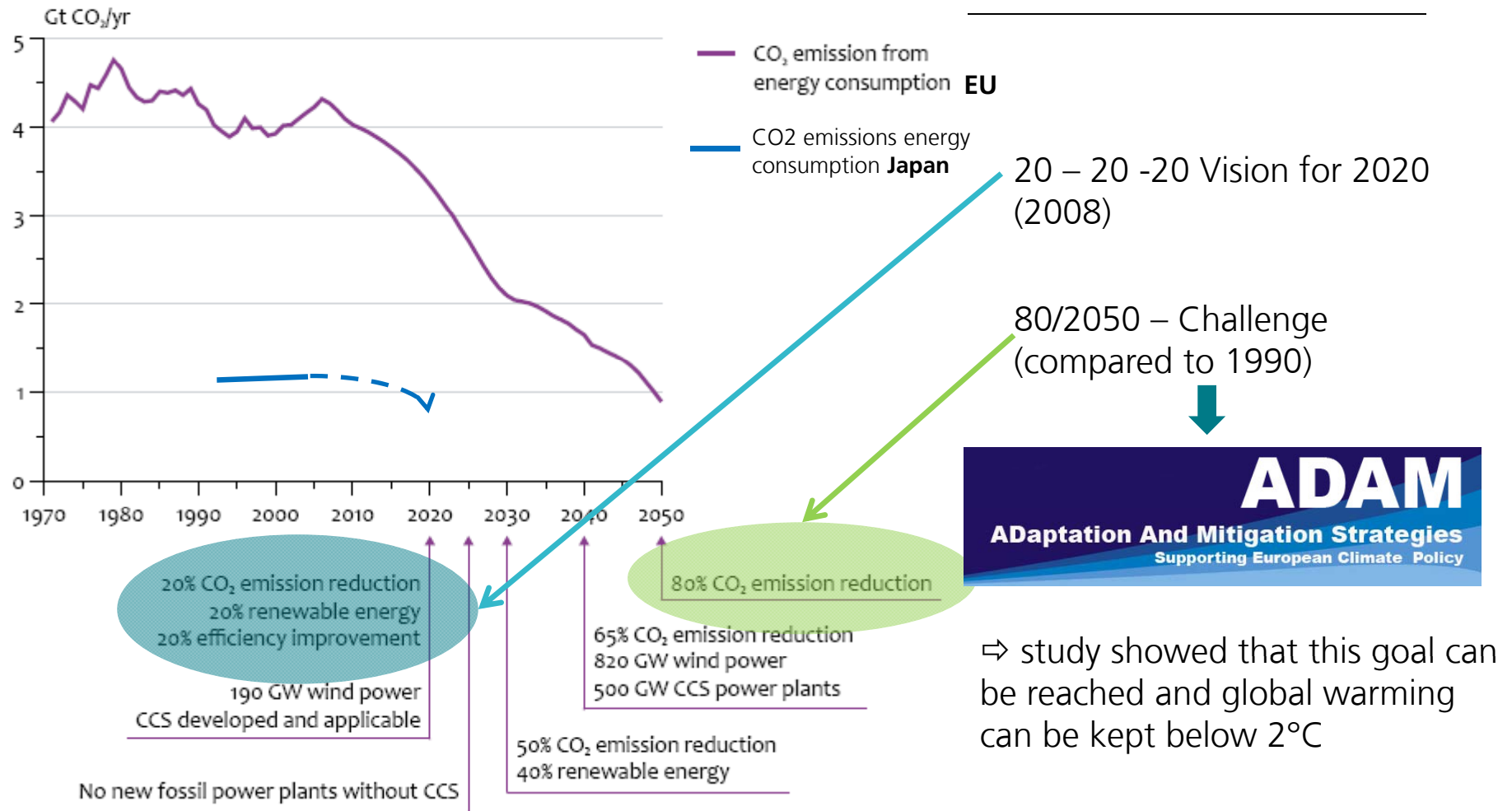


Research needs to investigate future pathways to a post carbon society



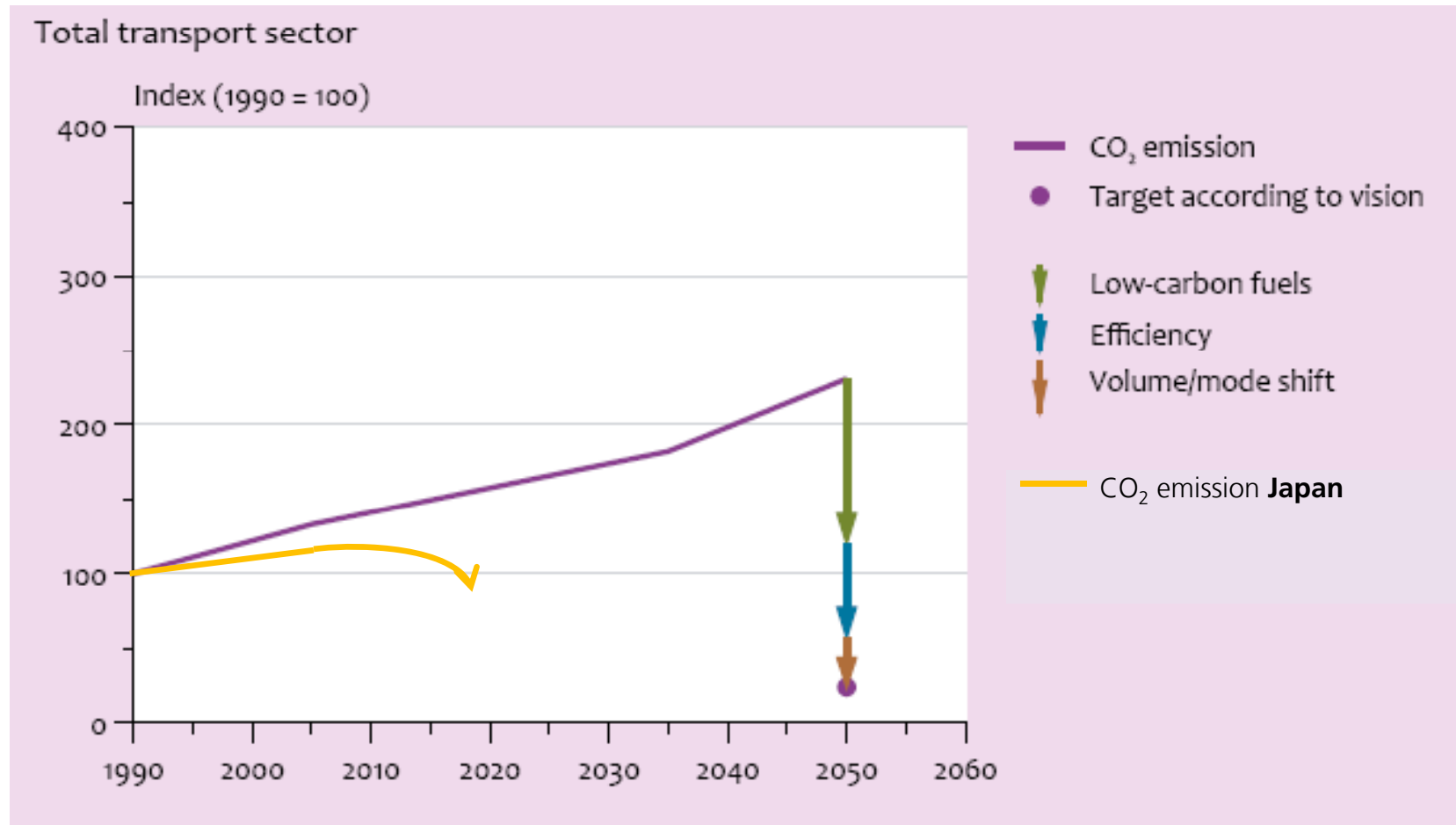
- replacing conventional energy sources
- reducing GHG emissions

GOALS+MEASURES - TOTAL



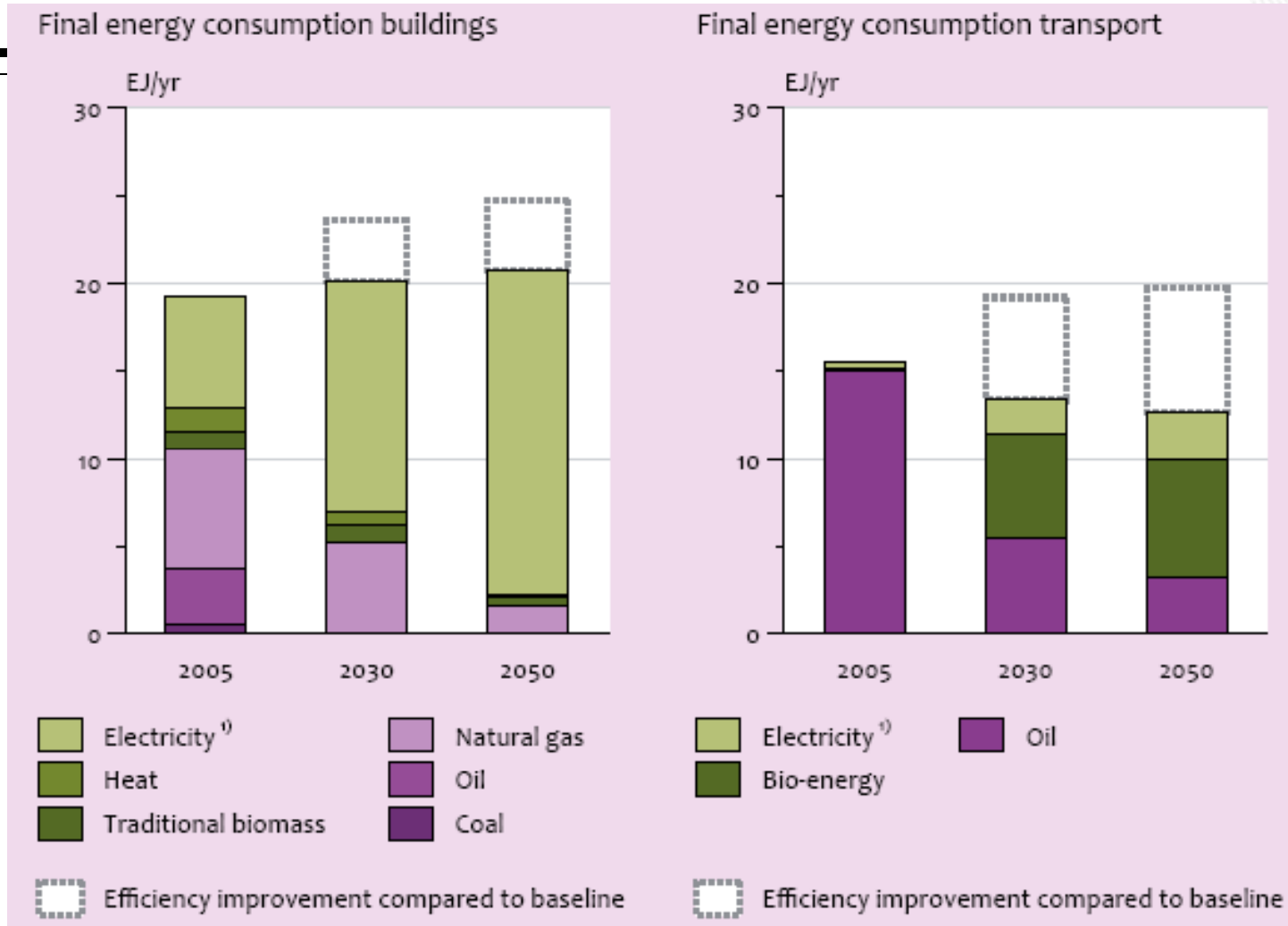
source: NEEA/SRC 2009, p.59

GOALS+MEASURES - TRANSPORT



sources: NEEA/SRC 2009, p.73, Ministry of Environment Japan

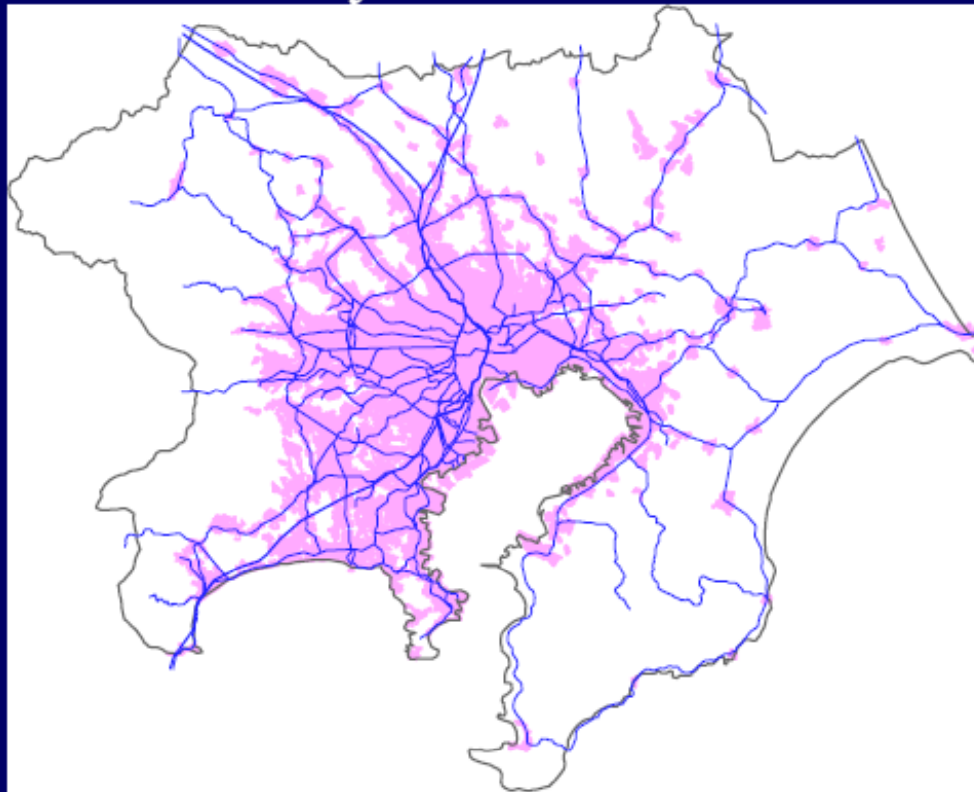
GOALS+MEASURES – BUILDINGS+TRANSPORT



sources: NEEA/SRC 2009, p.54



Railway-Oriented Land Use: Railway Network and DID



DID: Densely Inhabited District, population density over 4,000 persons/km² and resident population of over 5,000.

high railway share
in Munich and
Tokyo due to the
rail-oriented
land use pattern

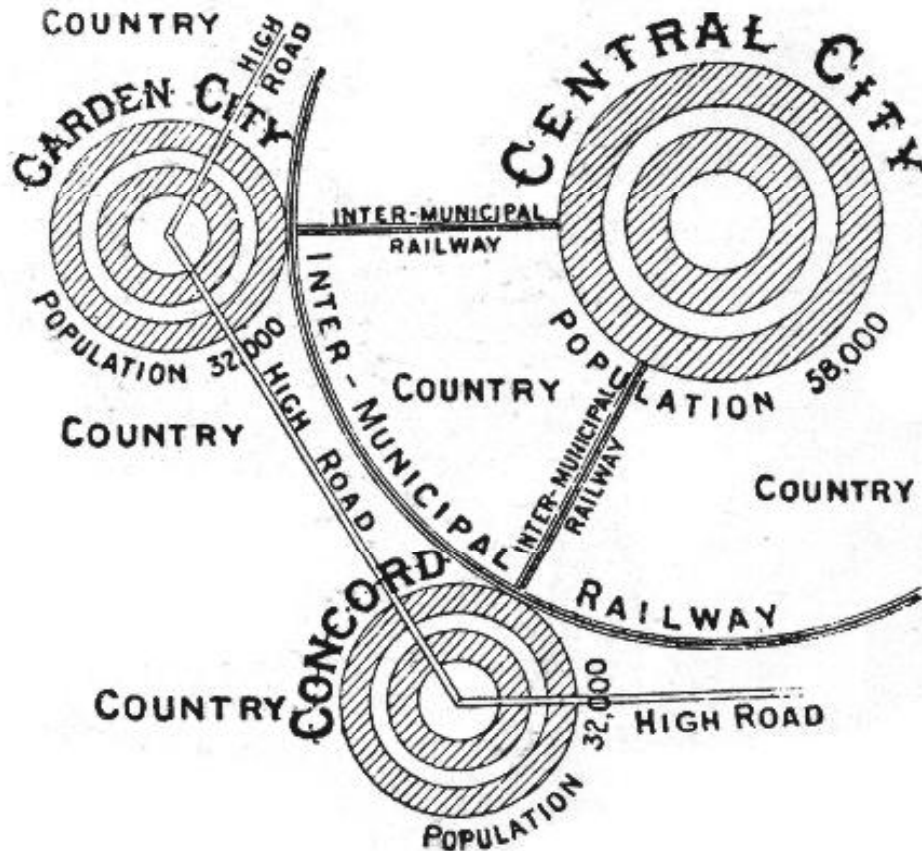
⇒ *Transit Oriented
Development +
Compact City*
promotes use of
more energy
efficient modes

LAND USE AND TRANSPORT – CONCEPTS



Local and regional planning and land use conceptsoften promotes separation of functions

Ex. Tokyo



Ebenezer Howard's Garden City concept in 1898



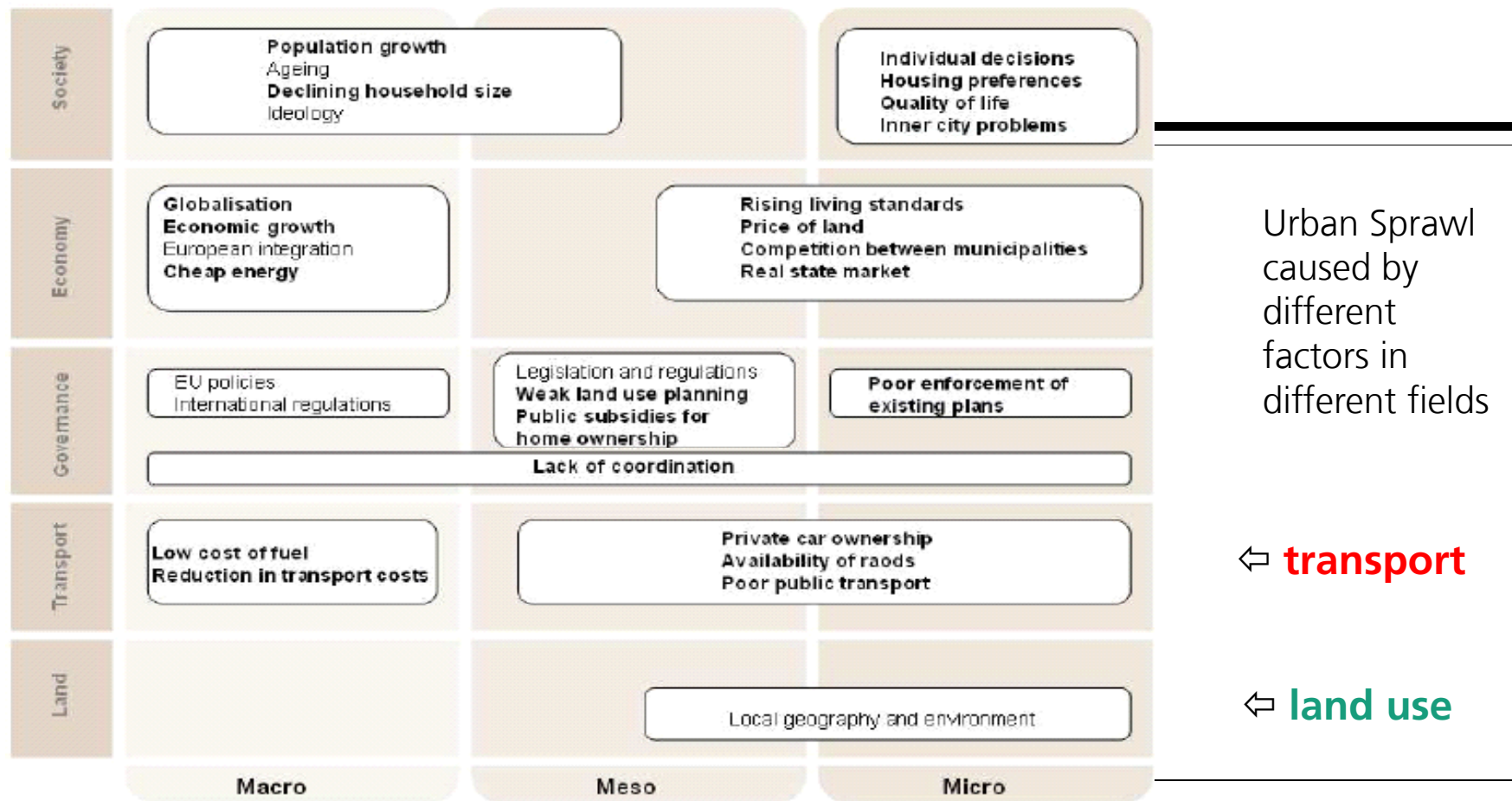
⇒ Fostering suburbanisation and mobility demand



LAND USE AND TRANSPORT – TRENDS



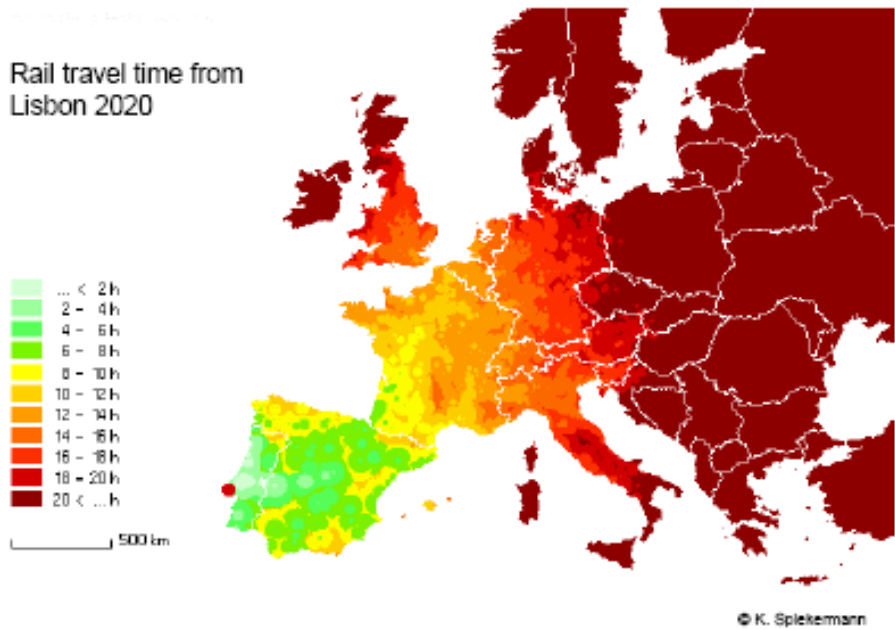
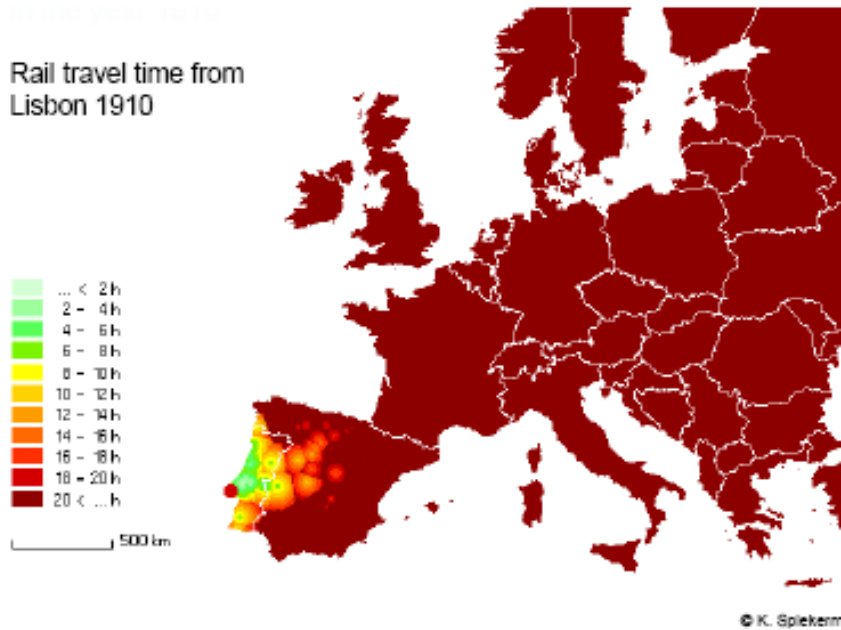
Main drivers of urban sprawl in Europe (ESPON 2009)



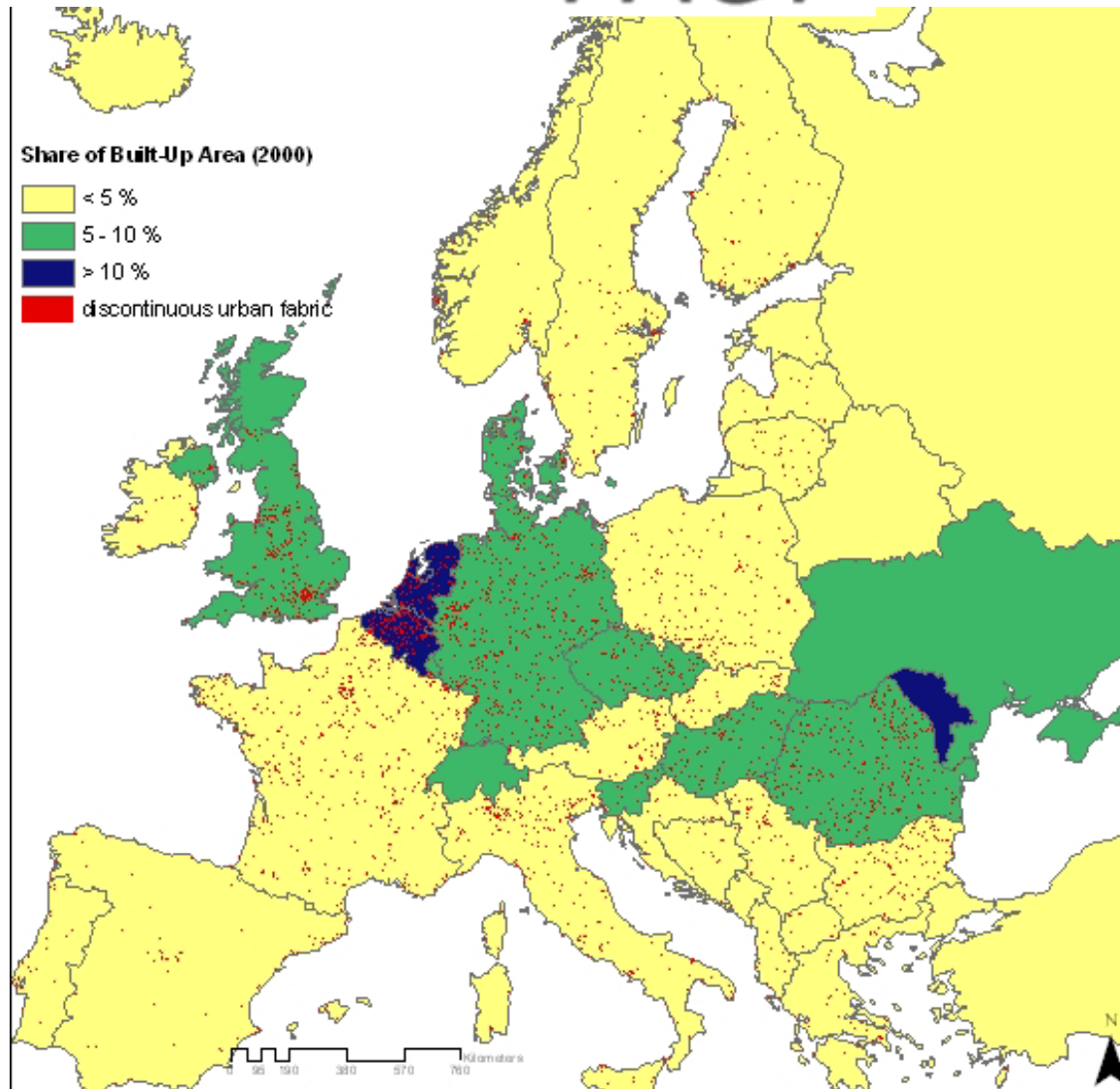
LAND USE AND TRANSPORT –TRENDS



Huge increase in mobility over time - worldwide



source: Wegener 2010



„Pathways for Carbon Transitions“

The PACT project aims at shaping what a sustainable post-carbon society would look like and how we could reach it within the next 50 years.

⇒ most urbanised countries (blue) are often characterised by sprawl (= discontinuous urban fabric))

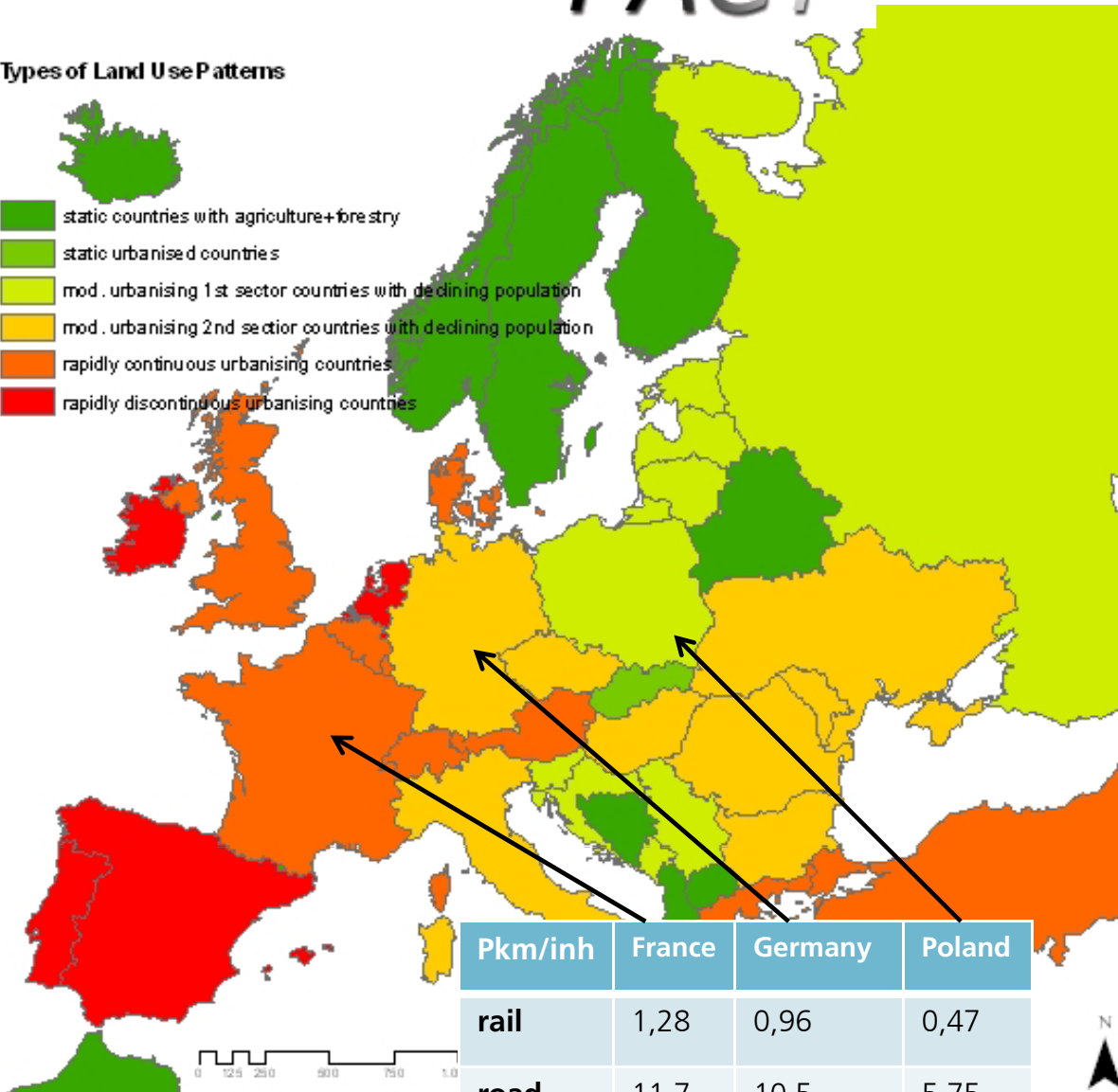
EU-PROJECT

PACT



Types of Land Use Patterns

- static countries with agriculture+forestry
- static urbanised countries
- mod. urbanising 1st sector countries with declining population
- mod. urbanising 2nd sector countries with declining population
- rapidly continuous urbanising countries
- rapidly discontinuous urbanising countries



Pkm/inh	France	Germany	Poland
rail	1,28	0,96	0,47
road	11,7	10,5	5,75

Typology of countries according to urban structure and demographic situation

⇒ from northeast to southwest:

the rather static and less urbanised countries turn into red indicating rapid (discontinuous) urban development

datasource: CORINE

Sub-Type		Solar	Wind	Bioenergy
1.1	static countries with > 60% natural land	x	X	X
1.2	static countries with > 40% agricultural land		X	x
2	static urbanised countries	X	x	
3.1	moderate urbanising countries with > 60% natural land	x	X	X
3.2	moderate urbanising countries with > 40% agricultural Land	x	X	x
4	moderate urbanising countries	x	x	x
5.1	rapidly continuous urbanising countries with > 60% natural land	x	X	X
5.2	rapidly continuous urbanising countries with > 40% agricultural Land	x	X	
5.3+5.4	rapidly continuous urbanising countries (urban area dominated)	X	x	
6	rapidly discontinuous urbanising countries	X	x	

solar technologies are generally suitable for built-up areas and sunny regions

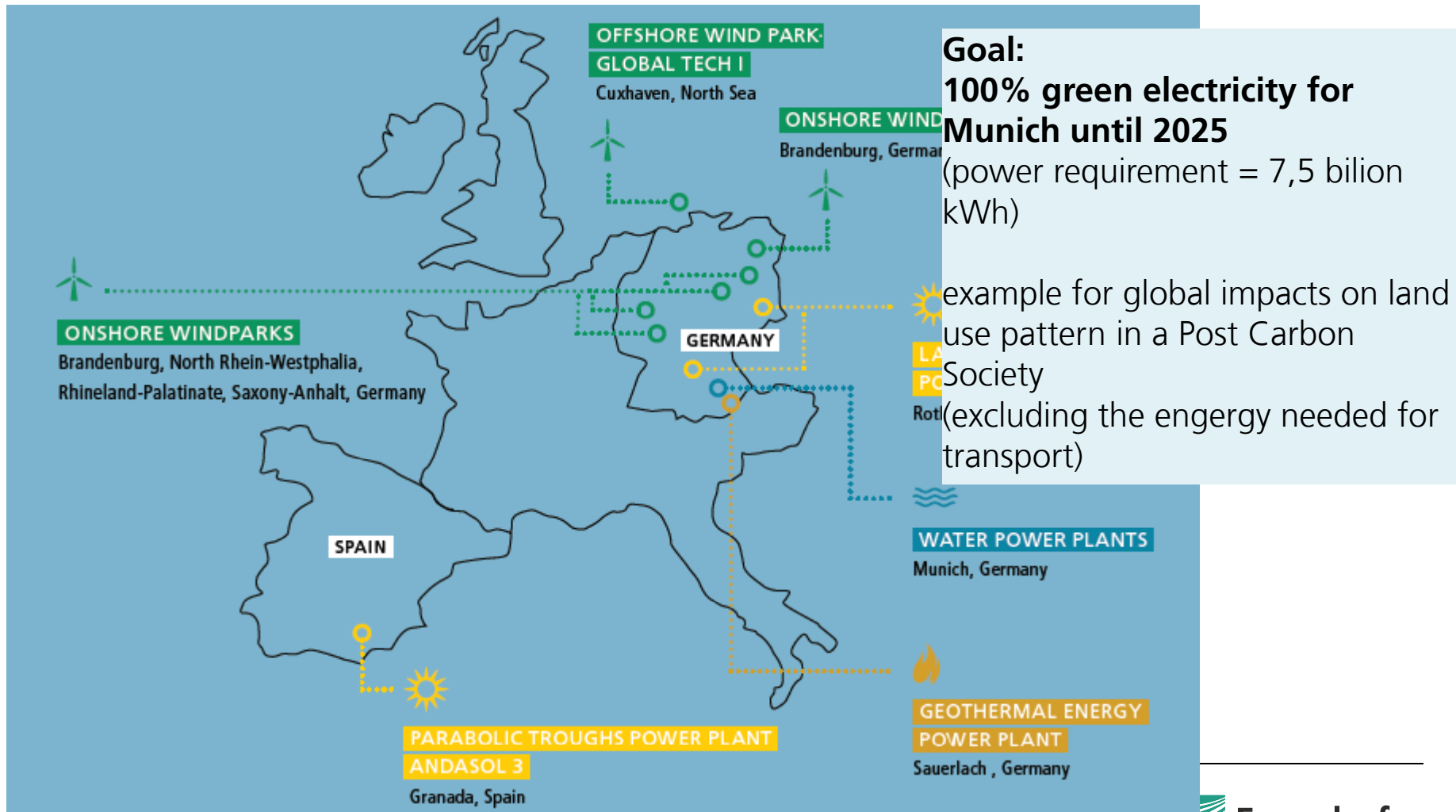
wind energy is well suited for agriculture and natural land because it allows multi-purpose land use

bioenergy may be produced from existing forests and on agriculture land (but with competition to crops and livestock products)

Table 5: Renewable energy sources and land-types

(Large X indicates first best options while small x indicates second best options to collect diffused renewable energy of the given land-type.)

EX. MUNICH CITY UTILITIES (SWM)



THANK FOR YOUR ATTENTION

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