



Technische Hochschule  
Ingolstadt  
Fakultät für Maschinenbau

Zukunft in  
Bewegung



## New Trends in Automotive Mobility

Mobility today

Prof. Dr. Harald Göllinger 11/2016

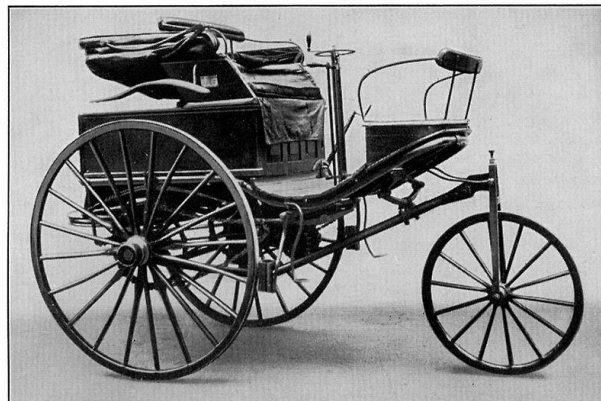
### The Evolution of Mobility Where it started...



1885 Benz Motorwagen:



First cross-country automobile journey  
On 5 August 1888 Mannheim-Pforzheim



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*The Evolution of Mobility  
Where it started...*



Mass production of cars by Henry Ford: Ford Model T

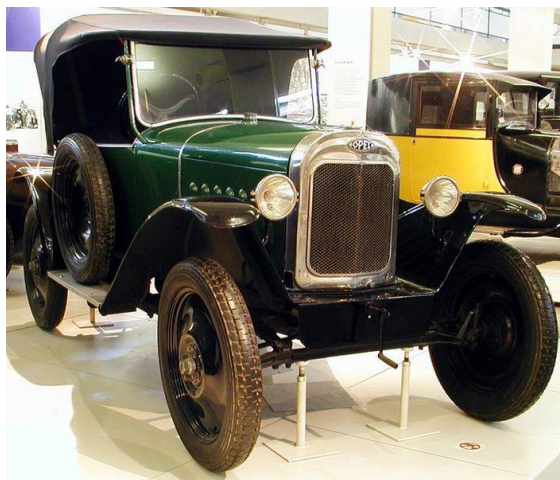


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*The Evolution of Mobility  
Where it started...*



1924-31 Opel Laubfrosch („treefrog“)



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*The Evolution of Mobility  
Where it started...*



1956 – 61 Romi-Isetta, first car produced in Brazil



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*The Evolution of Mobility  
How the Future looked like in the Past*



1955 Lincoln Futura

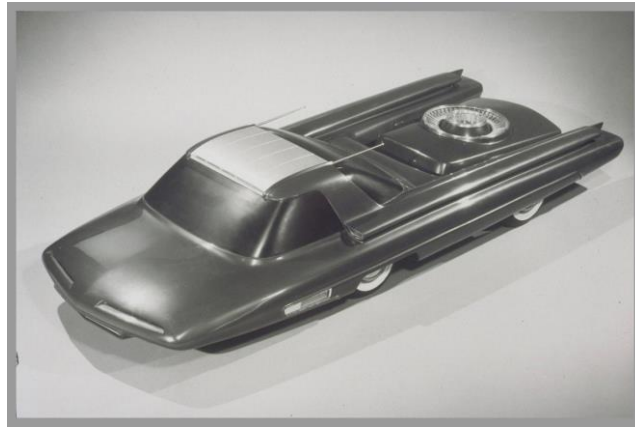


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*The Evolution of Mobility*  
*How the Future looked like in the Past*



1958 Ford Nucleon: how to design a nuclear powered car.  
 (a steam engine powered by uranium fission like in a nuclear submarine)



Source: <http://www.taringa.net/posts/autos-motos/15245234/Ford-Nucleon-un-auto-nuclear.html>

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*The Evolution of Mobility*  
*How the Future looked like in the Past*



1959 GMC Firebird III



[http://www.conceptcarz.com/view/photo/312710\\_4658/1959-GMC-Firebird-III\\_photo.aspx#photo](http://www.conceptcarz.com/view/photo/312710_4658/1959-GMC-Firebird-III_photo.aspx#photo)

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*The Evolution of Mobility  
How the Future looked like in the Past*



Source: <http://dayeses.com/gm-firebird-iii.html>

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*The Evolution of Mobility  
How the Future looked like in the Past*



1959 GMC Firebird III  
with a gas turbine engine and a 10 hp gasoline engine

Features include:

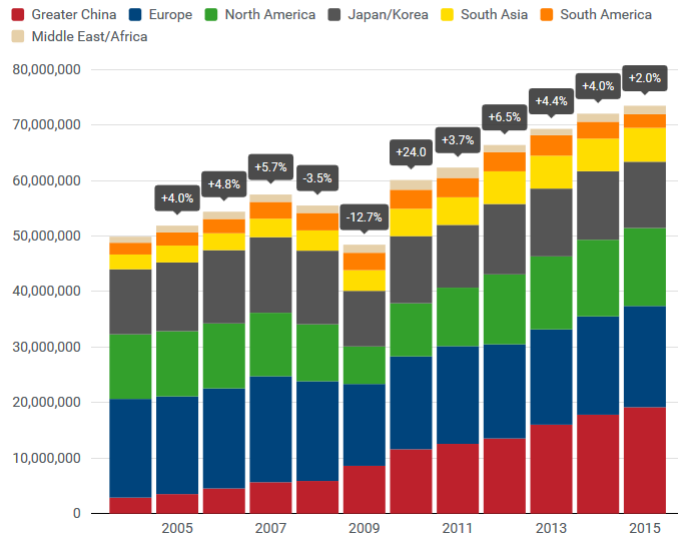
- steering by a joystick
- Automatic Cruise Control
- antilock brake
- drag brakes
- road guidance on the „highway of the future“



[http://dayeses.com/data\\_images/posts/gm-firebird-iii/gm-firebird-iii-08.jpg](http://dayeses.com/data_images/posts/gm-firebird-iii/gm-firebird-iii-08.jpg)

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### The Evolution of Mobility World passenger car production



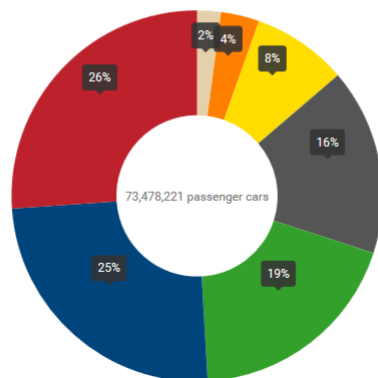
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### The Evolution of Mobility World passenger car production in 2015



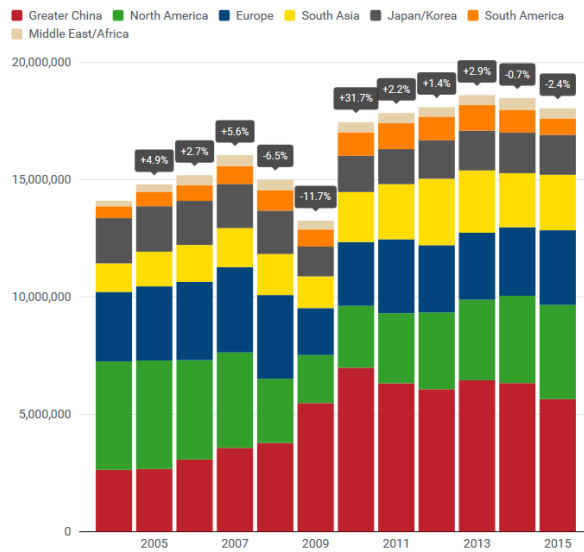
Greater China Europe North America Japan/Korea South Asia South America Middle East/Africa

% share



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## The Evolution of Mobility World commercial vehicle production

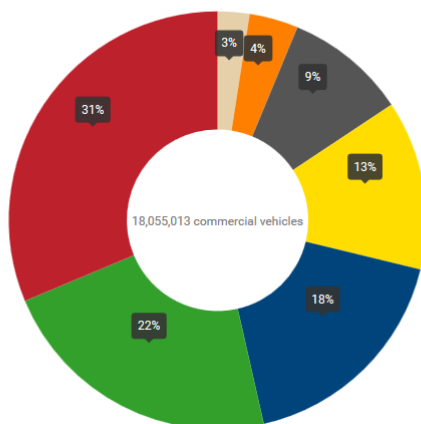


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## The Evolution of Mobility World commercial vehicle production in 2015

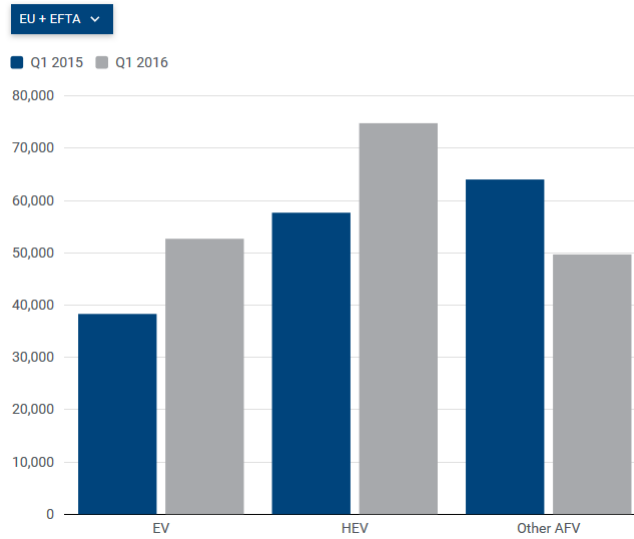


Greater China North America Europe South Asia Japan/Korea South America  
Middle East/Africa  
% share



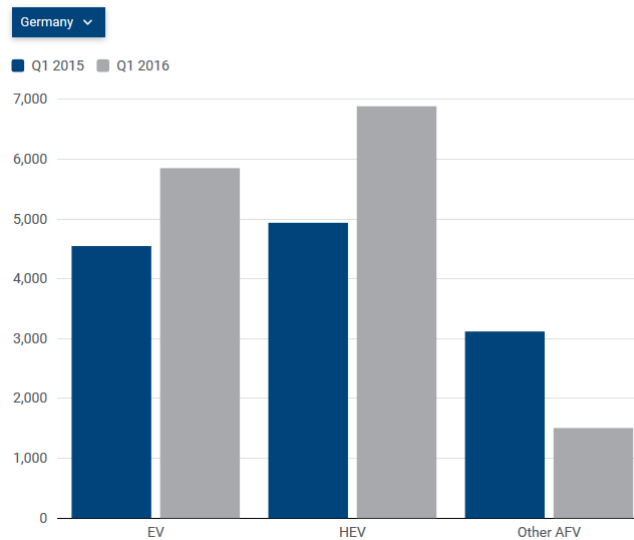
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*The Evolution of Mobility*  
*New passenger car registrations in the EU*  
*by alternative fuel type*



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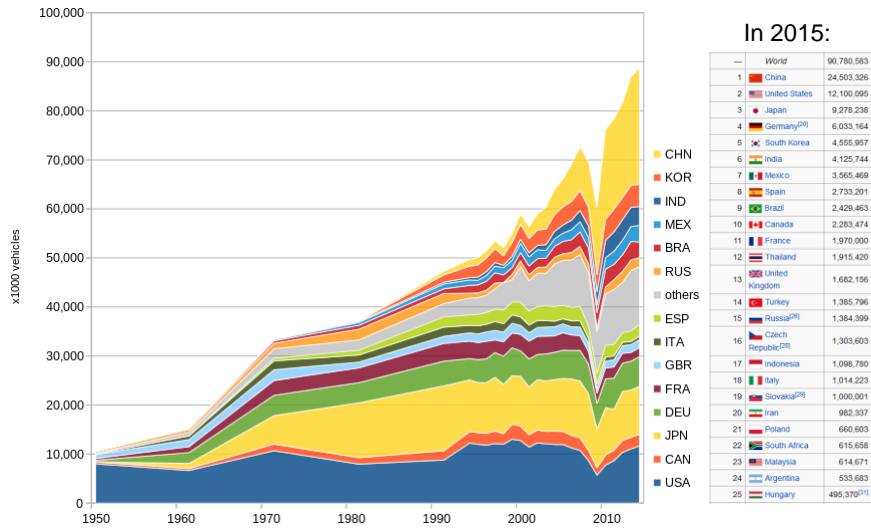
*The Evolution of Mobility*  
*New passenger car registrations in Germany*  
*by alternative fuel type*



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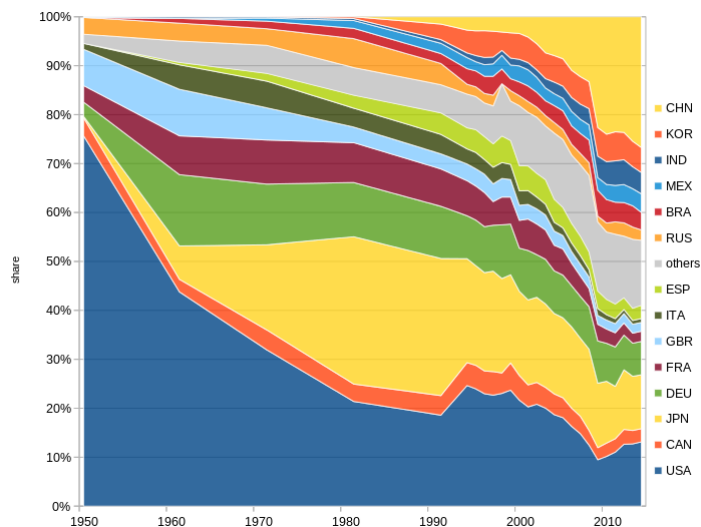
### The Evolution of Mobility Countries by volume of production since 1950



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Source: by Masaqui - Own work, CC BY-SA 4.0,  
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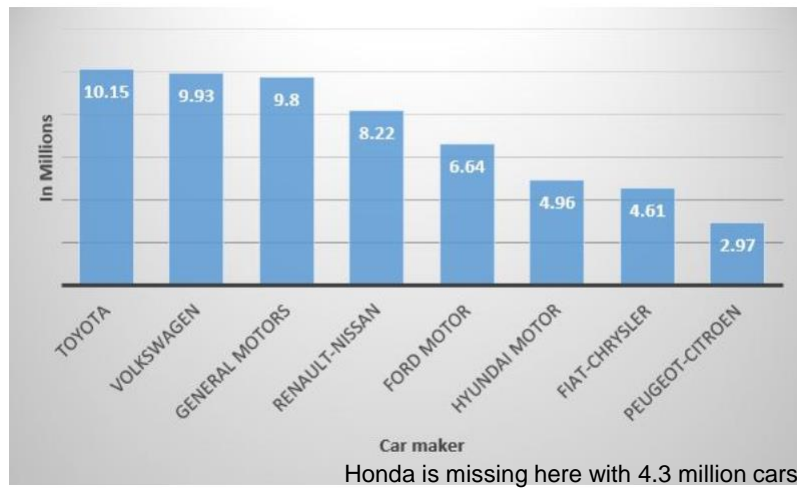
### The Evolution of Mobility Countries by shares of production since 1950



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Source: by Masaqui - Own work, CC BY-SA 4.0,  
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The Evolution of Mobility  
The world's biggest vehicle manufacturers by sales in 2015



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<https://news.markets/shares/toyota-remains-the-worlds-biggest-car-company-9737/>

The Evolution of Mobility  
Vehicle Production  
by Manufacturers  
in 2013

Rank	Group	Country	Total	Cars	LCV	HCV	Heavy Bus
1	Toyota	Japan	10,324,995	8,565,176	1,481,722	5,686	
2	General Motors	United States	9,628,912	6,733,192	2,890,958	4,762	
3	Volkswagen	Germany	9,379,229	9,259,506	119,723		
4	Hyundai	South Korea	7,233,080	6,909,194	242,021	67,290	14,575
5	Ford	United States	6,077,126	3,317,048	2,667,220	92,858	
6	Nissan	Japan	4,950,924	4,090,677	837,331	22,916	
7	Fiat Chrysler Automobiles	Italy	4,681,704	2,163,040	2,350,697	124,131	43,836
8	Honda	Japan	4,298,390	4,263,239	35,151		
9	Suzuki	Japan	2,842,133	2,452,573	389,560		
10	Groupe PSA	France	2,833,781	2,445,889	387,892		
11	Renault	France	2,704,675	2,347,913	356,762		
12	BMW	Germany	2,006,366	2,006,366			
13	SAIC	China	1,992,250	1,685,392	231,374	74,431	1,053
14	Daimler	Germany	1,781,507	1,631,502	150,005		
15	Mazda	Japan	1,264,173	1,175,443	88,730		
16	Dongfeng	China	1,238,948	642,092	226,319	357,414	13,123
17	Mitsubishi	Japan	1,229,441	1,090,571	135,306	3,564	
18	Changan	China	1,109,889	873,794	166,056	70,039	
19	Tata	India	1,062,654	650,708	279,511	117,425	15,010
20	Geely	China	969,896	969,896			
21	BAIC	China	918,879	243,437	285,947	384,425	5,070
22	Fuji (Subaru)	Japan	808,919	808,919			
23	Brilliance	China	782,904	479,335	264,210	39,359	
24	FAW	China	717,883	448,290	61,822	203,895	3,876
25	Mahindra & Mahindra	India	584,534	407,563	173,398	2,237	1,236
26	Great Wall	China	557,564	430,423	127,141		
27	Isuzu	Japan	532,966		36,094	494,907	1,955
28	JAC	China	517,577	206,132	120,588	174,571	16,286
29	BYD	China	510,950	510,950			
30	AvtoVAZ	Russia	507,242	495,013	12,229		

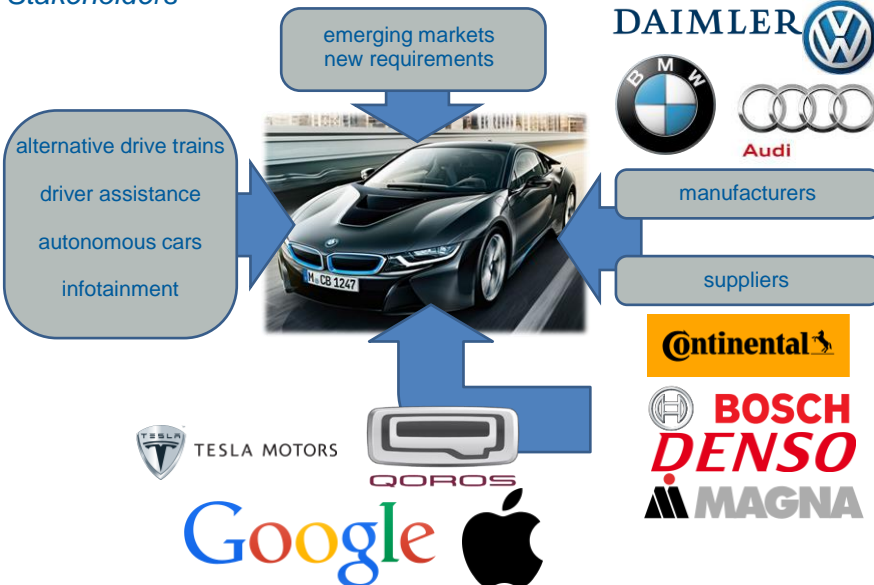
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The Evolution of Mobility  
Vehicle Production in Germany today



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The Evolution of Mobility  
Stakeholders



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## The Evolution of Mobility Questions



How will mobility change in the next 20 years?

Would you like to drive a car in 20 years?

How will luxury cars look like in 20 years?

What does a customer expect from a luxury car in 20 years?

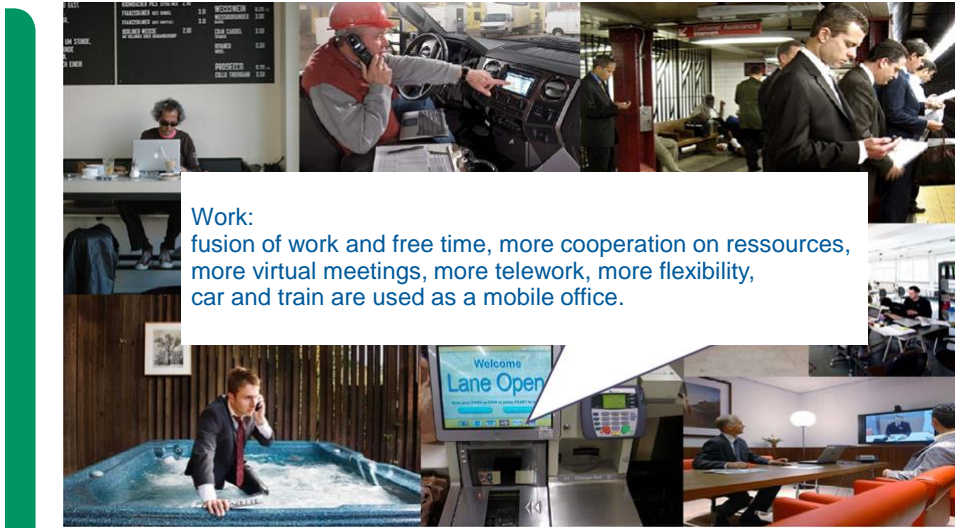
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## The Evolution of Mobility Changes in Society in 2030



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*The Evolution of Mobility  
Changes in Society in 2030*



**Work:**  
fusion of work and free time, more cooperation on resources, more virtual meetings, more telework, more flexibility, car and train are used as a mobile office.

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*The Evolution of Mobility  
Changes in Society in 2030*



**Consumption:**  
More individual services, more location based services, more informed consumers, design is important, less ownership, more availability: sharing, leasing, lending, more updates and modular products  
Reduce, re-use, recycle, repair  
More „good“ products, „green“ and „fairtrade“ consumption

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The Evolution of Mobility  
Changes in Society in 2030



**Mobility:**  
More time on the road, more comfort, more environment friendly mobility, more connected cars, intelligent transport systems, local public transport as a backbone of mobility, fusion of cars and local public transport, sharing, leasing of cars, more entertainment and services

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The Evolution of Mobility  
Megacities

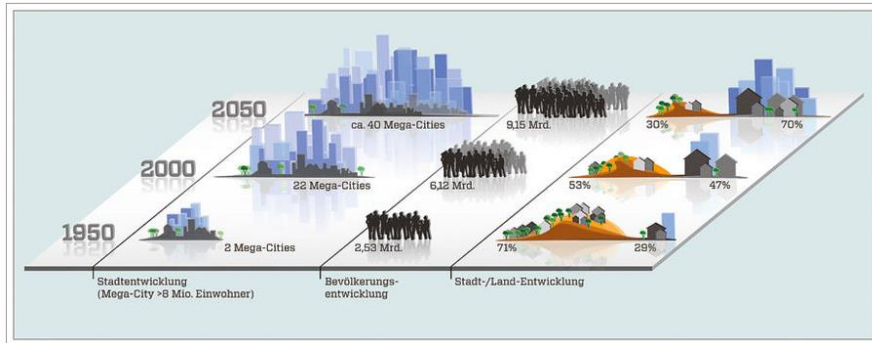


Source: <https://en.wikipedia.org/wiki/Megacity>

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Rank	Megacity	Country	Continent	Population
1	Tokyo-Yokohama	Japan	Asia	37,900,000
2	Jakarta	Indonesia	Asia	30,326,103 <sup>[2]</sup>
3	Seoul	South Korea	Asia	26,100,000
4	Delhi	India	Asia	25,703,000 <sup>[3]</sup>
5	Shanghai	China	Asia	25,400,000
6	Karachi	Pakistan	Asia	24,000,000 <sup>[4]</sup>
7	New York City	United States	North America	23,632,722 <sup>[5]</sup>
8	Mexico City	Mexico	North America	22,200,000
9	Beijing	China	Asia	21,650,000
10	São Paulo	Brazil	South America	21,250,000
11	Lagos	Nigeria	Africa	21,000,534 <sup>[6]</sup>
12	Mumbai	India	Asia	20,741,000 <sup>[3]</sup>
13	Osaka	Japan	Asia	20,260,000
14	Manila	Philippines	Asia	20,040,000
15	Cairo	Egypt	Africa	18,810,000
16	Los Angeles	United States	North America	18,550,286 <sup>[7]</sup>
17	Dhaka	Bangladesh	Asia	18,250,000
18	Moscow	Russia	Europe	16,900,000
19	Buenos Aires	Argentina	South America	16,500,000
20	Bangkok	Thailand	Asia	15,350,000
21	Istanbul	Turkey	Europe/Asia	14,800,000
22	Kolkata	India	Asia	14,766,000 <sup>[3]</sup>
23	Rio de Janeiro	Brazil	South America	14,450,000
24	London	United Kingdom	Europe	14,031,830 <sup>[8]</sup>
25	Tehran	Iran	Asia	13,700,000
26	Guangzhou	China	Asia	12,700,000
27	Kinshasa	Democratic Republic of Congo	Africa	12,500,000
28	Shenzhen	China	Asia	12,250,000
29	Paris	France	Europe	12,005,077 <sup>[9]</sup>

The Evolution of Mobility  
More Megacities in the Future



source: auto, motor & sport: Mobilitätsreport – wie fahren wir in der Zukunft?

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The Evolution of Mobility  
Energy and Mobility



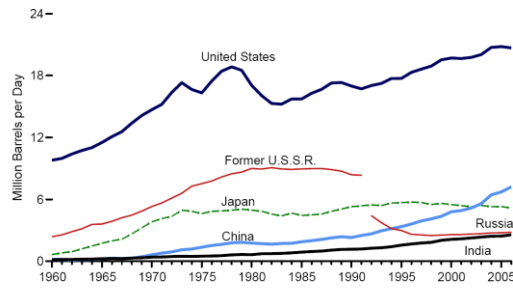
Petrol prices in the summer of 2009

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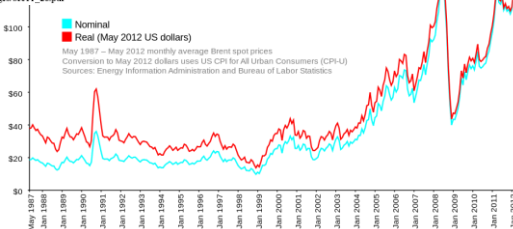
## The Evolution of Mobility Energy and Mobility



Top Consuming Countries, 1960-2006



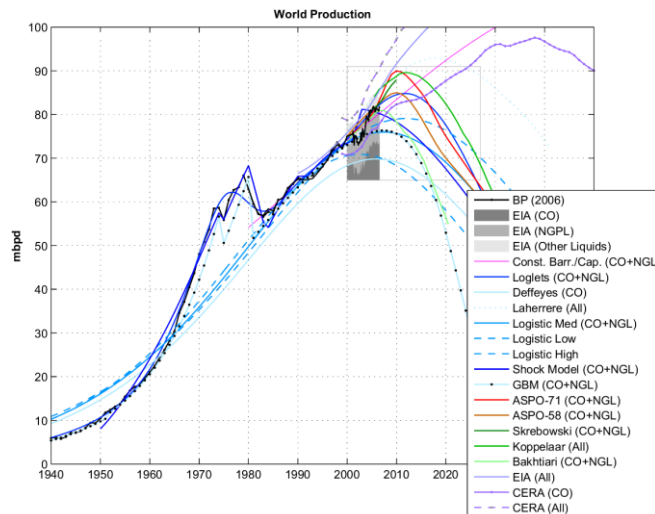
Source: [http://www.eia.doe.gov/emeu/aer/pdf/pages/sec11\\_20.pdf](http://www.eia.doe.gov/emeu/aer/pdf/pages/sec11_20.pdf)



source: [http://en.wikipedia.org/wiki/Oil\\_price](http://en.wikipedia.org/wiki/Oil_price)  
[en.wikipedia.org/wiki/Peak\\_oil](http://en.wikipedia.org/wiki/Peak_oil)

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## The Evolution of Mobility Predicting Peak Oil

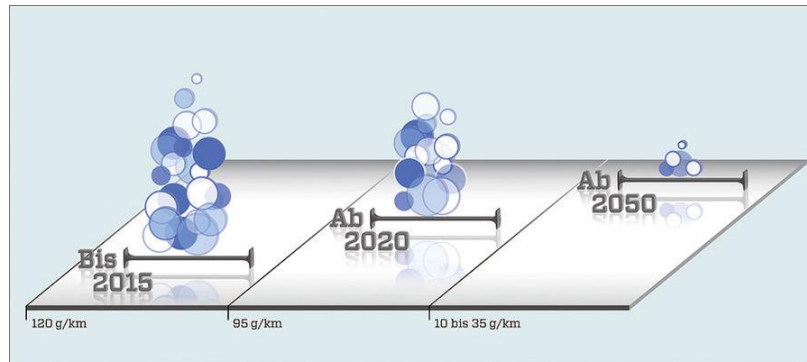


Quelle: [http://en.wikipedia.org/wiki/Peak\\_oil](http://en.wikipedia.org/wiki/Peak_oil)

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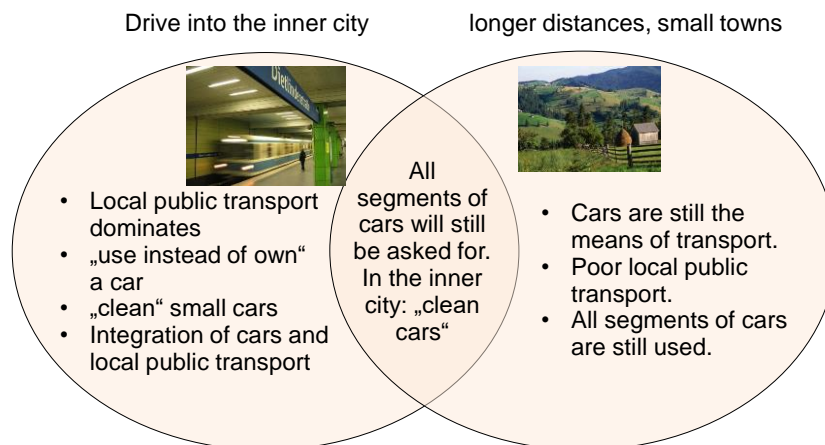
## The Evolution of Mobility Reduction of CO<sub>2</sub>-Emissions in the EU



source: auto, motor & sport: Mobilitätsreport – wie fahren wir in der Zukunft?

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## The Evolution of Mobility Cars as a Means of Transport in the Future



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