

Disrupting Mobility: Decarbonising Transport?

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and

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Kreuz
München-Nord
2500 m
Barching-Süd
1000 m

München, St. M., Nord
Salzburg

519.8

519.8



Das MICRO SMART GRID auf dem EUREF-Campus



„ Ein Smart Grid ist ein Stromnetz, in dem unterschiedliche Energiequellen, Verbraucher sowie stationäre und mobile Speicher intelligent verknüpft werden. Da diese Verknüpfung auf dem EUREF-Campus einen räumlich abgegrenzten Bereich betrimt, wird hier von einem „Micro“ Smart Grid gesprochen. Dies ist jedoch kein autarker Mikrokosmos, denn es besteht weiterhin Anschluss zum öffentlichen Stromnetz.“



S JULIUS-LEBER-BRÜCKE



Windrad	Photovoltaik
Netzpufferbatterie	Brennstoffzelle & Stirling Generator
EL Energieleitwarte	Klimatechnik - Gasmeter
Trafo	Daten-Verbindung
Windmessanlage	Parkplatz mit e-Ladestation

MICRO SMART GRID STAND: MÄRZ 2012

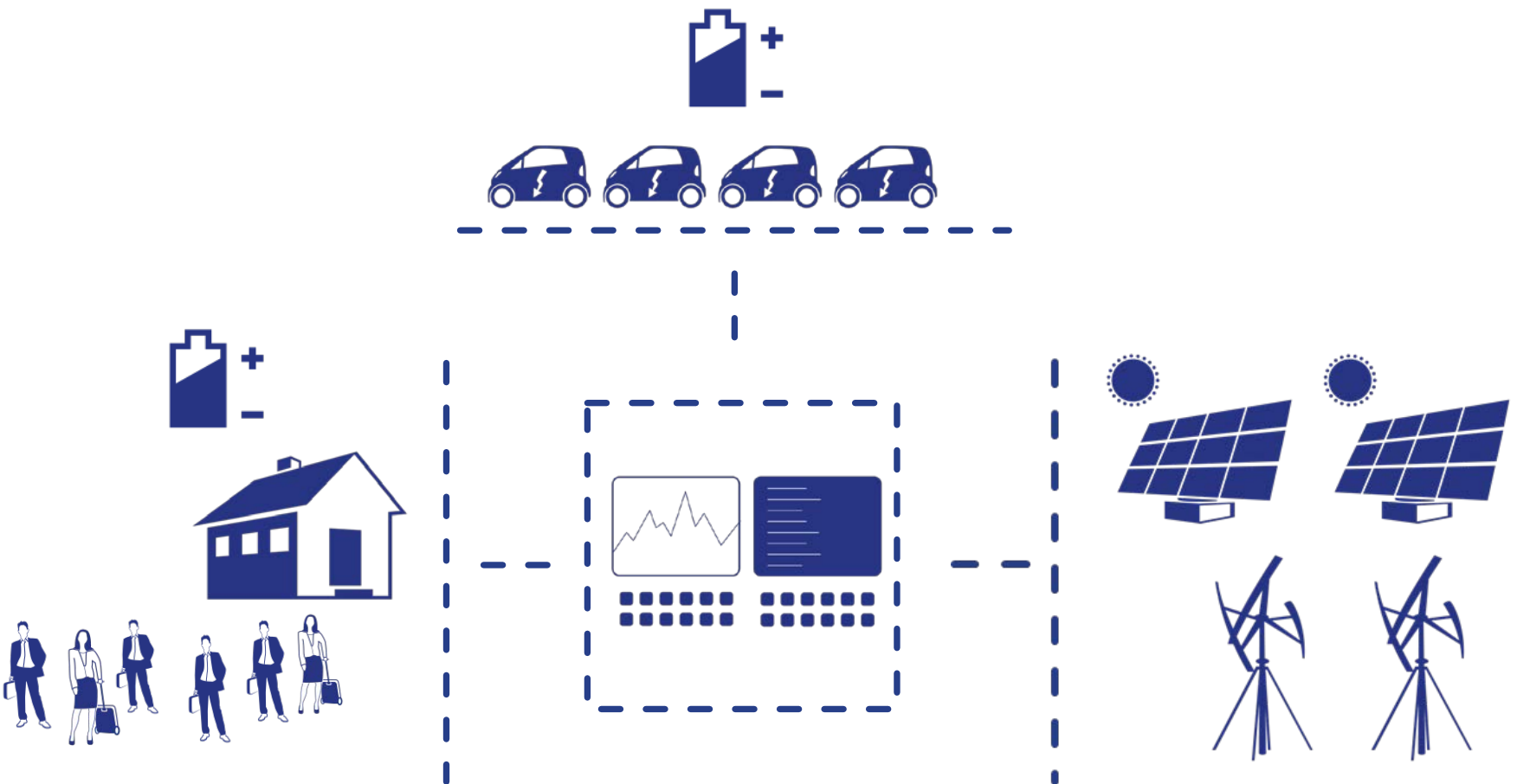


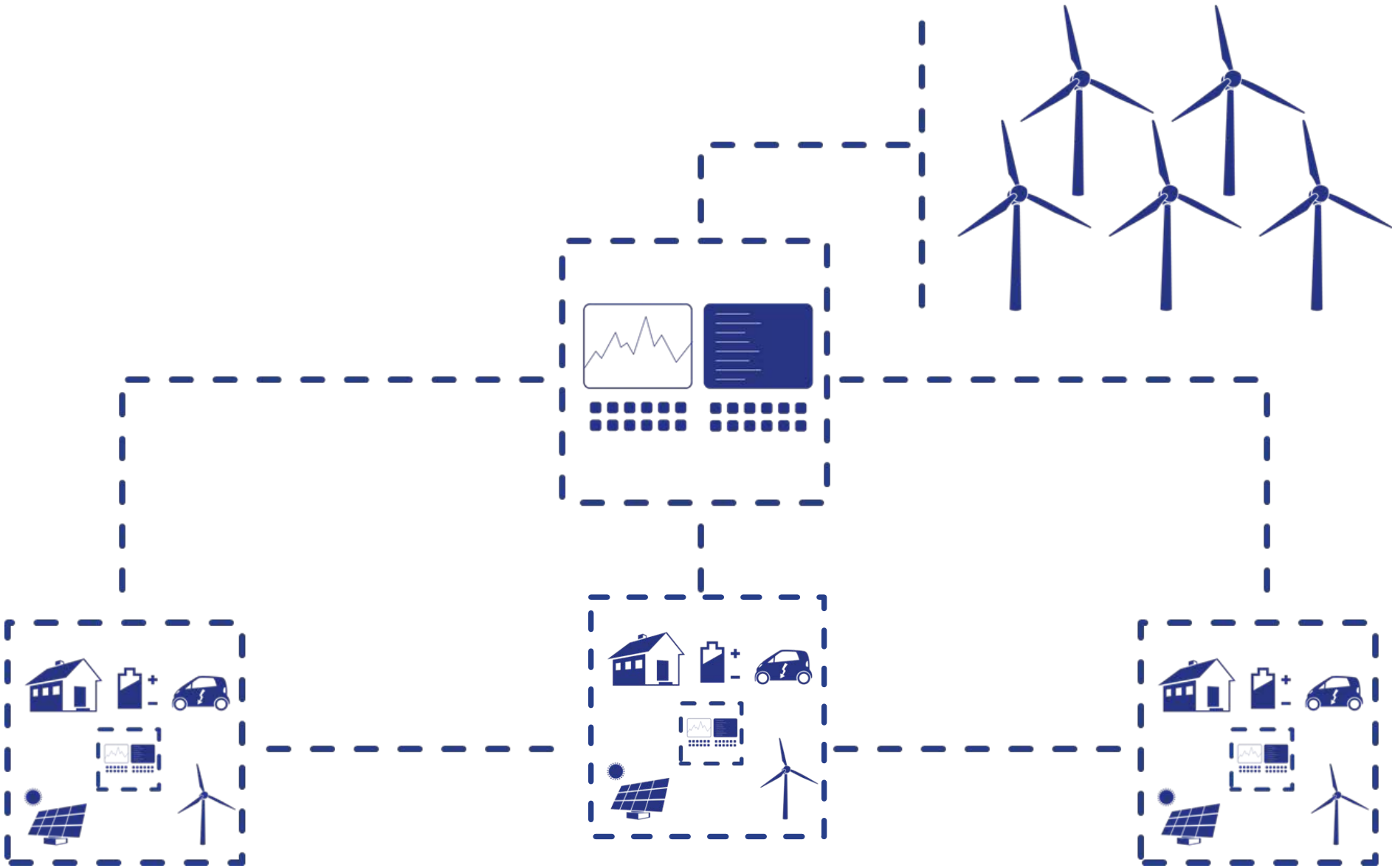
„ Der steigende Anteil dezentral produzierter regenerativer Energie stellt an das öffentliche Stromnetz hohe Anforderungen. Der schwankend vor Ort erzeugte Grünstrom sollte daher möglichst vor Ort verbraucht werden und zwar in einem Maße, das die Schwankungen am Netzanschlusspunkt möglichst gering hält. Dies betrifft sowohl Einspeisung und Bezug. Daher gewinnt die Integration von Speichern als Puffer immer größere Bedeutung. Über intelligente Steuerung können dann auch die Batterien der Elektroautos einbezogen und damit die Elektromobilität ökologisch und ökonomisch sinnvoll ausgestaltet werden.“

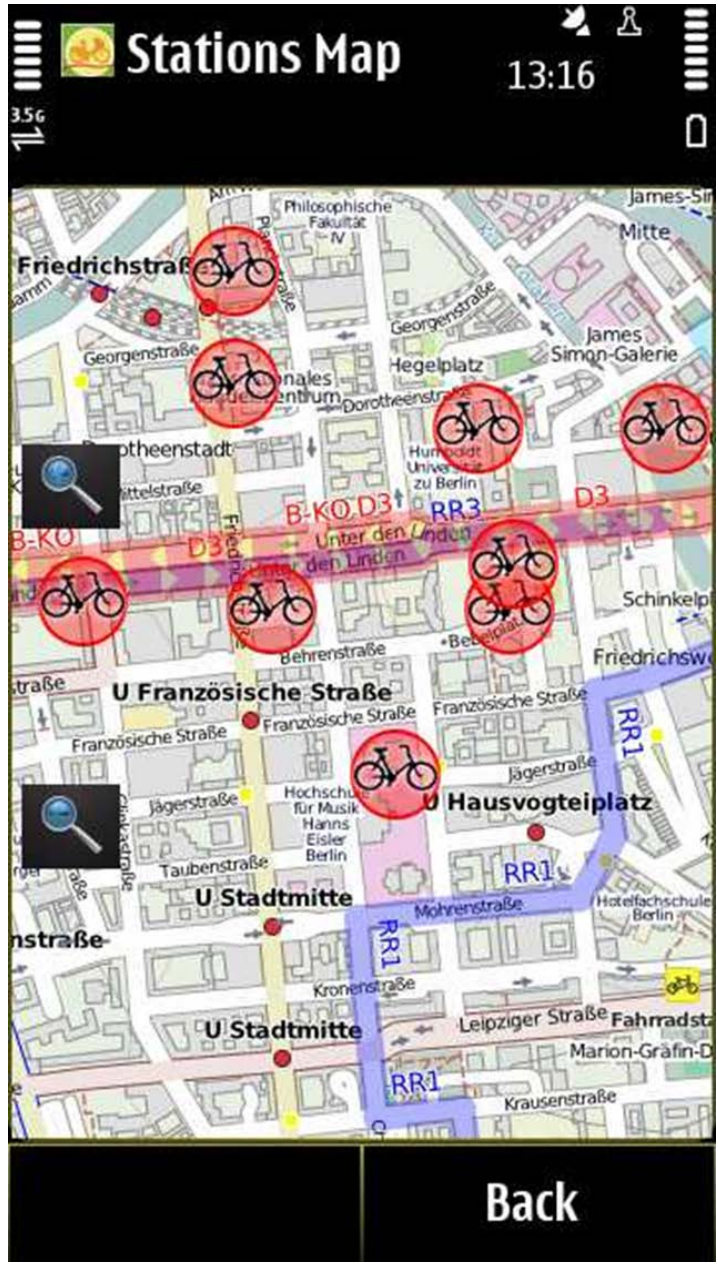














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F DB 8989

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B SB 4460



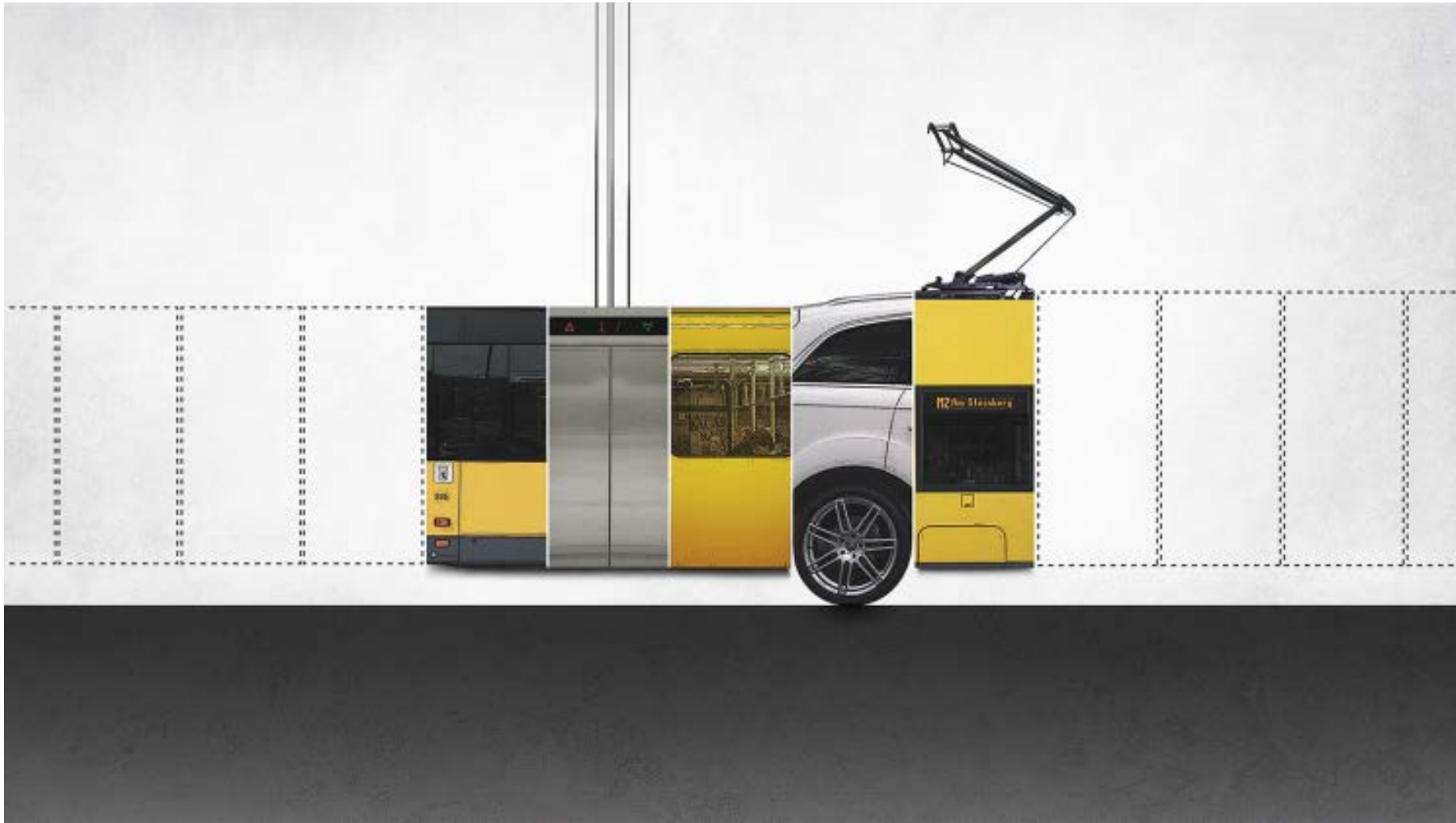


MOMMSENECK

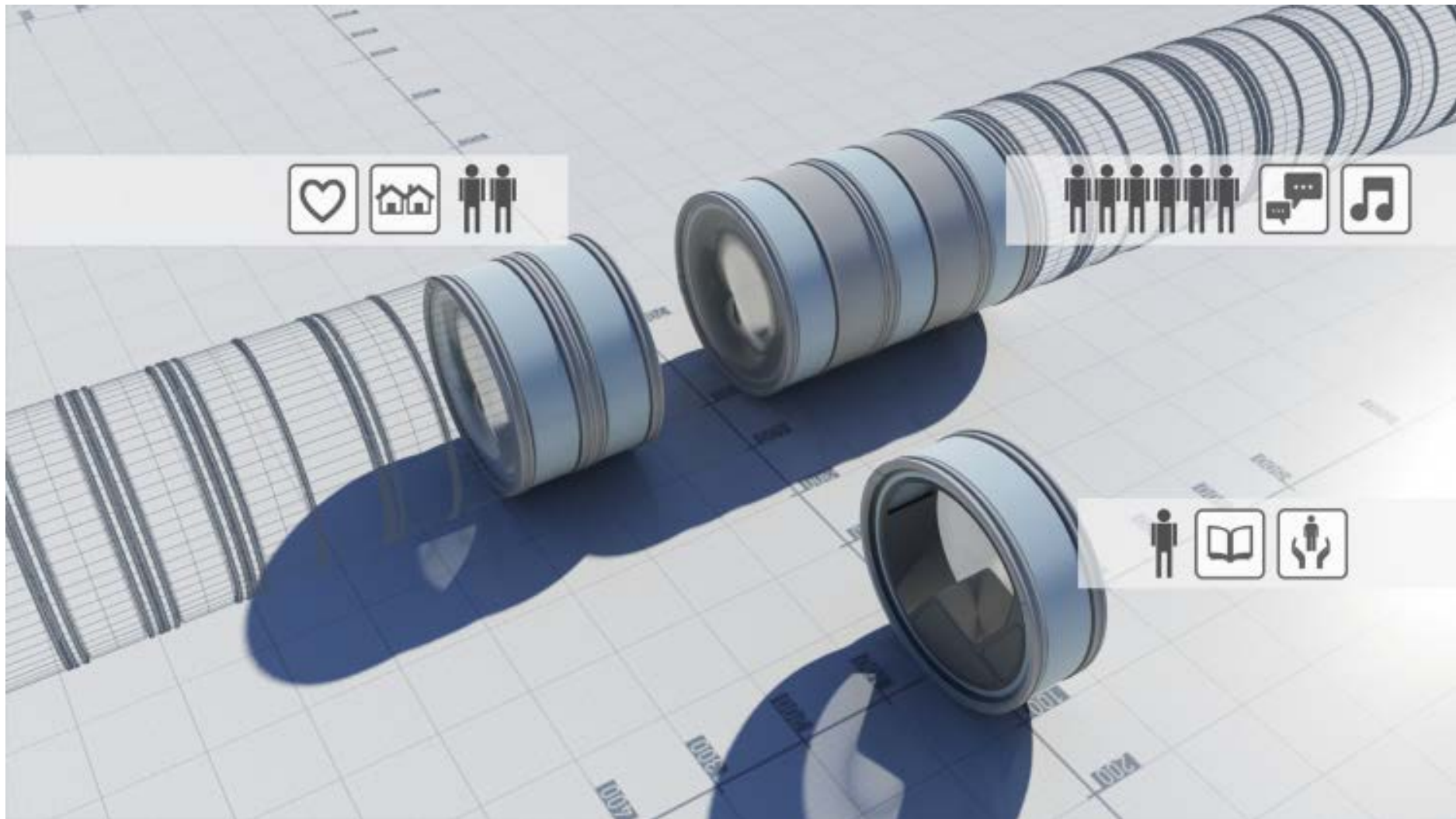
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KUNSTWERK
WIRD
VIDEOÜBERWACHT

MOCHT ICH
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WIRD
VIDEOÜBERWACHT





Studio Schwitalla, 2014

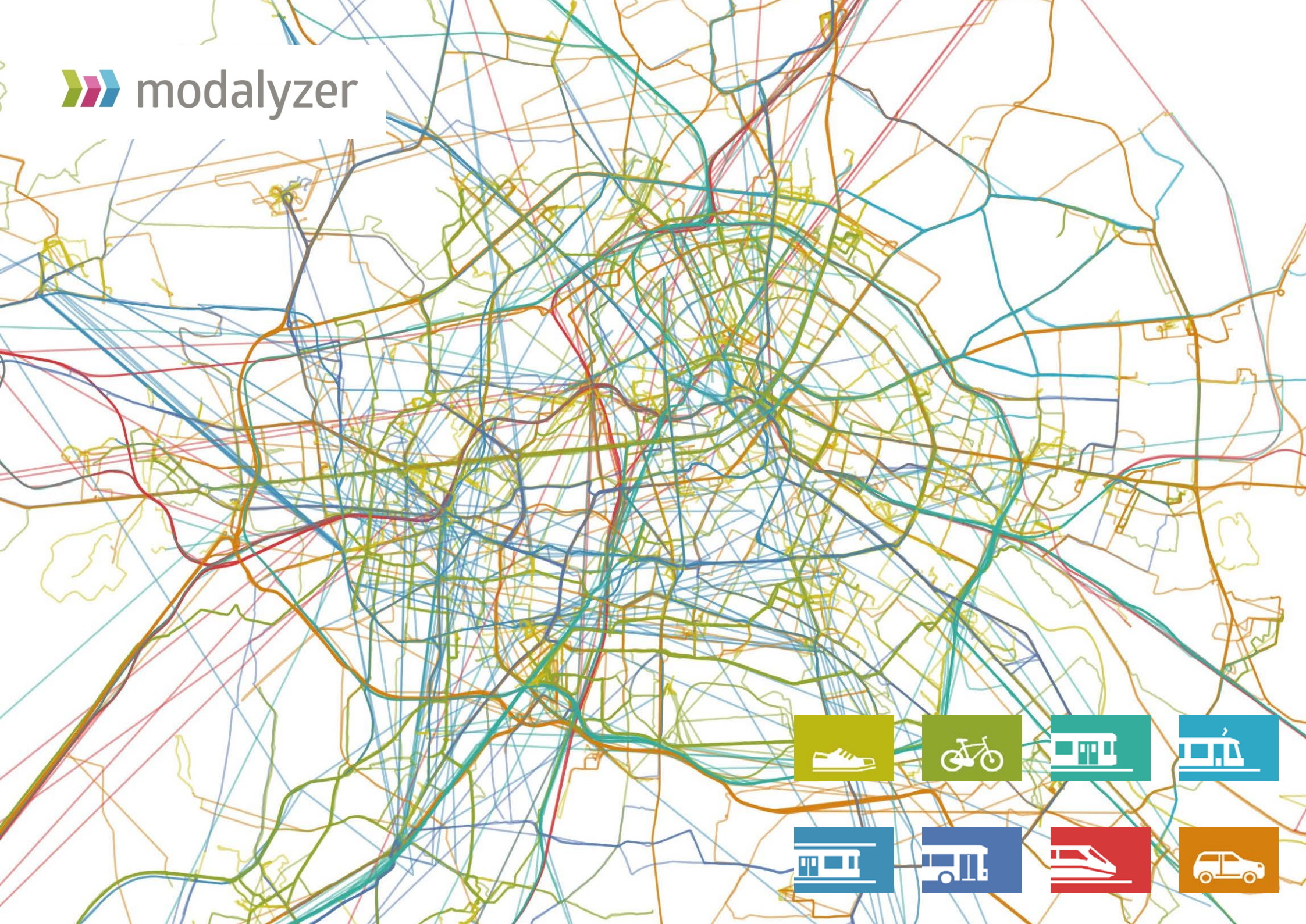


Studio Schwitalla, 2014





EHang 184







2010
2020
2030

Jahrzehnt
2010

Vernetzung

Smartphone
Nutzer
23%

Verkehrsteilnehmer
256

Familie

Start

Emissionen
(Lärm @ 90km/h)
8
Lärmpegel
(@ db)
66

Umweltfreundliche Fortbewegung
Daniel und Lisa Mustermann leben mit ihren drei Kindern am Stadtrand. Auf dem Weg ins Büro im Zentrum bringen sie die Kinder bei der Kita vorbei. Dabei legen besonderen Wert auf eine umweltfreundliche Fortbewegung.

Mobilitätsangebote
Mobilitätsangebote sind besser verbunden.
Ticketing/Booking
Automaten, fast überall von T&T-Diensten
IKT-Anwendungen/Anwendungen
Mobilitäts-Apps, Haltestellen, Preisermittler/Info, Tarifrechner
RailNavis: erste integrative App für Informationen, Buchung und Abrechnung
über mehrere Verkehrsträger hinweg
Energiesparende Angebote
CO₂-freie Angebote neben konventionellen
Angeboten
Begrifflichkeiten
Verbindungen

Towards New Urban Mobility The case of London and Berlin



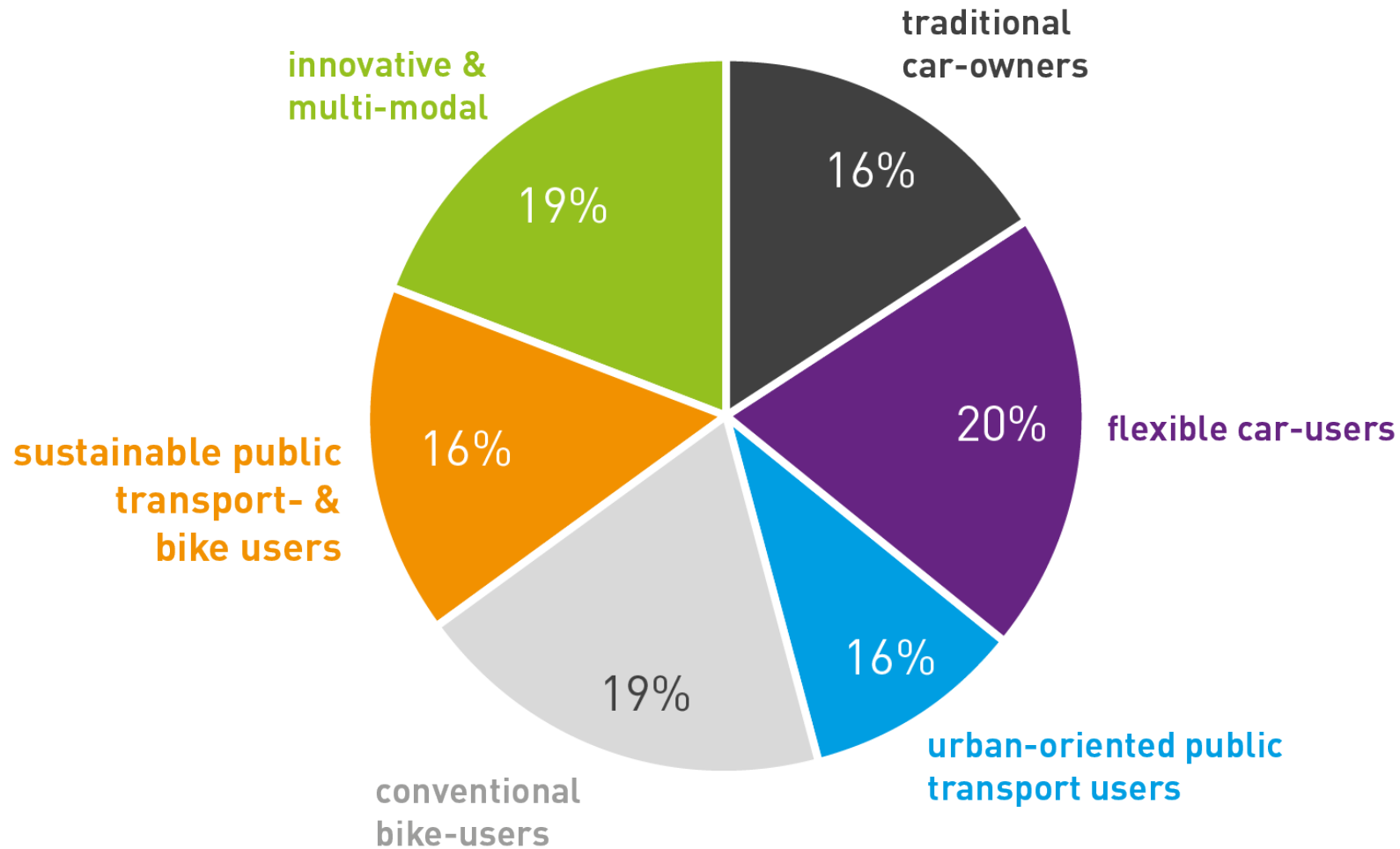
Towards New Urban Mobility

The case of London and Berlin

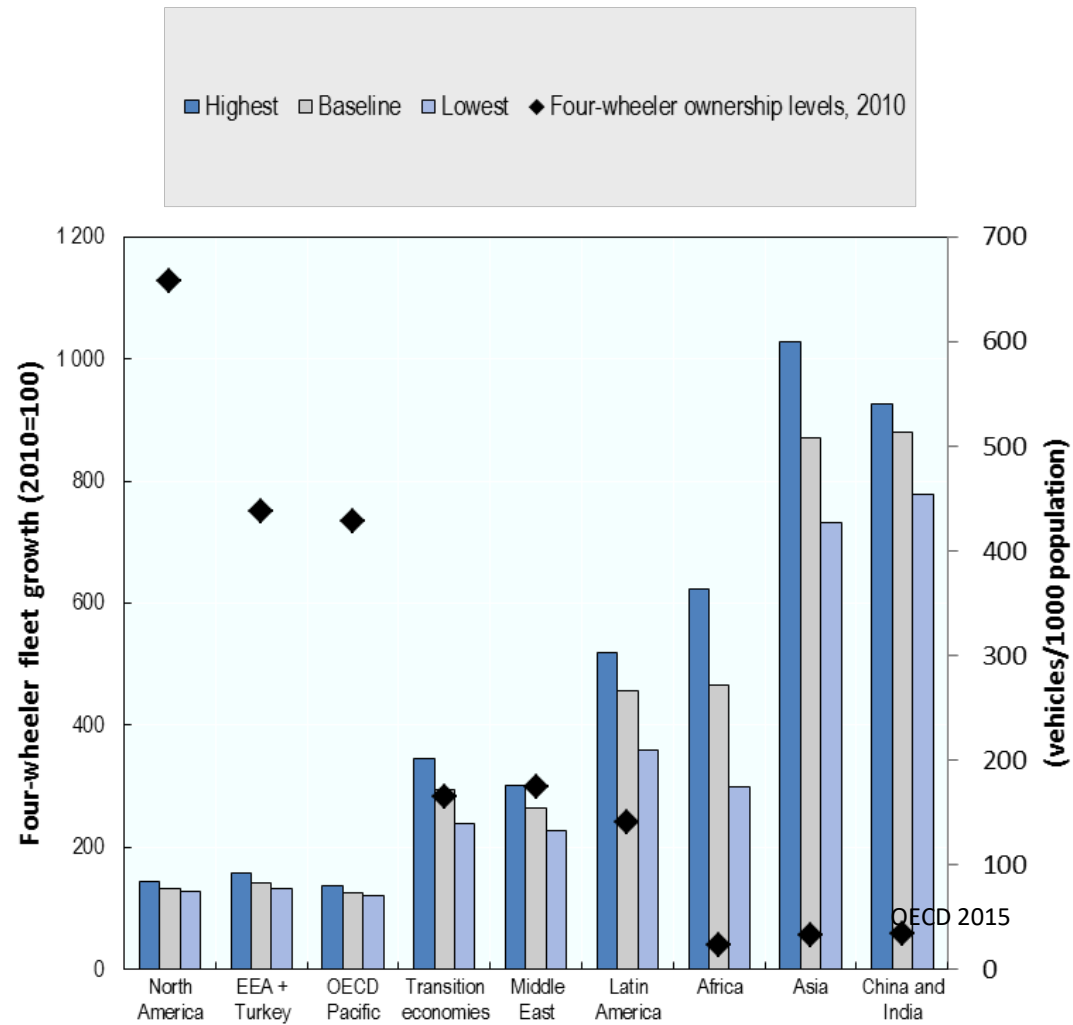


LSE Cities and Innø 2, 2015

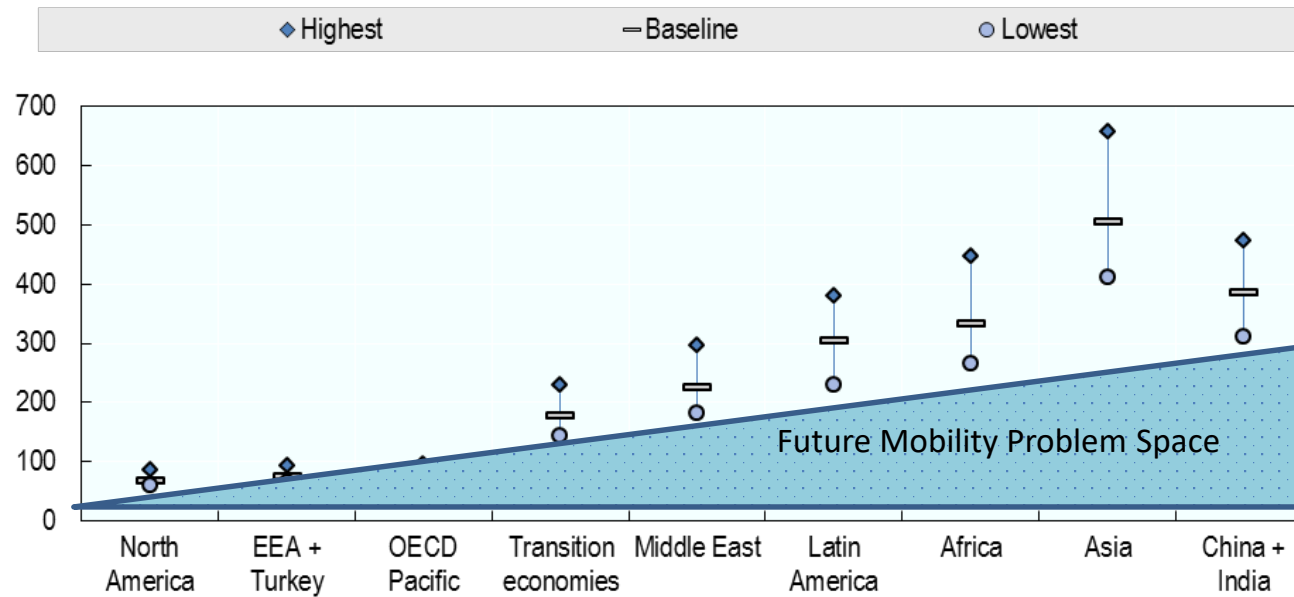
Typology of urban transport users



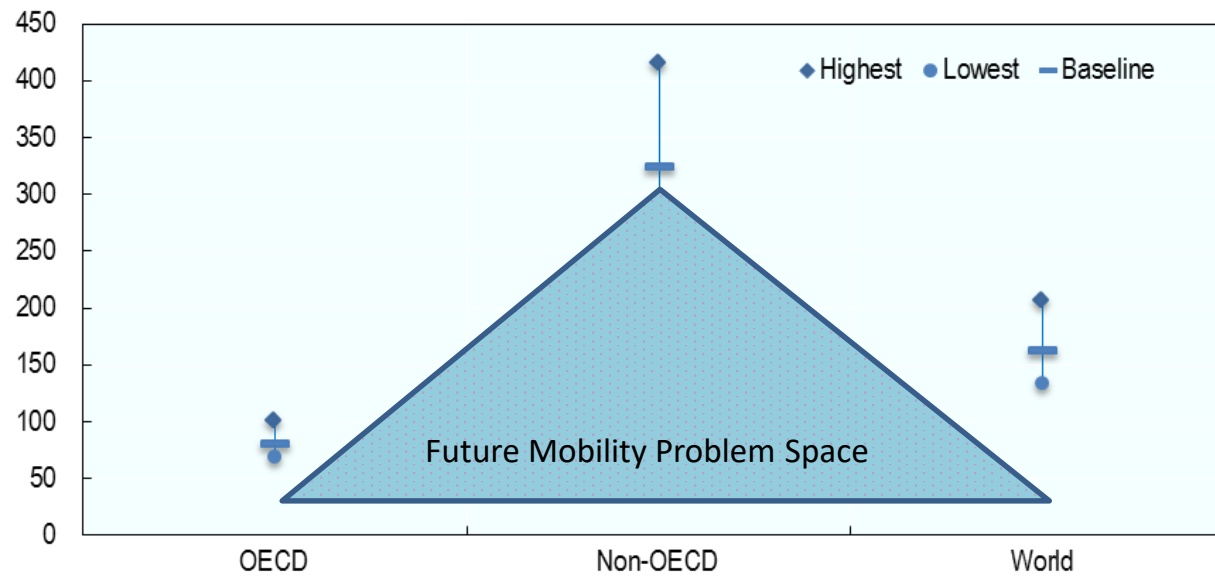
Four-wheeler ownership in 2010 and growth to 2050 by world region



CO₂ emissions for passenger transport by world region, 2050 (2010=100)



CO₂ emissions from surface freight and passenger transport, 2050 (2010=100)





Future mobility and decarbonisation

Visioning transport futures.
Pathways to decarbonisation in transport scenarios

Robert Schönduwe
Florian Lennert

Levers of Decarbonisation

- **Fuel, Vehicle and Circulatory Efficiency**
- **Fuel Substitution**
- **Modal Shift**
- **Land Use and Demand Management**

Levers of Innovation

- **Intelligent Traffic Management**
- **Electrification/Alternative Fuels**
- **Smart Urban Development and Infrastructure**
- **User Behaviour/Use Innovation**
- **Mobility as a Service**
- **Automated/Autonomous Services**
- **Mobility on Demand Systems and Services**
- **Data**

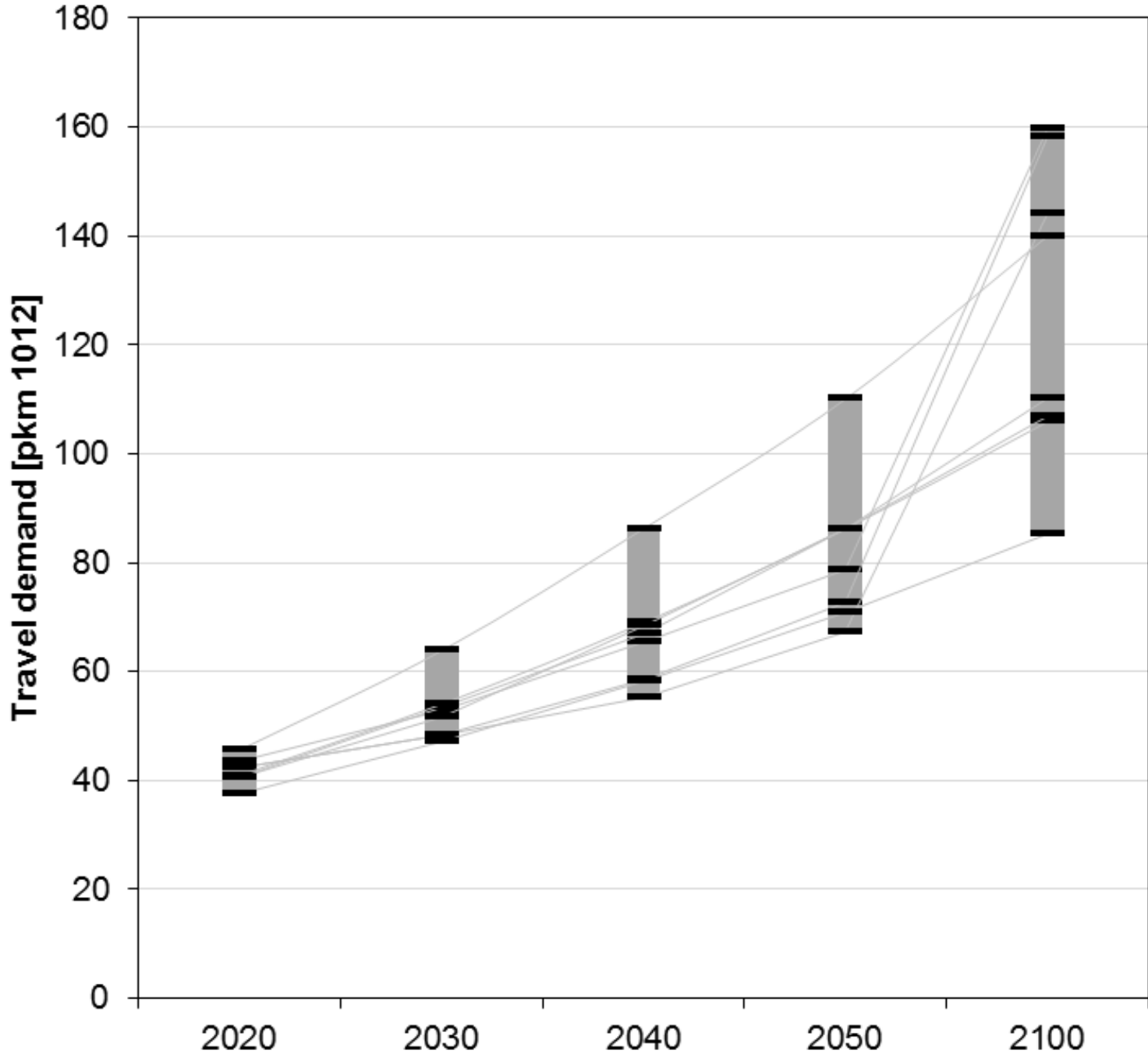
Scenario	Source
1 World Energy Outlook 2002	[8]
2 World Energy Outlook 2004	[9]
3 Mobility 2030	[10]
4 Foresight for Transport	[11]
5 Pathways to 2050	[12]
6 VIBAT UK	[13]
7 World Energy Outlook 2005	[14]
8 Szenarien der Mobilitätsentwicklung unter Berücksichtigung von Siedlungsstrukturen bis 2050	[15]
9 Intelligent Infrastructure Futures. The Scenarios - Towards 2055	[16]
10 World Energy Outlook 2006	[17]
11 Mobilität 2020. Perspektiven für den Verkehr von morgen	[18], [19]
12 Climate Change 2007: Mitigation of climate change	[20]
13 Transport technologies and Policy Scenarios to 2050	[21]
14 A sustainable energy system in 2050: promise or possibility?	[22]
15 World Energy Technology Outlook – WETO H2	[23]
16 International passenger transport and climate change	[24]
17 International Energy Outlook 2007	[25]
18 World Energy Outlook 2007	[26]
19 Backcasting approach for sustainable mobility	[27]
20 Politikszenerarien für den Klimaschutz IV. Szenarien bis 2030	[28]
21 VIBAT India & Delhi	[29]
22 World Energy Outlook 2008	[30]
23 Modell Deutschland	[31]
24 Renewbility - Stoffstromanalyse nachhaltige Mobilität im Kontext erneuerbarer Energien bis 2030	[32]
25 European Climate Change Policy Beyond 2012	[33]
26 Roads toward a low carbon future	[34]
27 Getting into the Right Lane for 2050	[35]
28 World Energy Outlook 2009	[36]
29 Energieszenarien für ein Energiekonzept der Bundesregierung	[37]
30 Energy 2050: Lifestyles subproject	[38]
31 Politikszenerarien für den Klimaschutz V	[39]

Szenarien der Mobilität

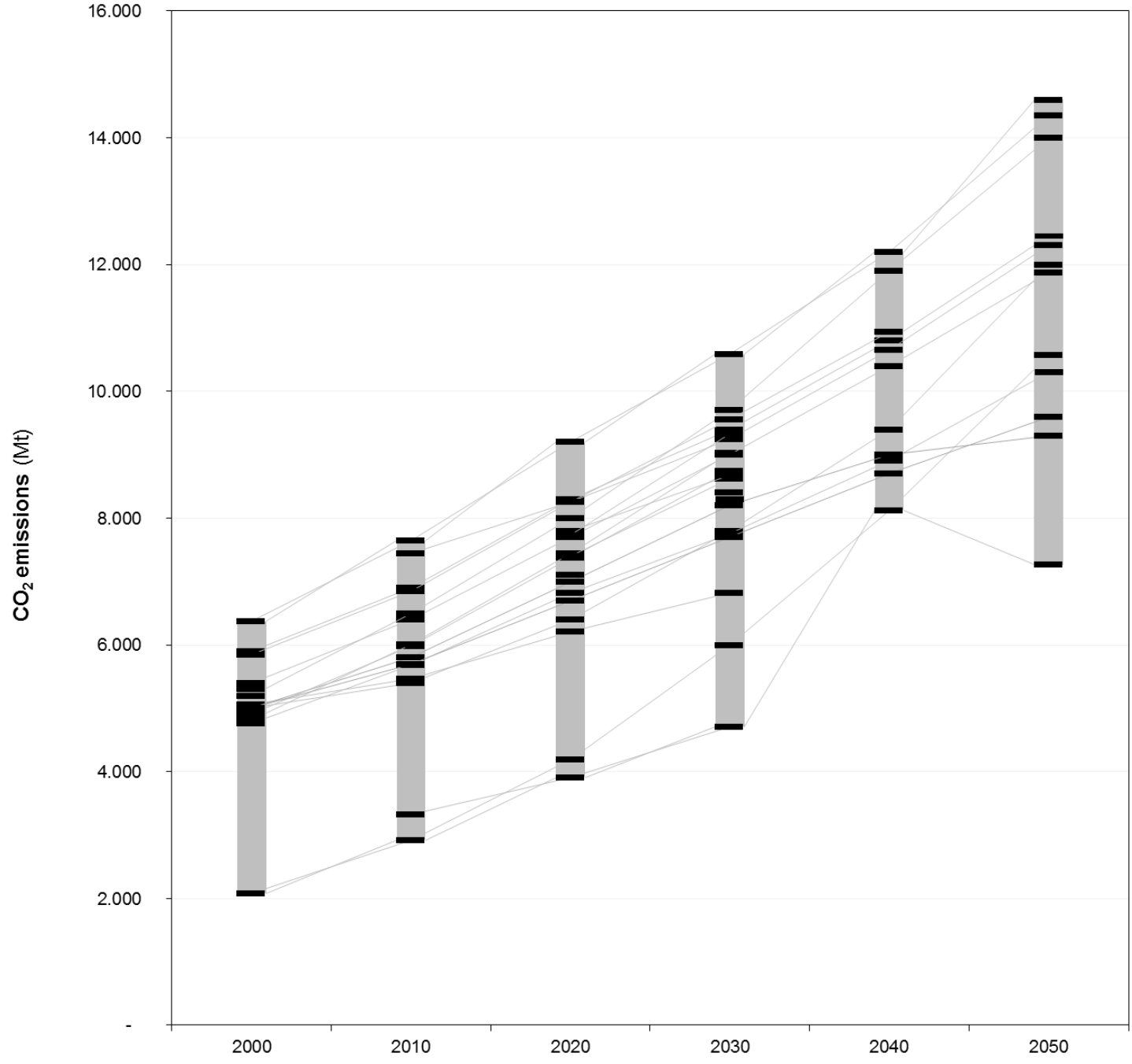
InnoZ 2016/Szenarien

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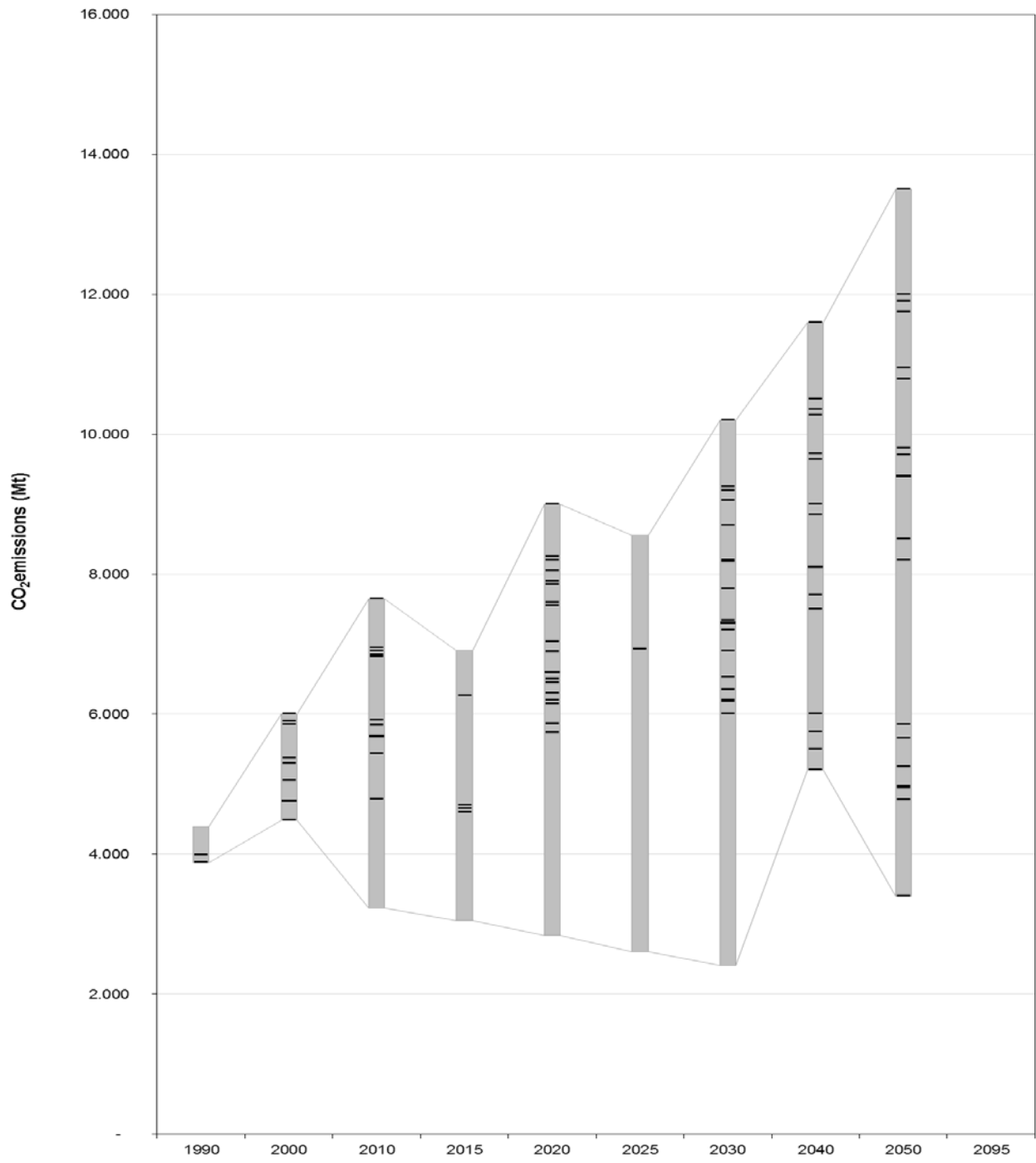
Scenario	Source
32 iTREN 2030	[40]
33 ADAM	[41]
34 World Energy Outlook 2010	[42]
35 EU Transport GHG: Routes to 2050?	[43]
36 Langfristszenarien und Strategien für den Ausbau der EE in Deutschland	[44]
37 Renewability II	[45]
38 The future energy and GHG emissions impact of alternative personal transportation pathways in China	[46]
39 Global travel within the 2°C climate target	[47]
40 Influence of travel behavior on global CO2 emissions	[48]
41 The future of Mobility. Scenarios for the United States in 2030	[49]
42 ITF Transport Outlook 2013	[50]
43 Potenziale des Radverkehrs für den Klimaschutz	[51]
44 Treibhausgasneutraler Verkehr 2050	[52]
45 Politiksznarien für den Klimaschutz VI	[53]
46 Economic assessment of low carbon vehicles	[54]
47 eMobil 2050. Szenarien zum Klimaschutzbeitrag des elektrischen Verkehrs	[55]
48 Re-Programming Mobility	[56]
49 Shell Pkw-Szenarien bis 2040	[57]
50 World Energy Outlook 2014	[58]
51 CECILIA 2050. Optimal EU climate policy	[59]
52 IPCC Climate Change 2014: Mitigation to climate change	[3]
53 ITF Transport Outlook 2015	[7]
54 Beyond traffic 2045	[60]
55 Nutzen statt besitzen	[61]
56 Urban mobility system upgrade	[62]
57 World Energy Outlook 2015	[1]
58 Vision Mobilität Schweiz 2050	[63]
59 DEFINE	[64]



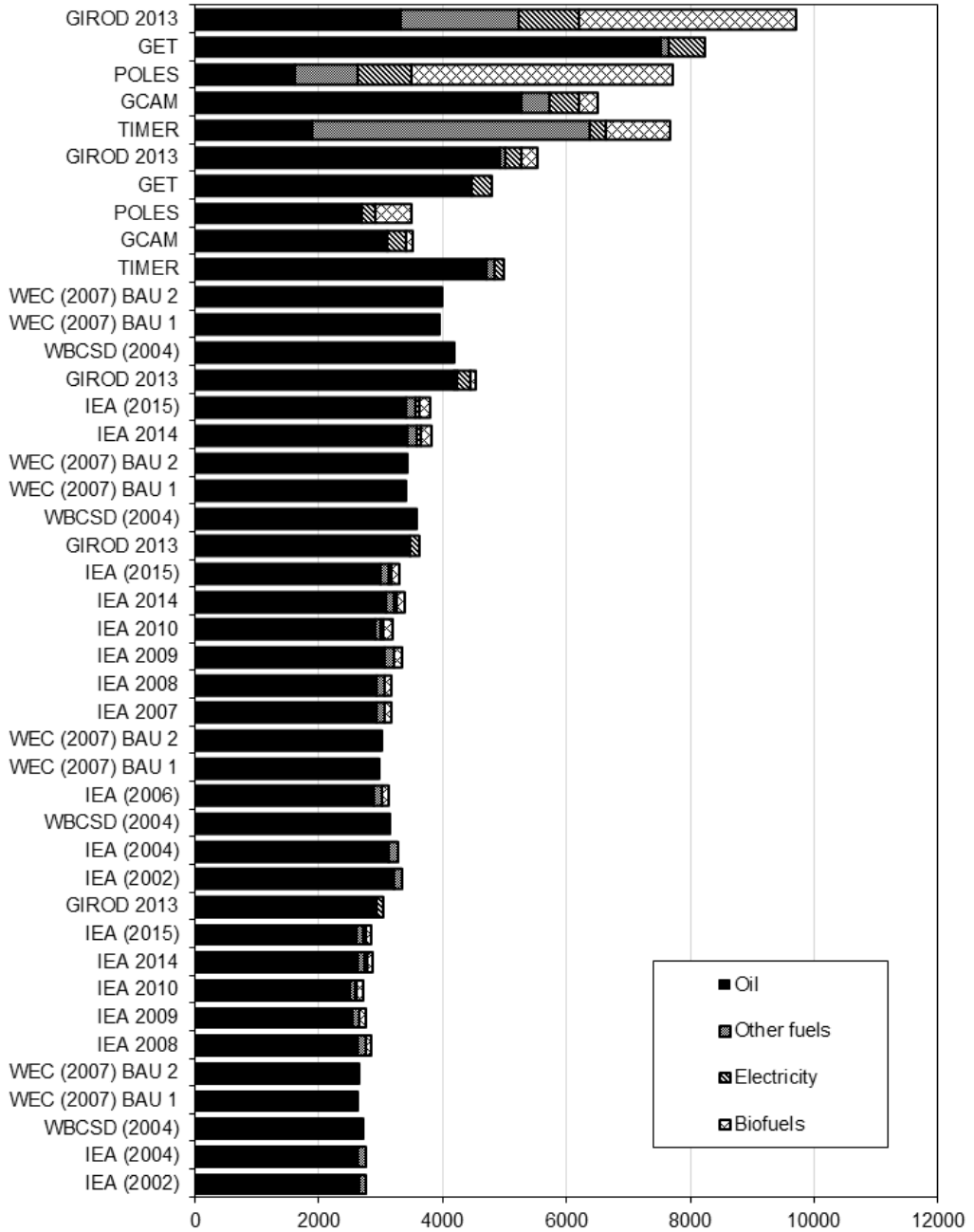
2050
Travel Demand
BAU/Policy
Scenarios



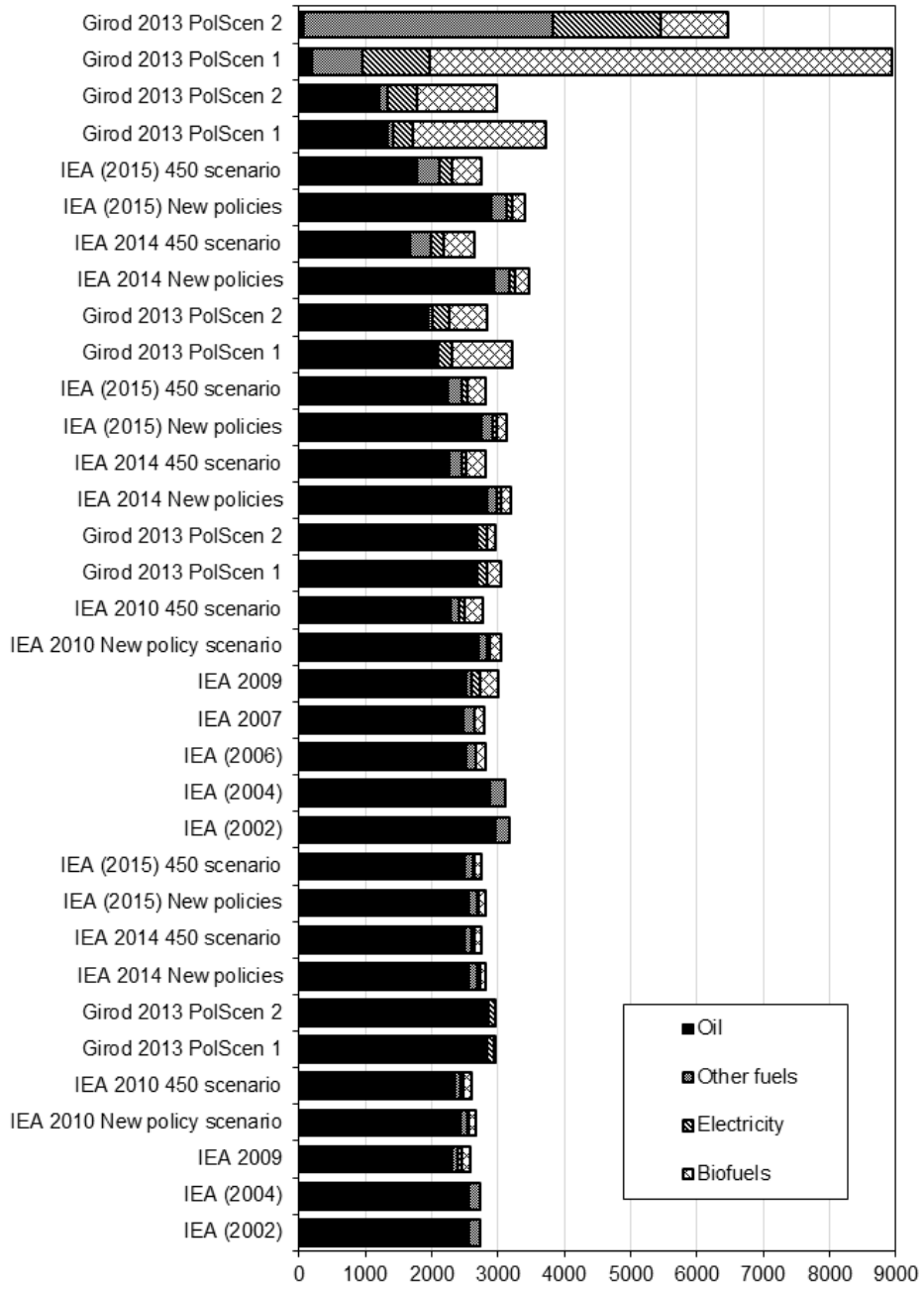
2050
Transport GHG Emissions
BAU Scenarios



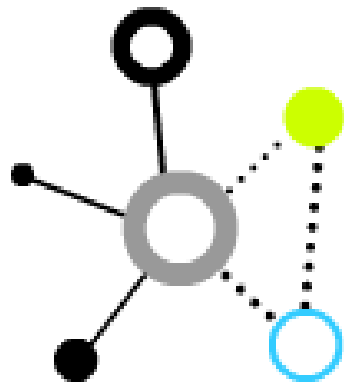
2050
Transport GHG Emissions
Policy Scenarios



**2050
Primary Fuel in Transport
BAU Scenarios**



**2050
Primary Fuel in Transport
Policy Scenarios**



Disrupting Mobility

11-13 November 2015

MIT Media Lab

Boston

www.disrupting-mobility.org

Lecture Notes in Mobility

Gereon Meyer
Susan Shaheen *Editors*

Disrupting Mobility

Impacts of Sharing Economy and
Innovative Transportation on Cities

 Springer



STIFTUNG
MERCATOR





July 2016

Strategic Transport Research Innovation Agenda (STRIA) SMART MOBILITY SYSTEMS AND SERVICES ROADMAP

Final Draft for Consultation

Draft Authors:

Florian Lennert (InnoZ, LSE), Cathy Macharis (VUB Brussels), Veronique van Acker (University of Amsterdam and Ghent) and Lukas Neckermann (Neckermann Strategic Advisors), with comments from Axel Volkery (European Commission, Directorate-General Mobility and Transport).

Further input was received from Henriette van Eijl (European Commission, Directorate-General Mobility and Transport) and Julija Sakovica (European Commission, Directorate-General Research & Innovation)



July 2016

**Strategic Transport Research Innovation Agenda (STRIA)
SMART MOBILITY SYSTEMS AND SERVICES ROADMAP**

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Brussels, 31.5.2017
SWD(2017) 223 final

COMMISSION STAFF WORKING DOCUMENT

**Towards clean, competitive and connected mobility: the contribution of Transport
Research and Innovation to the Mobility package**

 Bundesministerium
für Bildung
und Forschung

 FONA
Forschung für Nachhaltige
Entwicklung
BMBWF

Agendakonferenz | 22 und 23. Juni, Berlin

Wege zur Mobilitätswende

Forschung und Innovation für eine nachhaltige urbane Mobilität

Deutsche Telekom Hauptstadtrepräsentanz, Französische Straße 33 a - c



Evaluation of existing scenario and trend studies on decarbonisation in the transport sector



More than **300** studies considered, **59** studies selected, detailed evaluation of **48** Scenario studies: Detailed consideration and analysis of influencing factors, modelling, used indicators.

Selection criteria:



Timeframe
2030 to 2100

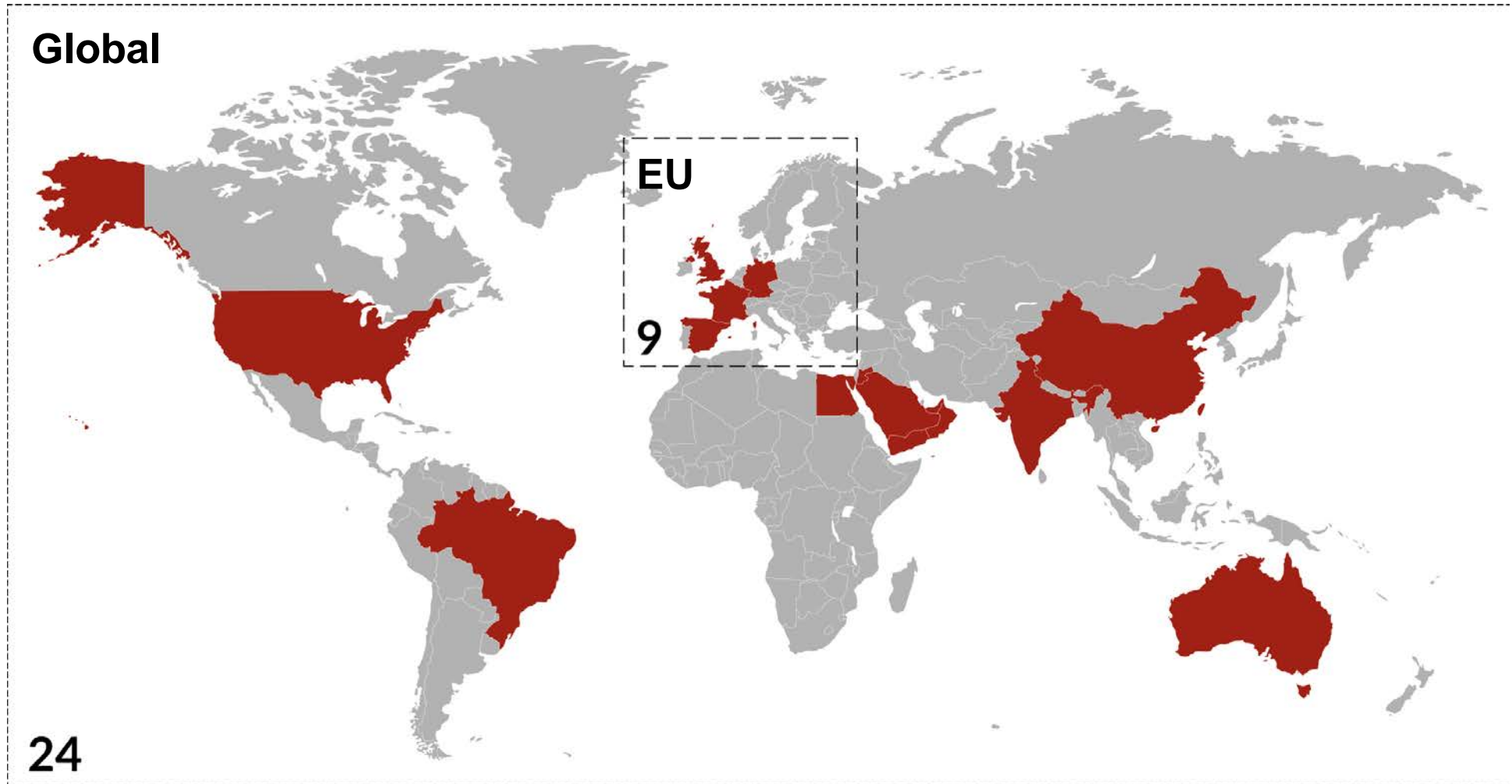


Passenger
transport



Decarbonisation is
addressed, sufficient
documentation is
available

Spatial focus of the scenarios considered: Focus on global, EU scenarios and scenarios for Germany



Country specific: 15

Two-step review: (1) Components of the scenarios: Model content and boundaries determine model output

A Spatial level

B Scenario type

C Type of model

- 1 Transport model
- 2 Energy- and emissions model

D Model complexity

E Model boundaries

- 1 Transport sector
- 2 Modes of transport
- 3 Traffic volumes
- 4 Emissions and environmental impact
- 5 Energy

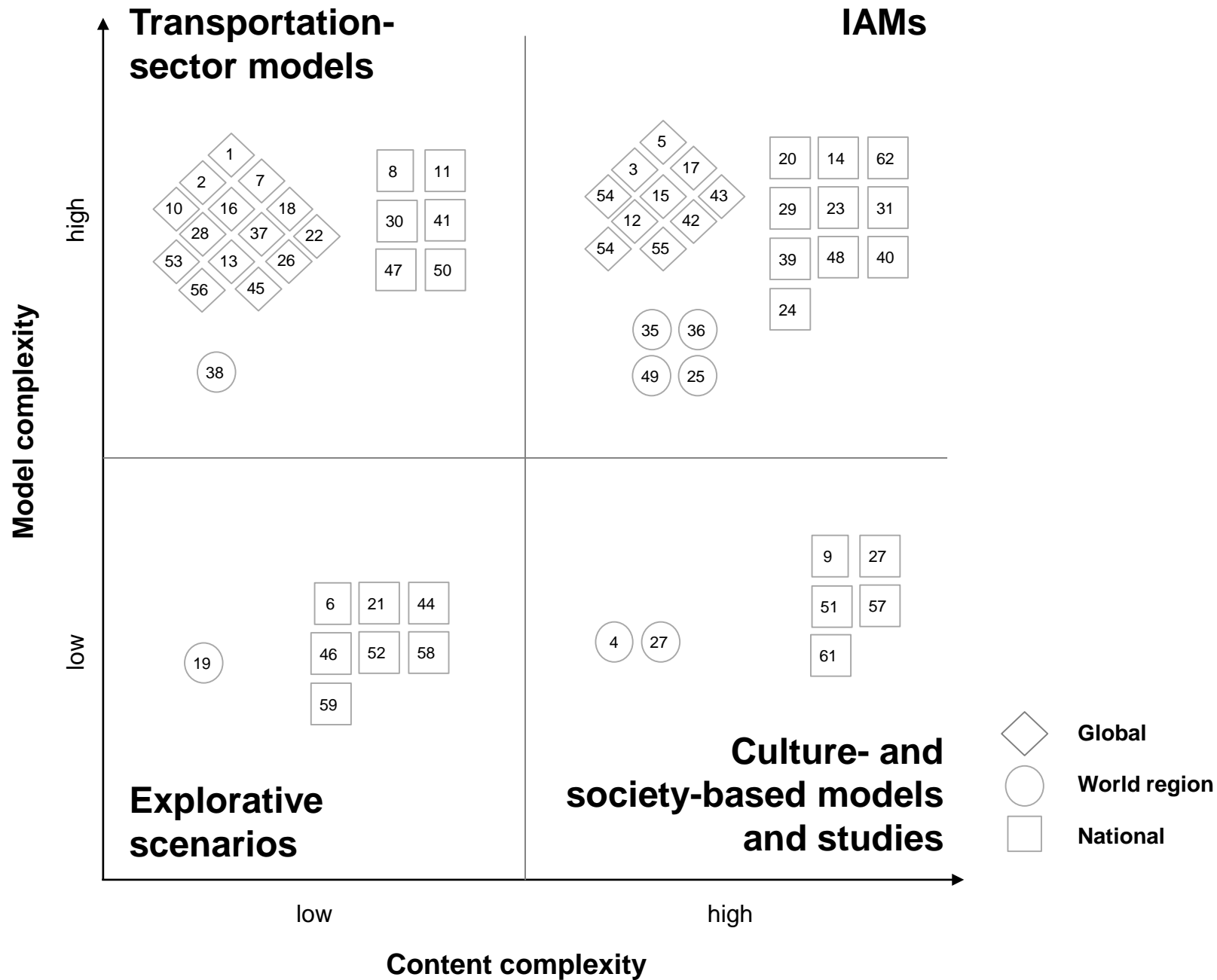
F Modellkomponenten

- 1 Transport demand
- 2 Population
- 3 Economy
- 4 Accessibility and spatial structure
- 5 Transport supply
- 6 Energy
- 7 Policies

Typology of the scenarios: Four types with different ontological and paradigmatic backgrounds

Type	Approach	Scope	Method	Solution space
1 Integrated assessment models (IAMs)	Deductive	Global, cross-sector	Cross-sectoral, econometric equilibrium models	Fuel shift, technological options
2 Transportation-sector models	Deductive/inductive	National / world regions, transport sector	Transport sector-specific econometric models	Efficiency, technological options
3 Culture- and society-based models and studies	Inductive	National / regional, transport sector, society	Backcasting, qualitative methods	Infrastructure and behavior, demand side solutions
4 Explorative studies	Inductive	National / regional, transport sector, society	Qualitative, explorative methods	Infrastructure and behavior, demand side solutions

Typology of the scenarios considered



Two-step review: (2) Factors considered in the scenarios: 114 factors, categorized by six topics

A Society

B Technology

C Energy and resources

**D Spatial development
and infrastructures**

E Transport and mobility

F Economy and policies



(A) People and society-related factors

	Type ¹	1	2	3	4
People and Society	Total (n)	20	28	6	6
Population and demographics	Index²	1,6	1,3	1,5	1,7
Population dynamics	n	10	17	2	3
Age distribution		10	9	3	4
Stage of life		1	2	1	0
Cross-border migration		2	5	2	1
Household structure		8	3	1	2
Attitudes, values and lifestyles	Index	0,5	0,8	2,8	2,3
Change of behavioural and lifestyle patterns in general	n	6	6	4	4
Social acceleration and deceleration		0	1	2	1
Individualisation		1	1	2	2
Social polarisation		1	4	2	2
Environmental awareness		1	5	2	2
Attitudes towards new technologies and „digital lifestyles“		0	4	4	3
Data protection and privacy		0	1	1	0
Cultural aspects of travel	Index	0,5	0,3	0,5	0,8
Car ownership and status	n	4	6	1	4
Quality of service		5	1	2	0
Mobility styles		1	0	0	1

Index computed as scenario-type specific sum of factors mentioned divided by total number of studies; highest value marked green

1 - IAMs

2 - Transportation-sector models

3 - Culture- and society-based models and studies

4 - Explorative Studies

(B) Technology-related factors 1: Vehicle technologies

	Type ¹	1	2	3	4
Technology	Total (n)	20	28	6	6
Vehicle technologies	Index ²	2,8	1,8	2,5	2,3
Propulsion systems	n	16	17	4	4
Alternative fuels		15	13	4	4
Automation in road transport		2	3	1	1
Automation in rail transport		1	1	0	1
Battery technologies		6	6	1	1
Recuperation and waste heat recovery		3	1	0	0
Microcars and lightweight materials		4	5	1	0
Aviation innovation		4	4	3	2
Rail innovation (HSR, Maglev, Hyperloop)		4	1	1	1

Index computed as scenario-type specific sum of factors mentioned divided by total number of studies; highest value marked green

1 - IAMs

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(B) Technology-related factors 2: ITS and connected infrastructures and connected travel

Technology	Type ¹	1	2	3	4
	Total (n)	20	28	6	6
Connected infrastructures and connected travel	Index²	0,6	0,6	1,7	1,3
Cyber-Physical-Systems / Internet of things	n	1	1	2	1
Connected car (C2C, C2X)		3	2	1	2
Platooning		1	3	1	0
Connected Infrastructure (X2X)		3	3	1	2
Intermodal connections		4	3	3	2
Global navigation satellite systems		0	2	1	1
Standardised data formats and Open data		0	2	1	0
Intelligent Transportation Systems (ITS)	Index	1,9	1,4	2,7	2,5
Traffic management centre	n	5	5	2	4
Demand responsive traffic management		6	5	2	3

Index computed as scenario-type specific sum of factors mentioned divided by total number of studies; highest value marked green

1 - IAMs

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4 - Explorative Studies

(B) Technology-related factors 3: Logistics, Services and production sector technologies

	Type ¹	1	2	3	4
Technology	Total (n)	20	28	6	6
Logistics	Index				
Freight modal split	n	11	13	2	2
Intelligent freight traffic management		3	5	4	3
Intelligent and flexible load carriers		2	4	1	0
Urban goods distribution centres		5	2	1	3
Reduced shipment size		1	3	1	0
New carriers (e.g. Cargolifter, drones)		1	1	1	0
Cargo bike		0	1	1	0
Reverse logistics		4	1	1	0
Services (based on real time information)	Index	0,3	0,3	0,8	0,2
Location-Based-Services and augmented reality	n	0	0	1	0
Traffic incident management		1	1	1	0
Mobility-as-a-Service (MaaS)		3	4	1	0
Seamless access, e-tickets		1	2	2	1
Production sector technologies	Index	0,1	0,0	0,2	0,0
3D printing		1	1	0	0
Robotics		0	0	1	0

1 - IAMs

2 - Transportation-sector models

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4 - Explorative Studies

(B) Technology-related factors 4: Disruptive innovations and events

	Type ¹	1	2	3	4
Technology	Total (n)	20	28	6	6
Disruptive innovations and events	Index	0,1	0,1	0,2	1,0
eHighway		1	1	1	0
Radical concepts and technologies for aviation		0	0	0	1
Hoverboards		0	0	0	1
Radical concepts and technologies for shipping		0	0	0	1
Radical concepts for replacing travel		0	0	0	1
Environmental disruptions		1	3	0	2

1 - IAMs

2 - Transportation-sector models

3 - Culture- and society-based models and studies

4 - Explorative Studies

(C) Factors related to energy and resources

	Type ¹	1	2	3	4
Energy and resources	Total (n)	20	28	6	6
Energy supply	Index²	3,2	2,4	2,0	1,2
Renewable energy: Solar	n	14	12	2	1
Renewable energy: Wind		14	12	2	1
Renewable energy: Other		13	11	3	2
Increasing energy efficiency		14	8	1	1
Electric vehicles and the electricity market		3	6	1	1
Power grids		4	9	2	0
Energy storage		2	8	1	1
Fossil resources and emissions	Index	0,7	0,6	0,8	0,5
Resource scarcity	n	4	6	3	1
Carbon Capture and Storage / Carbon sequestration (CCS)		10	11	2	2

1 - IAMs

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4 - Explorative Studies

(D) Factors related to spatial development and infrastructures

Spatial development and infrastructures					
Spatial inequalities and regional development	Index	0,3	0,3	0,8	0,2
Urbanisation	n	0	0	1	0
Reurbanisation		1	1	1	0
Land use patterns		3	4	1	0
Urban sprawl		1	2	2	1
(Transport) infrastructures	Index	1,0	0,8	1,3	1,2
(selective) Expansion of (transport) infrastructures		10	10	3	3
Maintenance requirments		0	3	1	0
Expansion of new specialized infrastructures		5	3	1	2
Congested transport infrastructures		4	3	3	2
Shared space		1	2	0	0
Climate change	Index	0,3	0,4	0,5	0,5
Increase of environmental disasters		1	6	1	1
Local air pollution		2	3	2	2
Temperature changes		3	1	0	0

1 - IAMs

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4 - Explorative Studies

(E) Transport and mobility-related factors

	Type ¹	1	2	3	4
Transport and mobility	Total (n)	20	28	6	6
Transport demand	Index²	1,5	1,1	1,7	1,7
Distances travelled	n	15	19	4	3
Long-distance travel		4	4	2	3
Leisure travel		4	1	2	2
Inter- and multimodality		4	5	2	1
Influences of political situation on tourism		2	1	0	1
Vehicle supply	Index	1,7	1,6	1,2	1,5
New vehicle registrations	n	8	12	1	2
Vehicle stock		10	16	1	2
Public transport		10	10	3	2
Cycling and Pedelecs		5	7	2	3
Sharing	Index	0,5	0,3	1,0	0,7
Bikesharing	n	2	2	1	1
Carsharing		4	4	3	2
Ridesharing		2	1	2	1
Rideselling		2	0	0	0
Mobility costs	Index	1,9	1,1	1,3	1,7
Oil price and price of gas		16	19	3	4
Energy costs		7	3	1	1
Individual mobility budget		8	7	2	3
Individual mobility time budget		6	3	2	2

Index computed as scenario-type specific sum of factors mentioned divided by total number of studies; highest value marked green

1 - IAMs

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4 - Explorative Studies

(F) Factors related to the economy and policies 1:

Political framework and work environment

	Type ¹	1	2	3	4
Economy and politics	Total (n)	20	28	6	6
Political framework	Index²	1,5	1,3	2,8	2,0
Liberalisation and privatisation	n	4	2	2	1
Legal regulations		4	6	2	0
Global trade policies		4	4	2	2
Global co-operation		5	7	3	1
Shift of economic centers of powers		1	7	0	1
Alternative financial market models		1	1	1	0
Governance structures / Transport policy competences		2	3	3	1
Carbon pricing		8	4	3	4
Shop opening hours		0	1	1	2
Work environment	Index	0,6	0,4	2,0	1,5
New employment models	n	0	2	3	2
Employment rate		5	2	3	2
Increasing degree of automatisisation		0	2	1	0
Flexibilisation of the labour market		1	2	2	2
Telework, telemeetings		6	2	3	3

1 - IAMs

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4 - Explorative Studies

(F) Factors related to the economy and policies 2: Consumption and economic development

	Type ¹	1	2	3	4
Economy and politics	Total (n)	20	28	6	6
Consumption	Index	0,1	0,2	1,0	0,7
Local added value	n	1	1	2	2
Rise of the prosumer		0	1	0	0
Shareconomy		0	2	2	1
e-Commerce		0	1	2	1
Economic development	Index	1,8	1,2	2,2	2,0
Gross domestic product (GDP)		17	17	3	3
Alternative economic models		0	1	1	1
Income distribution		6	2	2	2
Globalisation		7	4	4	4
Global freight transport costs		5	9	3	2

1 - IAMs

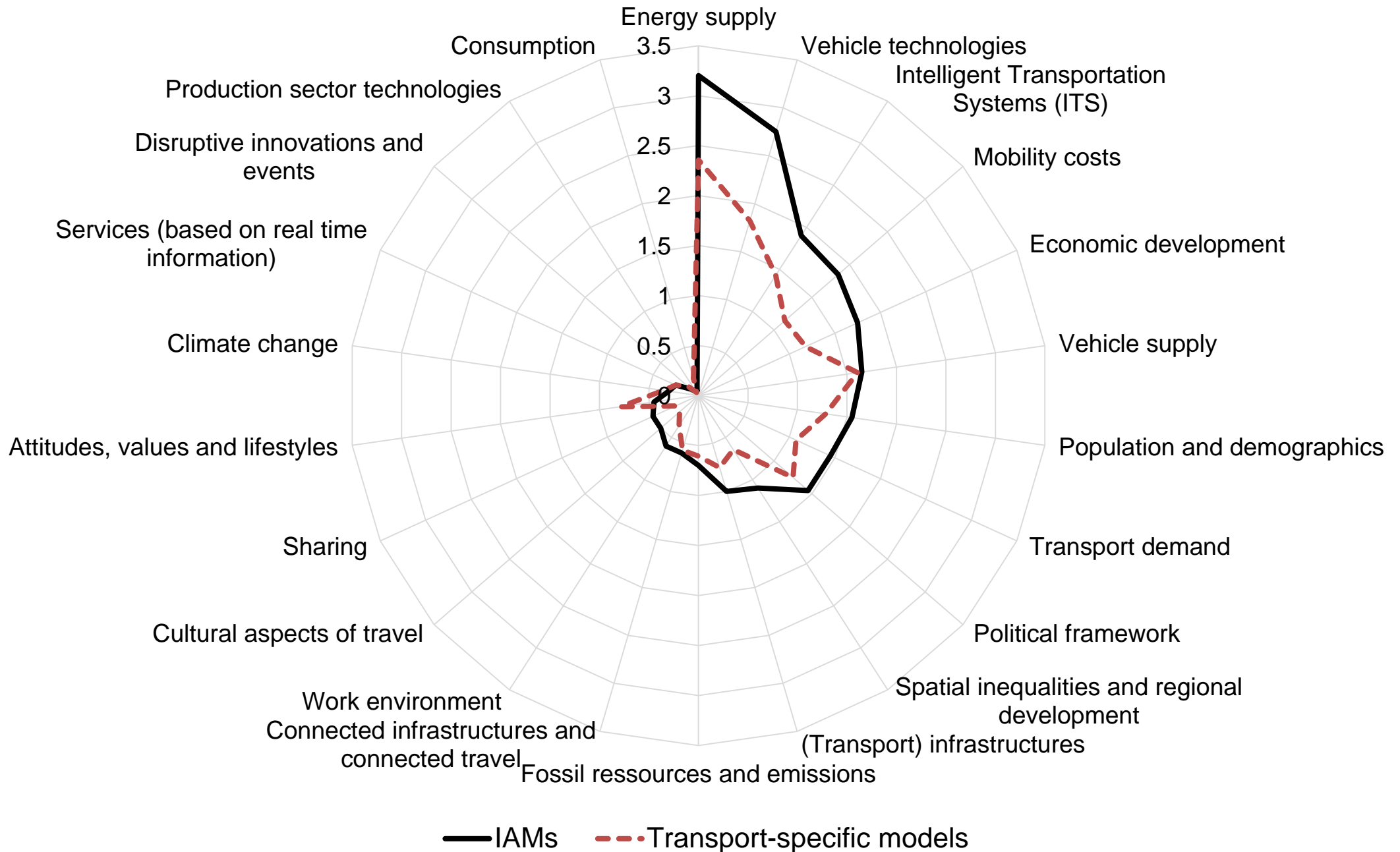
2 - Transportation-sector models

3 - Culture- and society-based models and studies

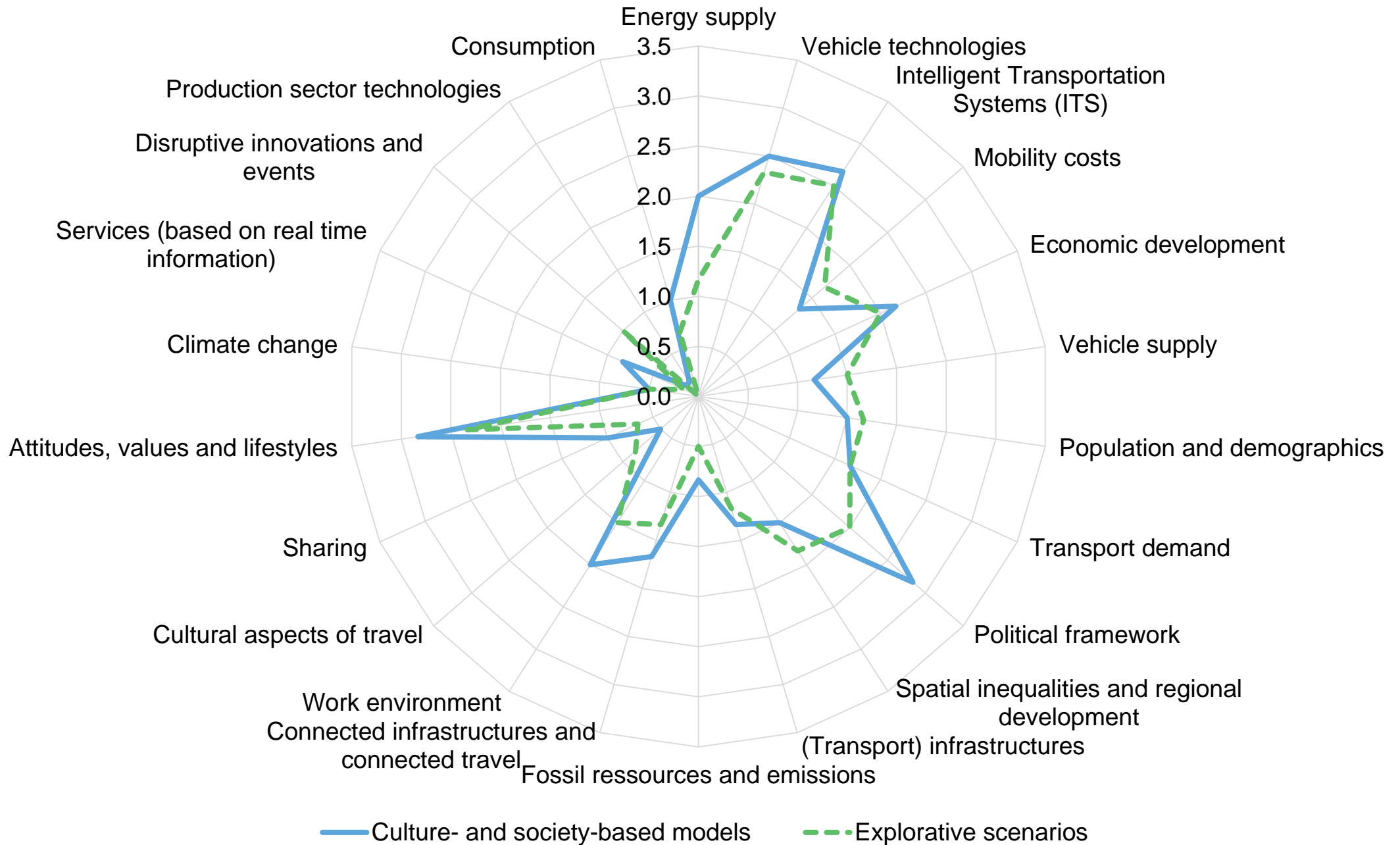
4 - Explorative Studies

Conclusions

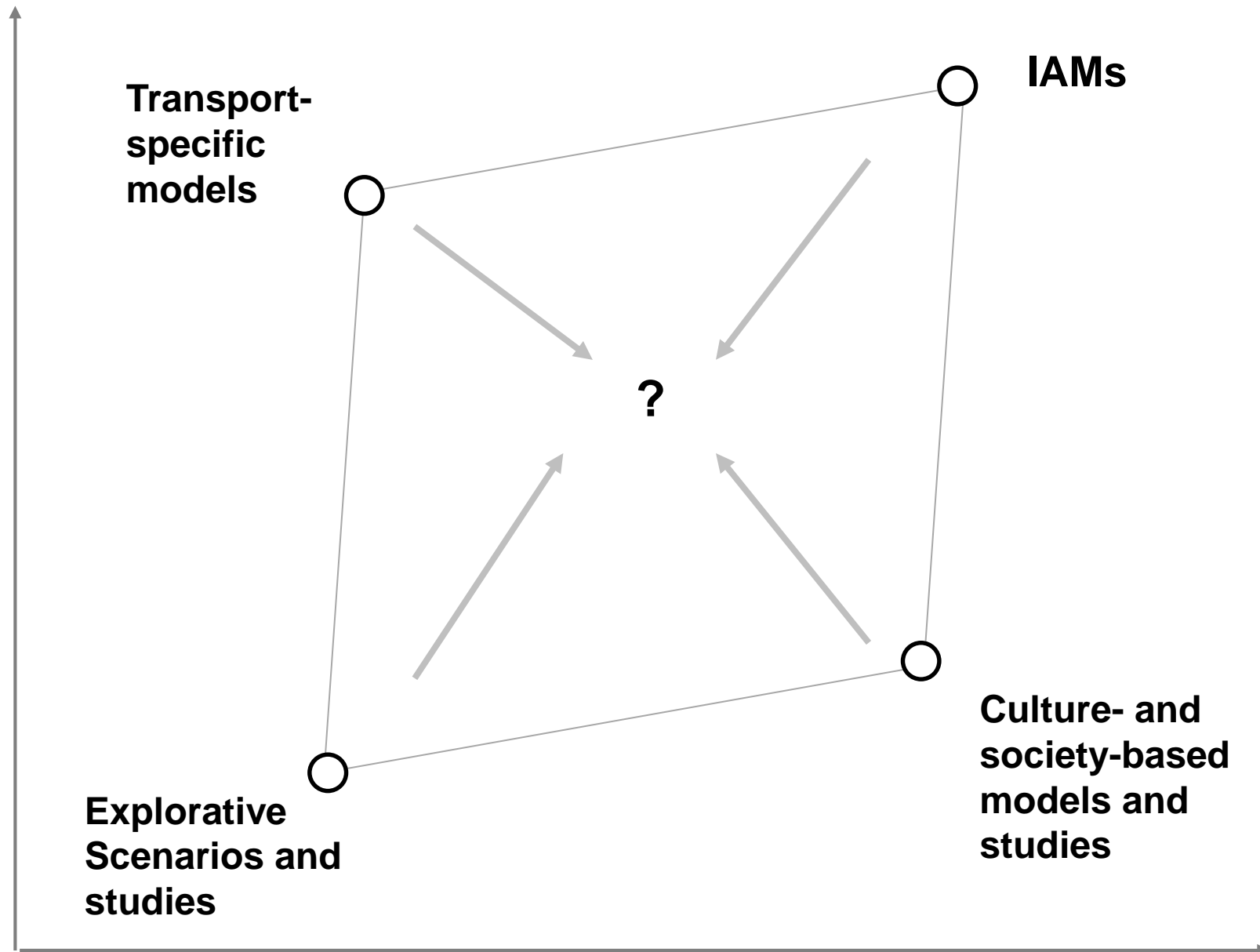
IAMs and Transportation-sector models with narrow focus on quantifiable factors



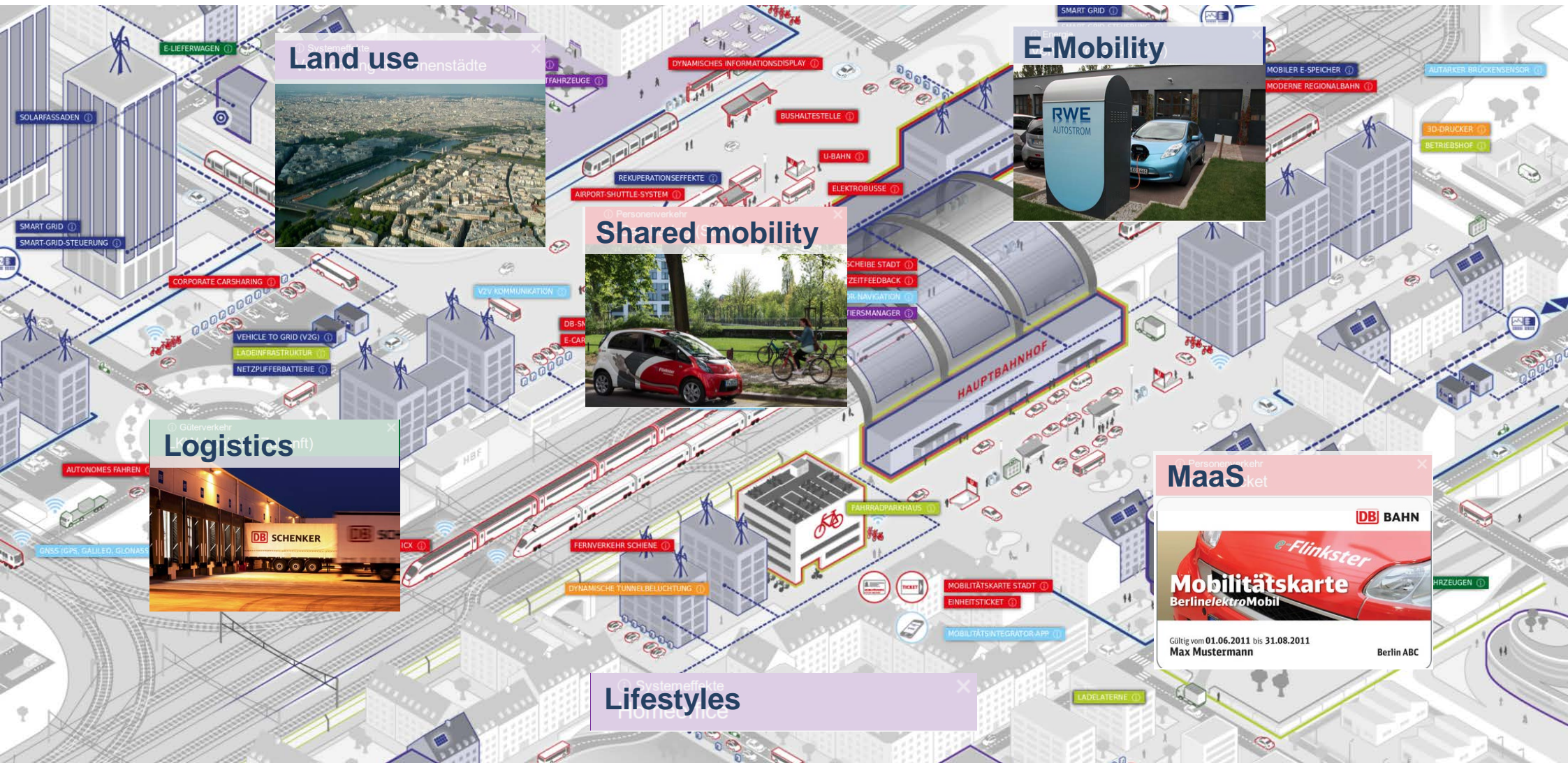
Society-oriented and explorative models with wider range of factors (but often not quantified)



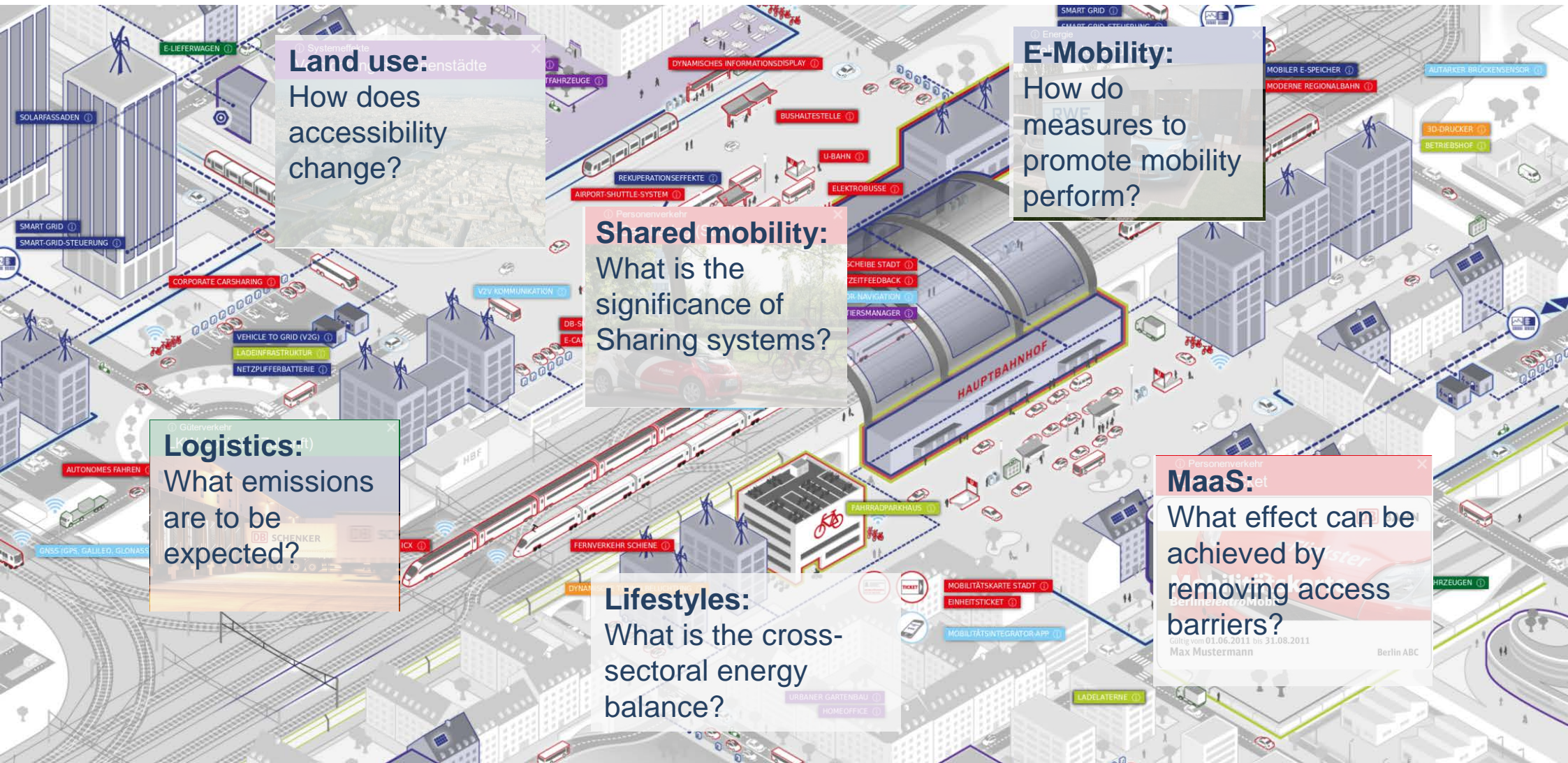
Convergence of paradigms with different low-carbon narratives: Operationalisation of the factors required



Options for sustainable transport: Quantifying the future requires data



Options for sustainable transport: Quantifying the future requires data



Land use:
How does accessibility change?

Shared mobility:
What is the significance of Sharing systems?

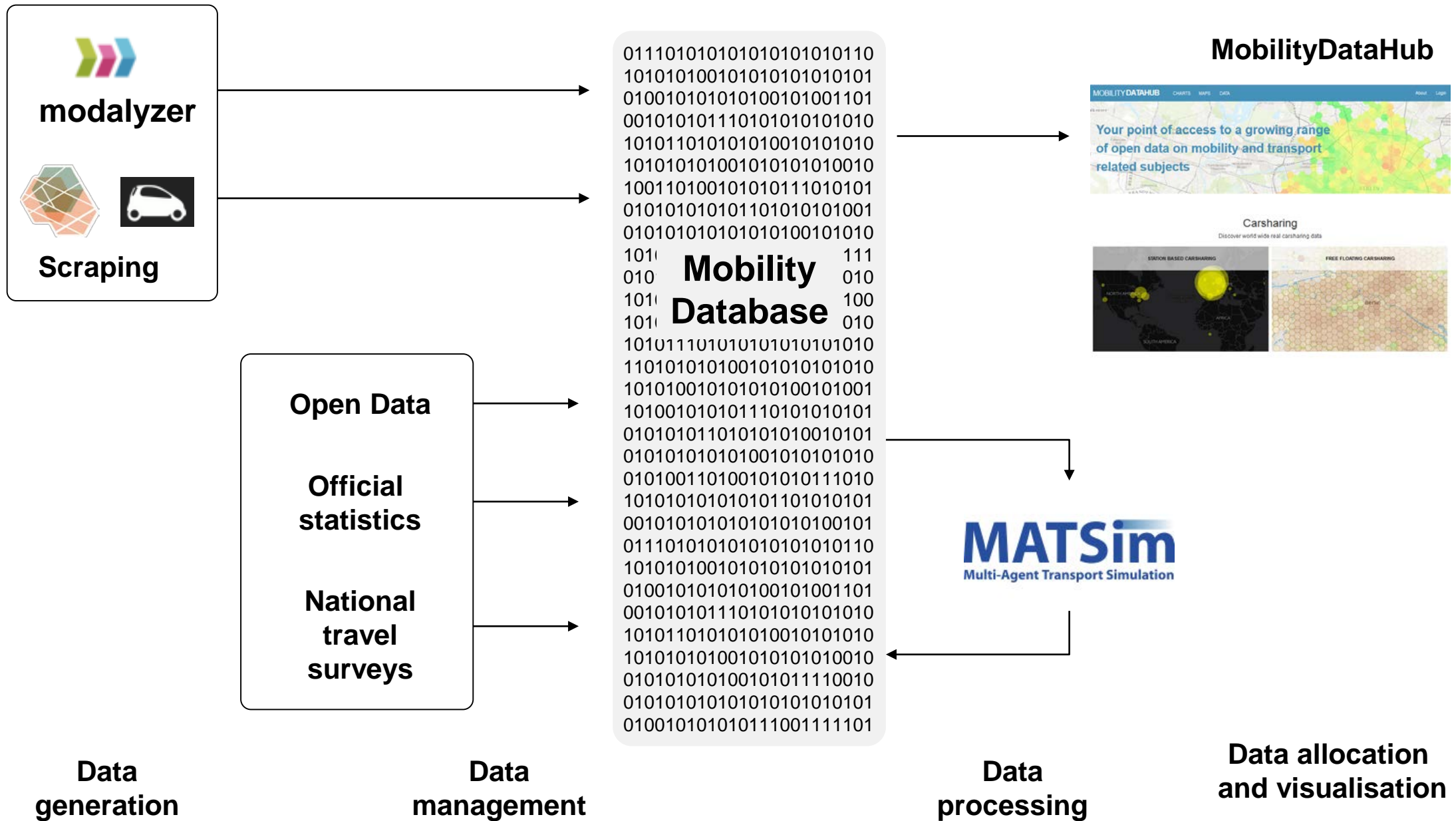
E-Mobility:
How do measures to promote mobility perform?

Logistics:
What emissions are to be expected?

Lifestyles:
What is the cross-sectoral energy balance?

MaaS:
What effect can be achieved by removing access barriers?
Gültig vom 01.06.2011 bis 31.08.2011
Max Mustermann
Berlin ABC

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