

Achievements, strategies and further needs in (global) political discussions

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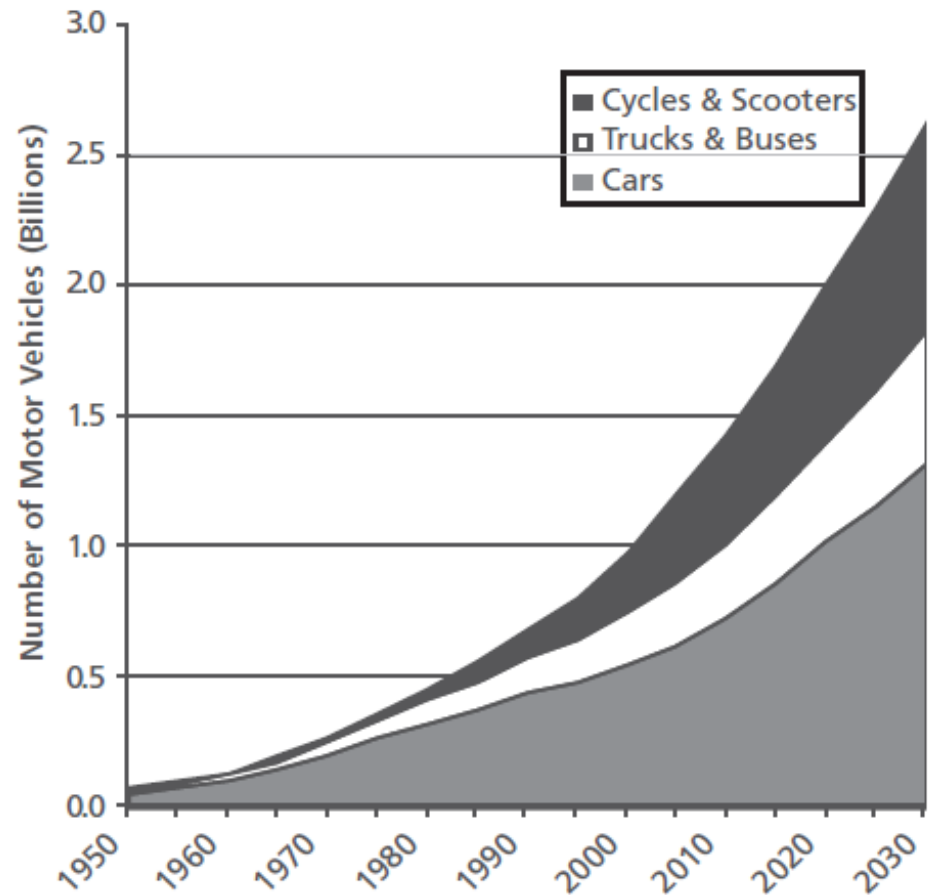
Sources: VIVER Kozinski/Fraunhofer-ISI, private

Agenda

- **Global trends**
- **Strategies** for climate mitigation
- Policy **measures** for climate mitigation of transport
- What about the changing mobility behaviour ?
- Turning the right corner – developing world

Study expectations of global mobility until 2030

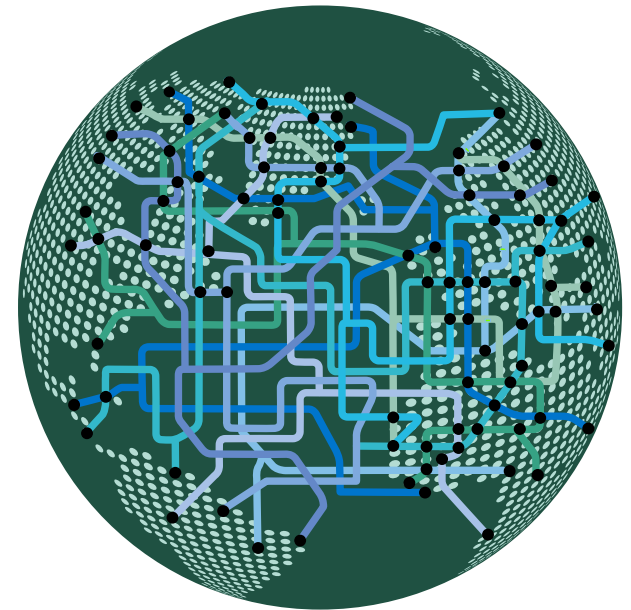
- Doubling of number of annual air passengers from 2.7 billion in 2011 to more than 6 billion in 2030 (ICAO)
- Doubling of annual flights from 30 million to 60 million until 2030 (ICAO)
- More than doubling of the global fleet of automobiles to 2000 million vehicles up from 700 million („2 Billion Cars“)



Source: Sperling/Gordon 2009.

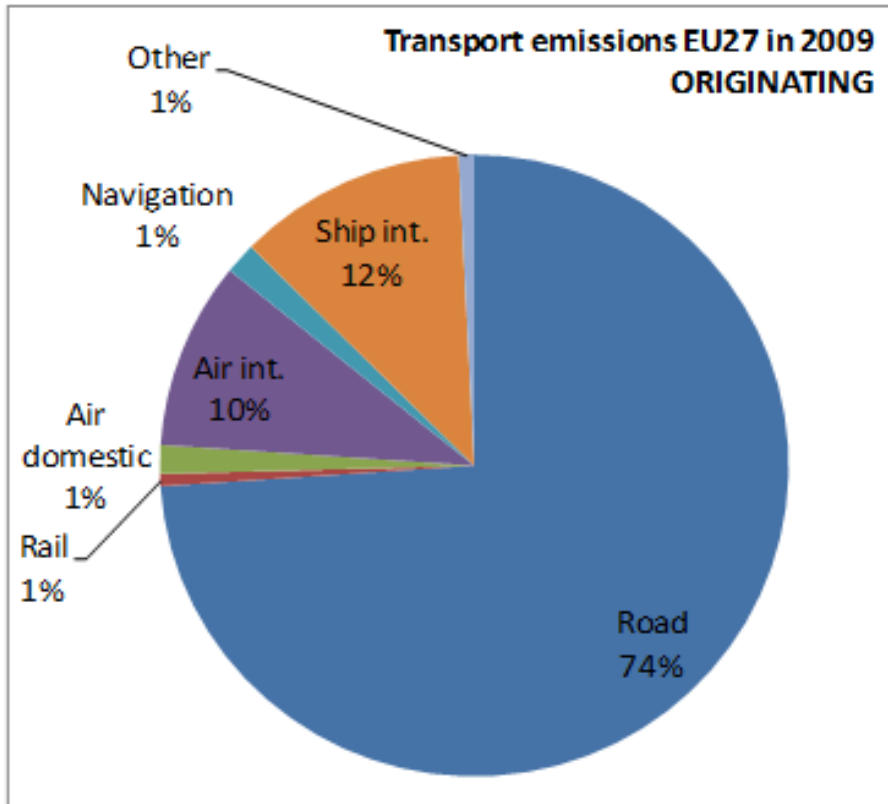
Scenarios 2030

Strategies for climate mitigation

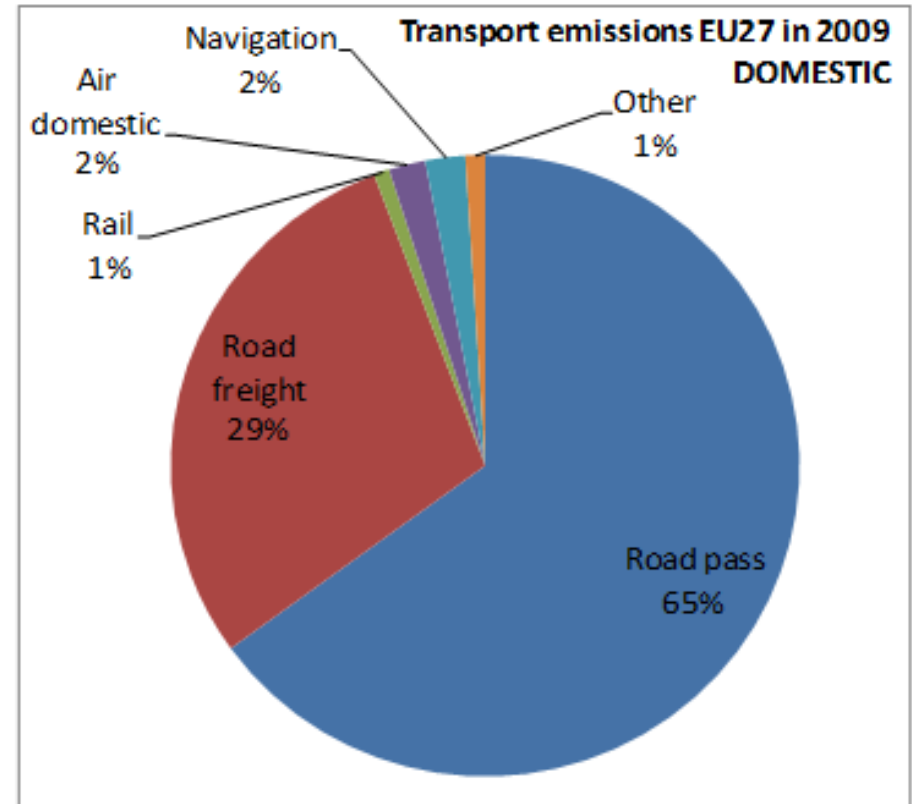


The EU27 GHG emissions of transport

All originating transport



Only domestic transport



Source: GHG-TransPoRD after EEA 2011

Theoretical technical GHG mitigation potentials

Analytic approach:

- Common energy framework
- Long list of potential measures
- Short list of promising measures
- GHG reduction potentials by mode:

Mode	Type of measures	2020	2050
Road	Technical cars*	-40 to -45%	-60 to -68%
	Technical trucks	-30 to -36%	-57 to -63%
	Urban measures**	-43%	-70%
	National policies***	-40%	-70%
Rail	Technology non-urban traffic	-10%	-42%
	Technology urban traffic	-8%	-55%
Air	Technology & policy	-15%	-41%
Shipping	Technology & policy	-5%	-20 to -25%
Biofuels	Technology****	-20%	n.a.

Source: GHG-TransPoRD D2.1, <http://www.ghg-transpord.eu>

GHG-TransPoRD assessment approach

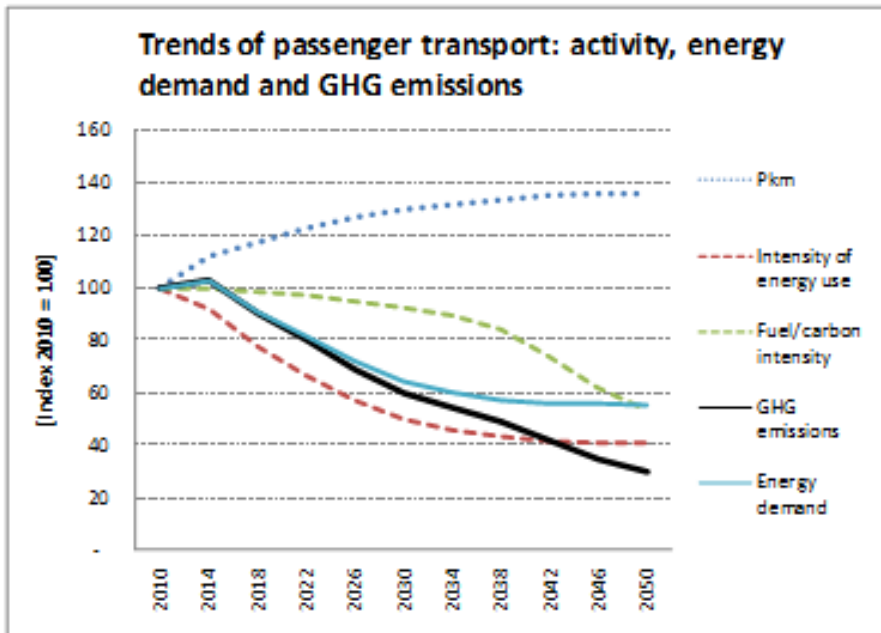
- Model-based integrated assessment – quantitative:
 - ASTRA-POLES (linked transport-energy system until 2050)
 - REMOVE (details until 2030), MARS (urban transport)
- Stepwise scenario building and testing
 - Technology based scenarios
 - Classical transport policies added (e.g. pricing)
 - Ambitious regulation added (e.g. ban conventional cars 2035)
- In 2050 electricity system must be built on >80% renewable electricity share

Recommended EU Policy strategy (GHG-TransPoRD)

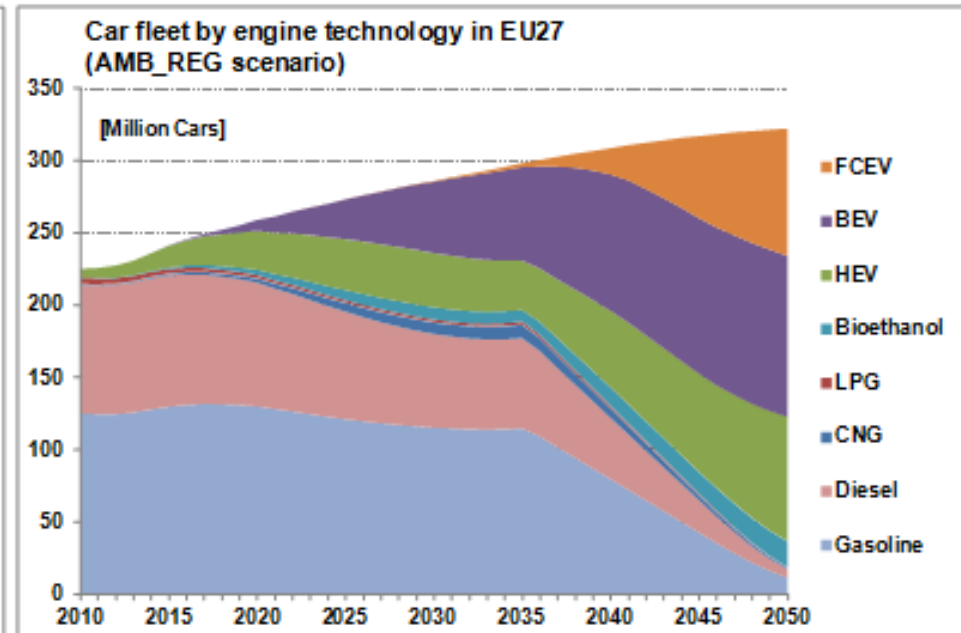
- **First, capture fast the energy efficiency potentials and then focus on the carbon-free energy potentials.**
- Fast development of efficiency technology - NOW
- Alternative engine technologies able to use renewable electricity – test now, massive deployment 2020+
- Ambitious policy-making in terms of pricing
 - to counterbalance rebound effects
 - to maintain financial stability of government transport revenues
- Regulation phasing out fossil fuel cars around 2035
- Moderate modal-shift from road towards more energy efficient modes
- Adaptation of the electricity system to become largely renewable based

Impacts of policy strategy - decomposition

ASIF decomposition analysis



European car fleet by technology



Source: Fraunhofer ISI, GHG-TransPoRD analysis

Feasible transport GHG mitigation targets in EU (www.ghg-transpord.eu)

Compared with reference scenario				
Mode		2020	2030	2050
Road	Passenger	-20% to -30%	-40% to -55%	-70% to -85%
	Freight	-10% to -20%	-30% to -45%	-40% to -60%
Air		0% to -5%	-10% to -20%	-40% to -55%
Ship		(+15% to 0%)	(+30% to 0%)	(+50% to -20%)
Rail		+10% to -10%	0% to -20%	-10% to -35%
Transport	(excl. ship)	-10% to -20%	-40% to -50%	-70% to -90%
Compared with 1990 GHG emission level				
Transport		+10% to +5%	-20% to -30%	-60% to -70%

Source: GHG-TransPoRD D7.1
 Acknowledgements: ISI, TRT, TML, IPTS,
 ITS

Policy process and policy measures for GHG mitigation in Germany (and the developed world)

Policy scenarios for climate mitigation IV (also reporting to UNFCCC)

	2010	2015	2020	2025	2030
	Savings of CO2 against reference scenario				
	[Mt CO2]				
Eco-tax escalator 1999-2003 (+3ct/l/year)	2	2	2	2	2
Commuting subsidy only for commute distances above 20 km (i.e. no tax deduction below 20 km)	1	2	2	2	2
Voluntary agreement of average CO2 emissions of new cars in Europe: 140 gCO ₂ /km until 2008	6	8	8	8	7
Heavy goods charge on German motorways (HGV > 12t)	2	3	3	3	3
Binding use of low resistance tyres and ultrafluid lubricants in cars (100% use in new cars by 2010, 100% use in fleet by 2020)	3	5	8	8	7
Binding CO2 standards for EU new car fleet: target 2012 130 gCO ₂ /km, target 2030 100 g CO ₂ /km bis.	1	7	11	14	16

Source: Fraunhofer ISI estimates
 ÖKO, FZJ, DIW, ISI (2008): Politikszenerarien für den
 Klimaschutz IV: Szenarien bis 2030. UBA Climate Change
 01/2008.

Policy scenarios for climate mitigation VI (also reporting to UNFCCC)




		2015	2020	2025	2030
	Start	Savings of CO2 against reference scenario [Mt CO2]			
Inclusion of air transport into EU-ETS (EU directive)	2012	0.5	0.6	0.9	1.1
German ticket tax on flights from / to German airports	2011	1.7	1.9	2.1	2.4
ICAO efficiency target (1.5% p.a., up from 1% p.a.)	2011	0.8	1.8	3.1	4.8
Kerosene tax of 30.2 ct/l on all flights starting in Germany	2013 (PSz-IV)	11	14	16	18
German strategy e-mobility (1 mill. EV in 2020, 6 mill. In 2030)	2011	0.3	0.7	1.8	4.5

Source: Fraunhofer ISI estimates
 ÖKO, FZJ, DIW, ISI (2013): Politikszzenarien für den Klimaschutz VI:
 Treibhausgas-Emissionsszenarien bis zum Jahr 2030.
 UBA Climate Change 04/2013.

Changing mobility behaviour - new mobility concepts





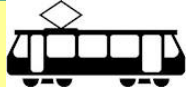







Changing mobility behaviour – not only niches!

Monomodal mobility	Day 1	
	Day 2	
	Day 3	

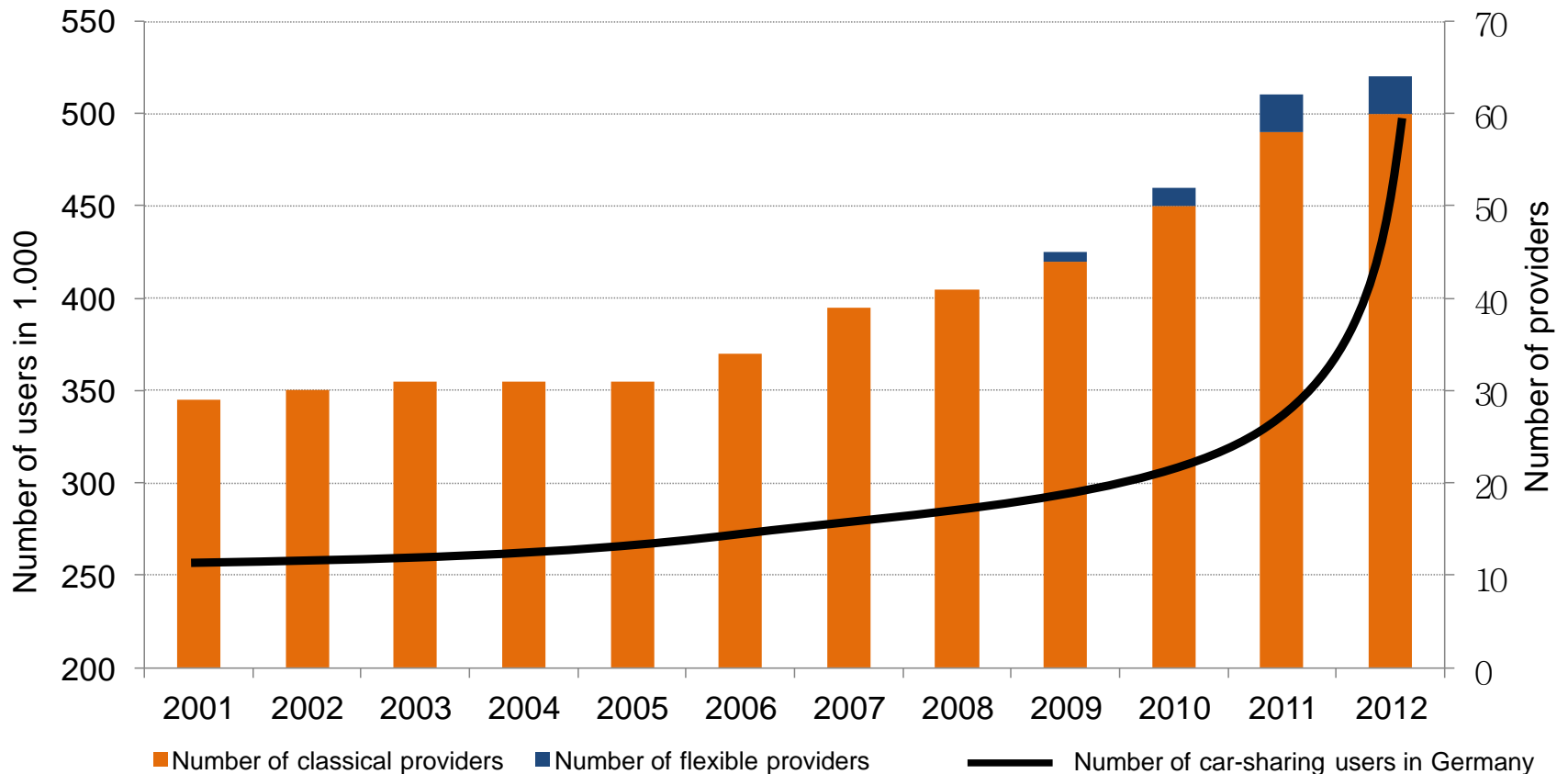
OLD Behaviour

NEW Behaviour

Multimodal mobility	Unimodal	Day 1	
		Day 2	
		Day 3	
	Intermodal	Day 1	 →  → 
		Day 2	 → 
		Day 3	 → 

Innovation Indicator: market formation (Germany)

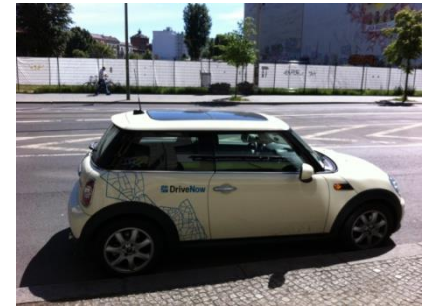
Exponential growth of car-sharing



Quoted in Schade/Krail/Kühn 2014

Innovation indicator: entrepreneurial activity – competition

- Berlin: competition of 10 car-sharing operators (examples)



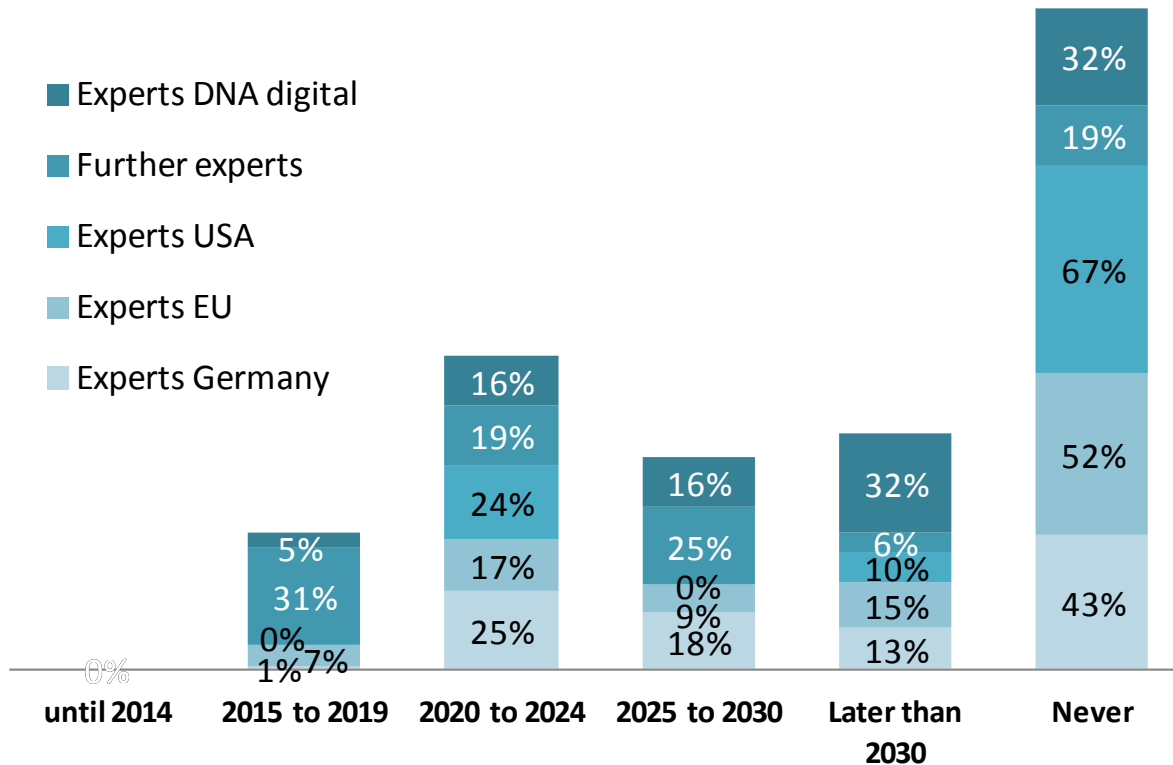
- Paris: AutoLib/Bolloré versus Car2Go/Daimler (competing tenders)



Sources: private

Innovation indicator: guidance of search

When will mobility services replace 25% of private car sales?



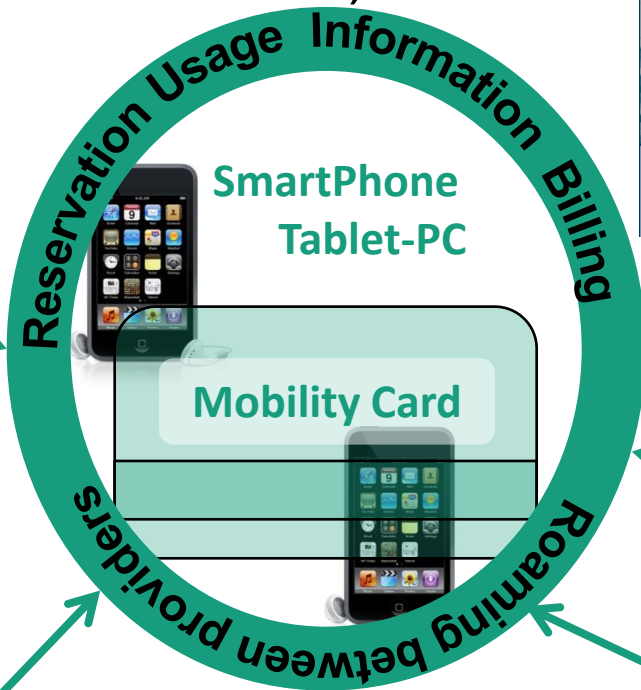
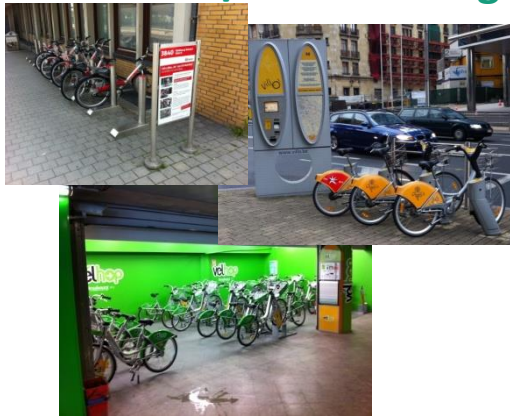
Quoted in Schade/Krail/Kühn 2014

Fifth Mode: multi-modal, integrated, seamless transport (VIVER vision)

New electric personal transporters (PT)



PT / Bike-sharing



Car-sharing



Ride-sharing



Modern public transport



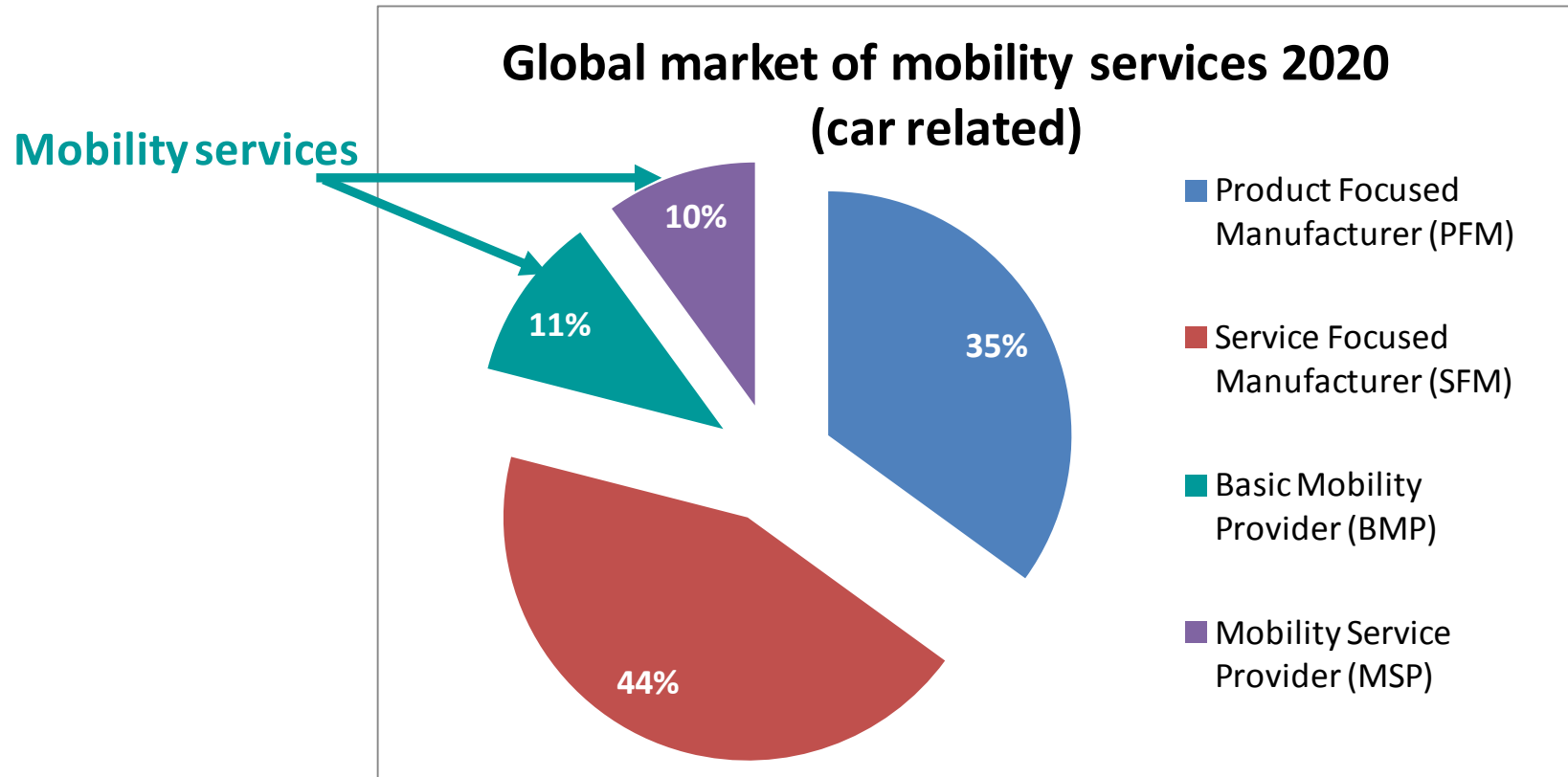
Electric city vehicles



Quellen: privat, Unternehmens-Website

Fifth Mode

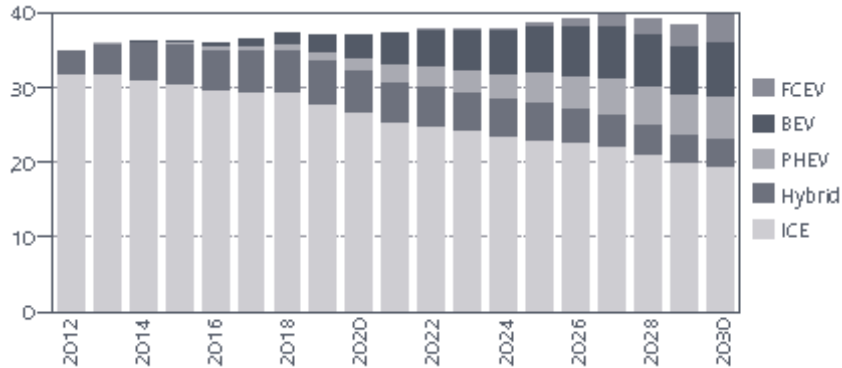
Market expectations on new mobility services



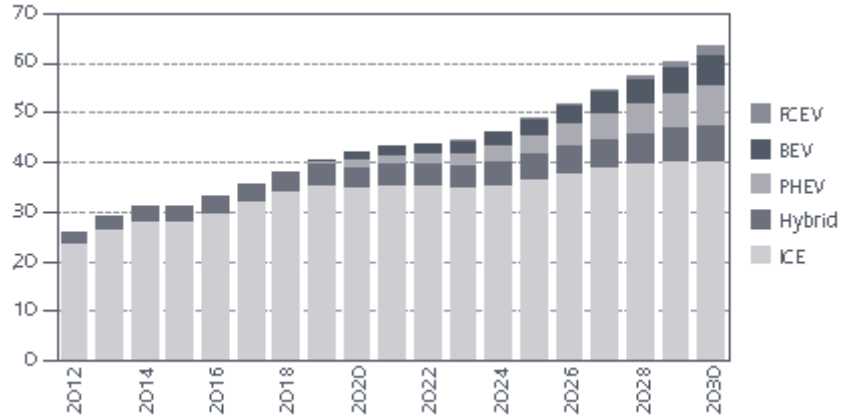
Source: A.D.Little, *Zukunft der Mobilität 2020*

Global vehicle sales affected by new mobility concepts

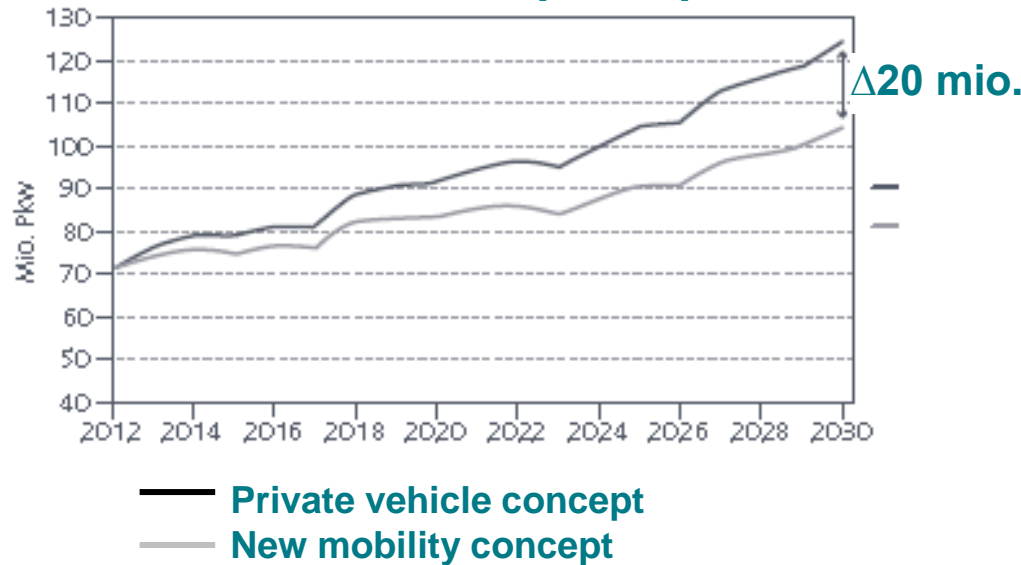
TRIADE



BRICS



Global sales (mio.)



Source: Schade et al. „Sieben Herausforderungen für die deutsche Automobilindustrie“ (2014)

What about the developing world ?



Commonalities and differences of developing world

Common measures:

- Efficiency standards
- Public transport – possibly also new mobility concepts (sharing bus rides is common, yet)
- Electric vehicles – maybe in future low cost 4-seater Evs (today electric scooters)

Specific measures (more in World Bank: turning the right corner):

- Abolishing fuel subsidies
- Make use of substantial co-benefits of transport measures (air pollution, GHG and noise)
- Lower path dependence on existing infrastructure (leapfrog)

Source: Huangzhou, Wikipedia



Conclusions and outlook

- Measures for GHG mitigation are there – barriers are also there
- Ambitious global vehicle standards most important – not race to the bottom
- A realistic measurement cycle for vehicle emissions / efficiency
- New mobility concepts will make a contribution – but how much?
- Air transport – global cooperation needed for real progress – unilateral steps possible
- Shipping – not to be forgotten – slow steaming = low hanging fruit
- Alternative: mitigation by the next global economic crisis – we can not want that



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Measuring the functions of TIS

Function	Negro (2007)	Hekkert (2007)	Bergek (2005, 2008)	Suurs (2009)
Knowledge Development & Diffusion	Desktop/Assessment/Feasibility studies on the technology, Workshops, Conferences	R&D projects; patents; R&D investments, no. of workshops; conferences	Bibliometrics; number, size and orientation, patents; learning curves	Studies, laboratory trials, pilots, prototypes developed, Conferences, workshops, alliances between actors, joint ventures
Guidance of the Search	Positive expectations of the technology; Government regulations, Negative expectations of the technology; Expressed deficit of regulations	Targets set by governments; no. press articles that raise expectations	Belief in growth potential; incentives from taxes (factor prices); regulatory pressure; expression of interest of leading customers	Expectations, promises, policy targets, standards, research outcomes
Entrepreneurial Experimentation	Project started/stopped	No. new entrants; no. diversification activities of incumbents; no. experiments	No of new entrants, number of different types of applications, breadth of technologies used, character of complementary technologies employed	Projects with a commercial aim, demonstrations, portfolio expansions
Market formation	Specific favorable tax regimes and environmental standards Expressed lack of favorable tax regimes or favorable environmental standards	No. niche markets; specific tax regimes; environmental standards	Market size; customer groups; actor strategies; role of standards; purchasing processes; lead users	Market regulations, tax exemptions, events supporting niche markets
Legitimation	Lobby activities for the technology; Support of technology by government, industry, Lobby activities against the technology; Expressed lack of support by government, industry	Rise and growth of interest groups and their lobby actions	Alignment with current legislation; standards; visions and expectations; depiction in newspapers	Coalitions, Lobbies, advice
Resource Mobilization	Subsidies, investments for the technology; Expressed lack of subsidies, investments	Whether or not inner core actors perceive resource access as problematic	Rising volume of capital, increasing volume of seed and venture capital, changing volume and quality of human resources, changes in complementary assets.	Subsidies, investments, infrastructure development
Development of positive externalities			Political power; resolution of uncertainties; pooled labor market; specialized intermediaries; information flows	

What do we need for this system transition? (not a prioritisation)

- Technology
 - New types of vehicles – small, silent, efficient electric urban vehicles
 - New ICT front-end technology – Apps and smartphones/wearables
 - New ICT back-end technology – time tables, payment systems, interfaces, big data
 - Infrastructure
 - True multi-modal hubs
 - Space for public sharing stations
 - Organisation
 - Sharing economy – car-sharing, bike-sharing, ride-sharing
 - New business models – Automotive industry, public transport, insurances, etc.
 - Behavioural change
 - Multi-modal behaviour – flexibility and comfort
 - Social media – mass trust
 - Regulation
 - Privacy, roaming, public-restricted parking, etc.
-

Berlin: diversity of car-sharing!



Quellen: privat

Innovations