

Bem Vindo
 Bienvenido benvenuto ჰეთლი იყალ თქვინ მთხობანება
 환영합니다 Sveiki atvykę қош келдіңіз Hoşgeldiniz
 Isten hozott Laipni lūdzam добро пожаловать բարի գալուստ
 Vítejte Добро Дошли Добре дошли
 Bine ați venit Vitajte Добро Дошли ЛАСКАВО ПРОСИМО
 Dobro Došli Serdecznie Witamy Mbemba Mekona
 Mirëse Erdhe Sawubona
 Mirë se vini  Mia Wezon
 Akwaba Mikabo
 ش و خ د ي د م ا **b i e n v e n u e** እንኳን ደህና መጡ
 स्वागत Velkommen እንኳን ደህና መጡ
 سلام علیکم **swagat** Mana'o ahoana
 स्वागतम **swagat** Tonga soa Welcome
 مرحبا **swagat** Ongi Etorri Καλωσ ήρθατε
 Selamat Datang **swagat** 
 Hoan Nghênh **swagat** 歡迎
 Sugeng Rawuh **swagat** 欢迎 will kommen
 வணக்கம்! **swagat** 欢迎 will kommen
 வணக்கம்! **swagat** 欢迎 will kommen
 ようこそ **swagat** Willkommen
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Sustainable mobility
Innovation in Electric Vehicle Technologies

International Renewable Agency (Irena)
 Irena Innovation Week
 Bonn May 12th 2016

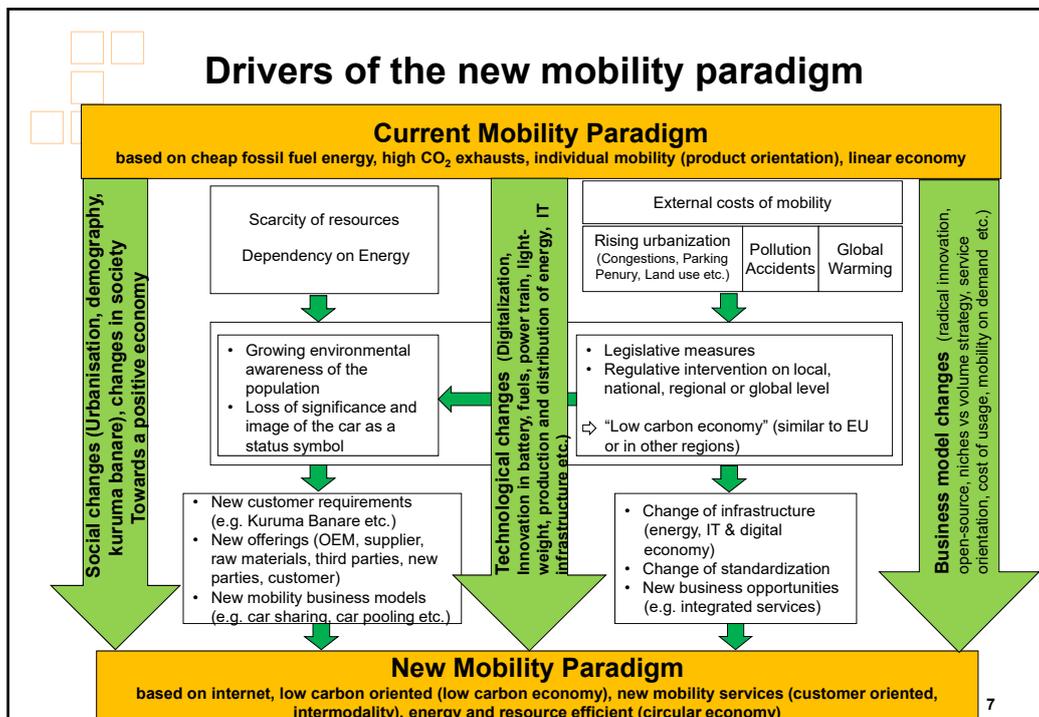
Prof. Dr. Guy Fournier

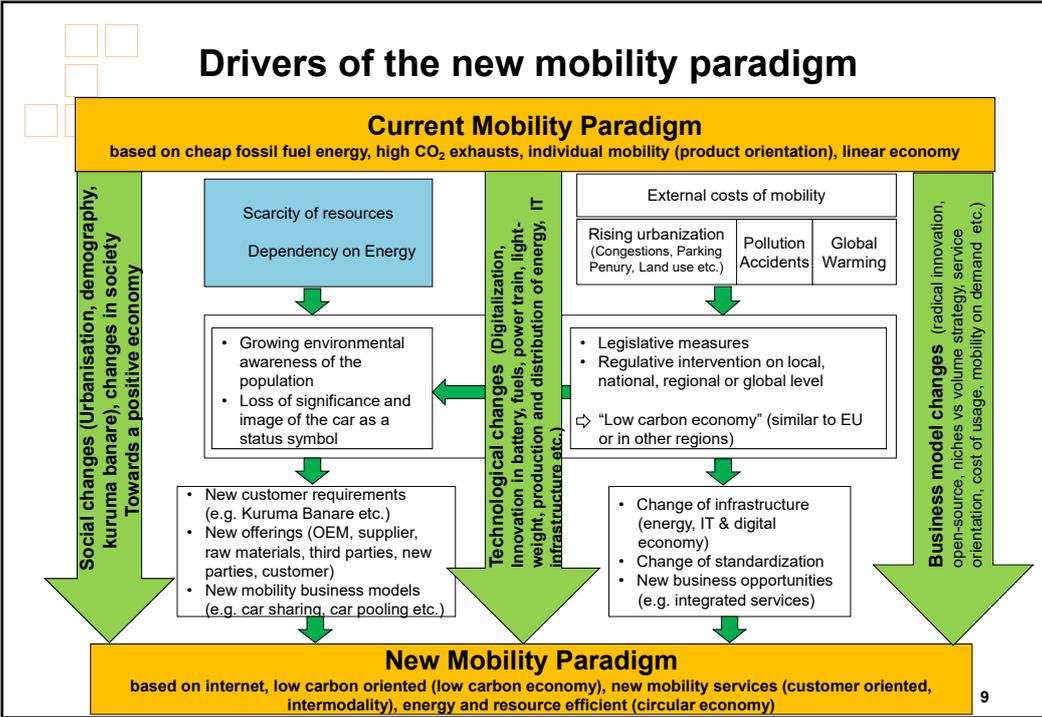
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Agenda

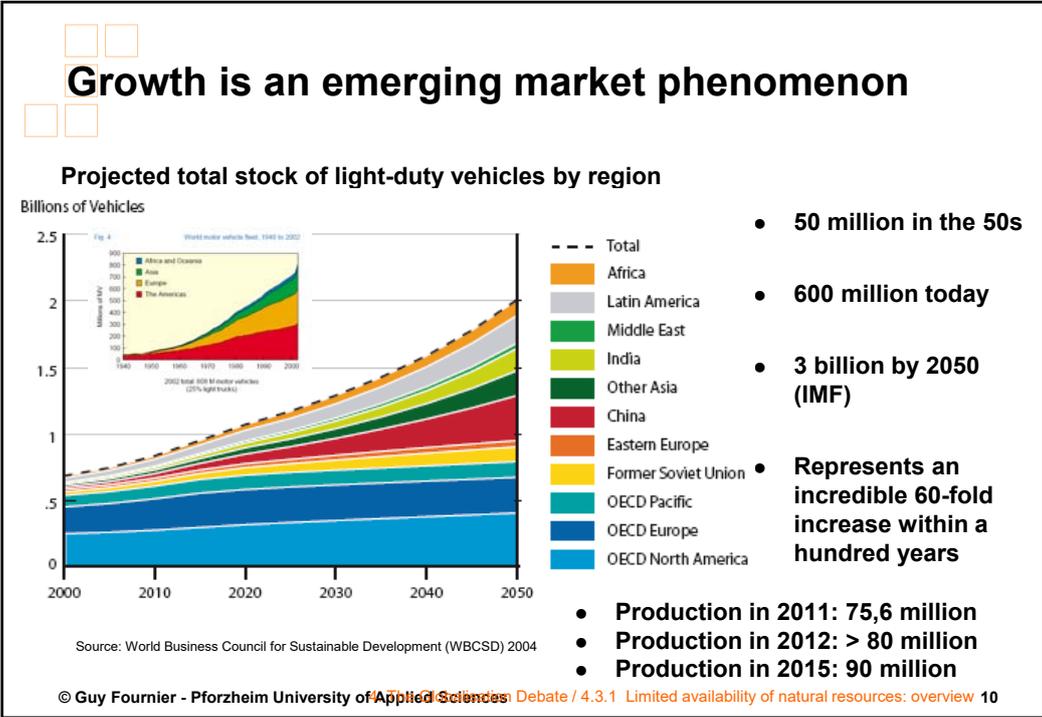
- Drivers of the new mobility paradigm
- Innovation in individual mobility: new powertrains
- Innovation in mobility services and value added services:
 - EV as a part of mobility solutions
 - EV as a part of storage solutions
 - Innovation in Autonomous EV: the example of robocabs
- Innovation in Developing Countries: Reverse innovation and frugal economy
- Conclusion

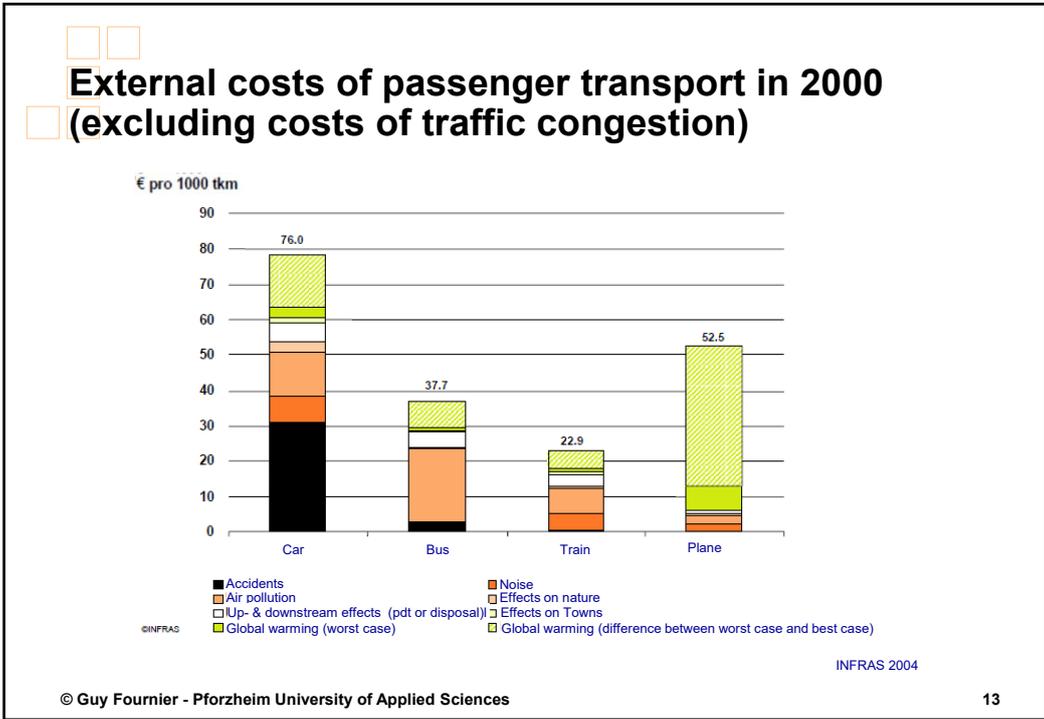
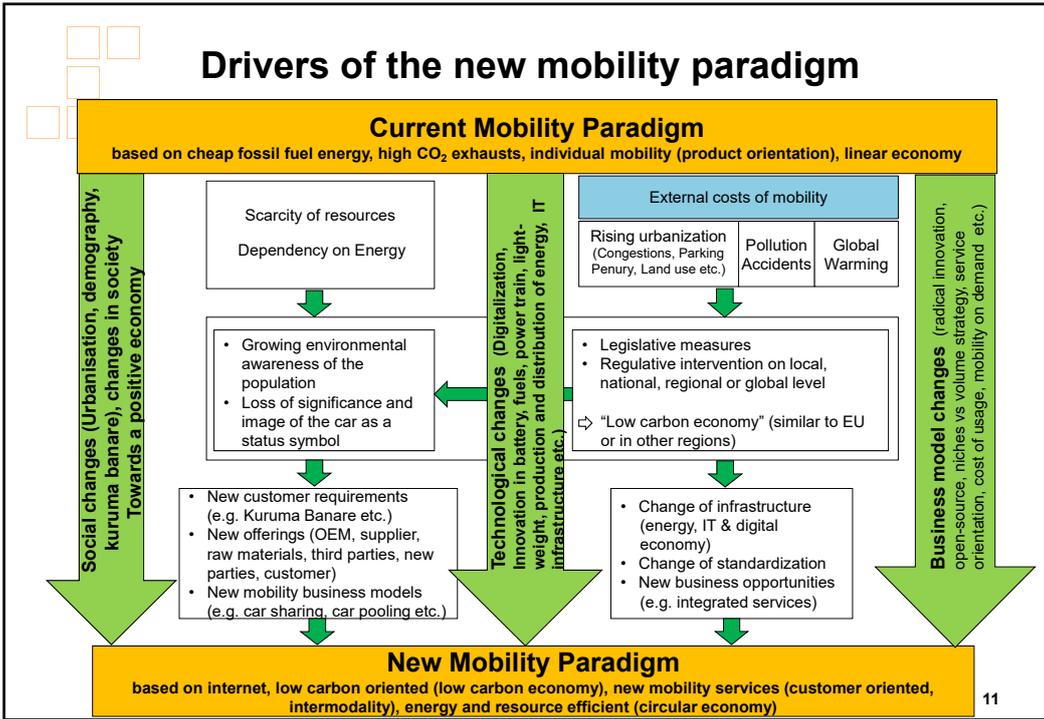
Drivers of the new mobility paradigm





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Drivers of the new mobility paradigm

Transportation as a driver of external costs



- Target for the EU to reduce its CO₂ emissions by 20% until 2020, or 30% if a broader international agreement is reached

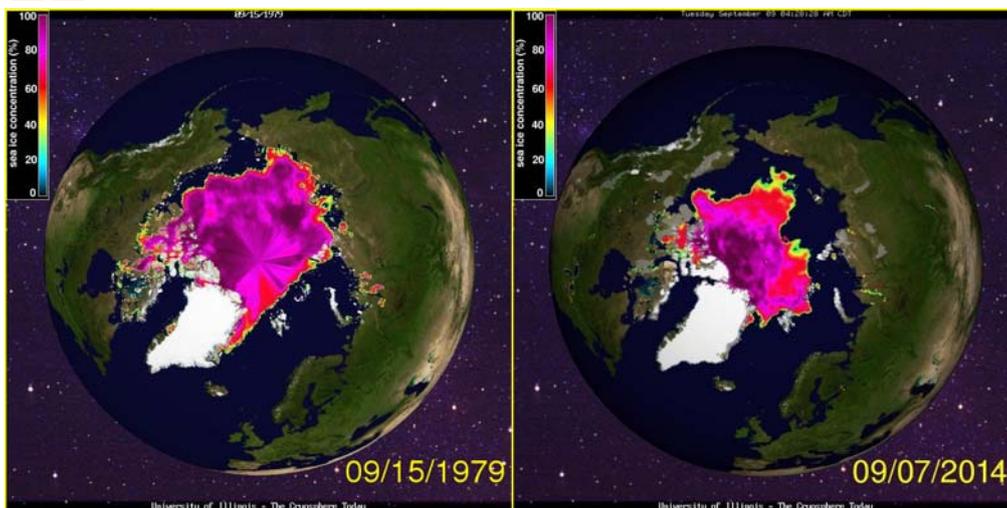


Paris March 2014

Costs of air pollution in France: between 886 millions € 1,817 bn € (2015)

- Cost estimation in Europe:
 - Global warming
 - Noise
 - Air pollution
 - Traffic Congestion1,1% GDP
- The aim of the EU is to internalise the external costs of transportation
- “Greening Transport Package“

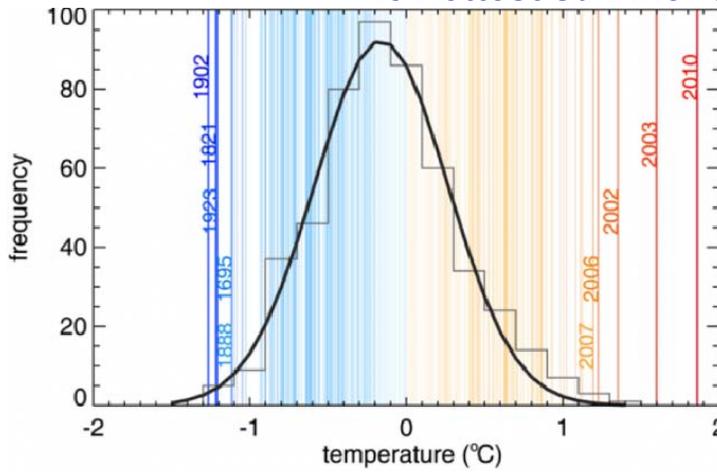
Comparison of the Daily Sea Ice



<http://igloo.atmos.uiuc.edu/cgi-bin/test/print.sh?fm=09&fd=15&fy=1979&sm=09&sd=07&sy=2014>

Temperature Anomalies in Europe

The hottest summer since 1500:

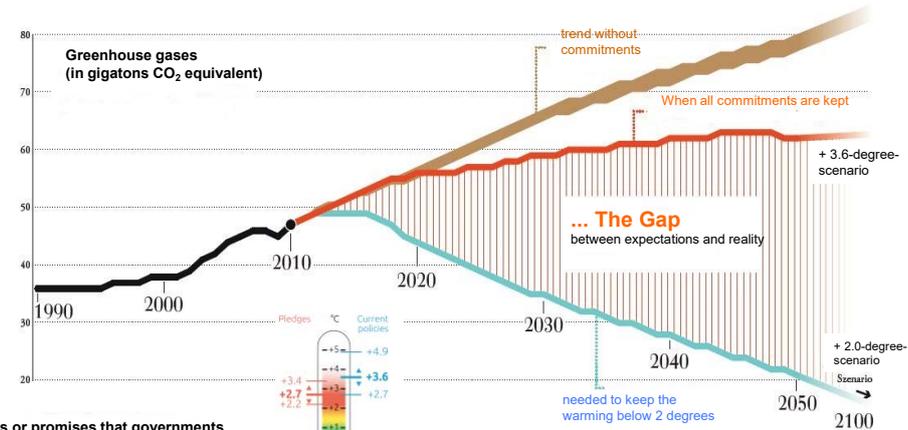


2010
2013
2002
2006

2015 will probably be the hottest summer since 1500

Barriopedro et al., 2010.

Climate Change

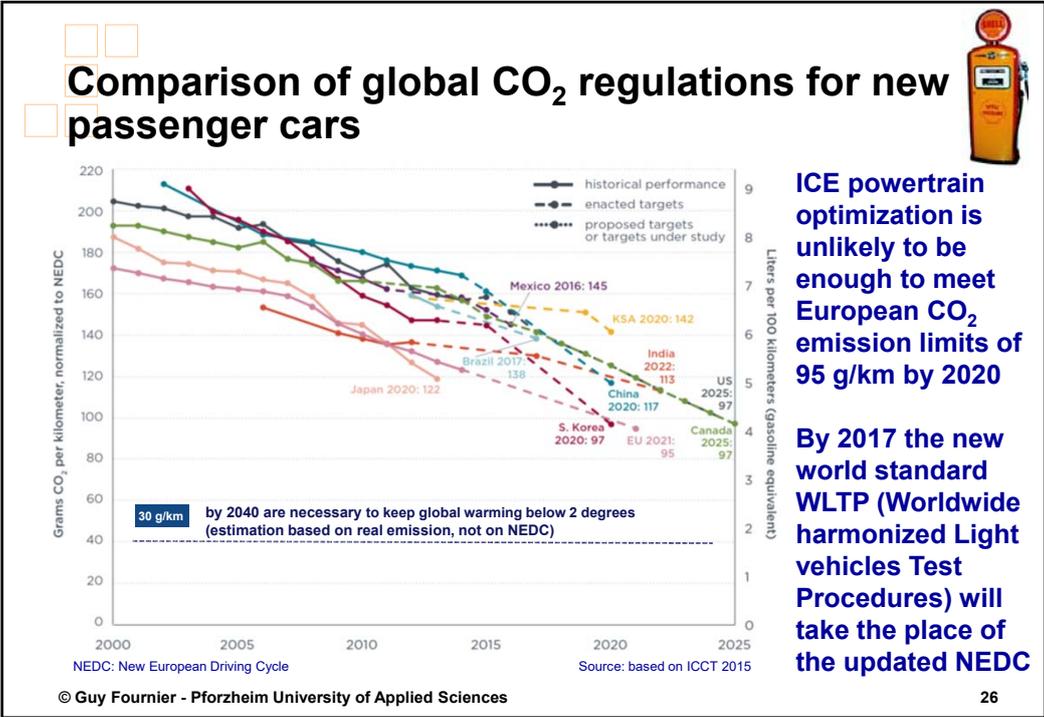
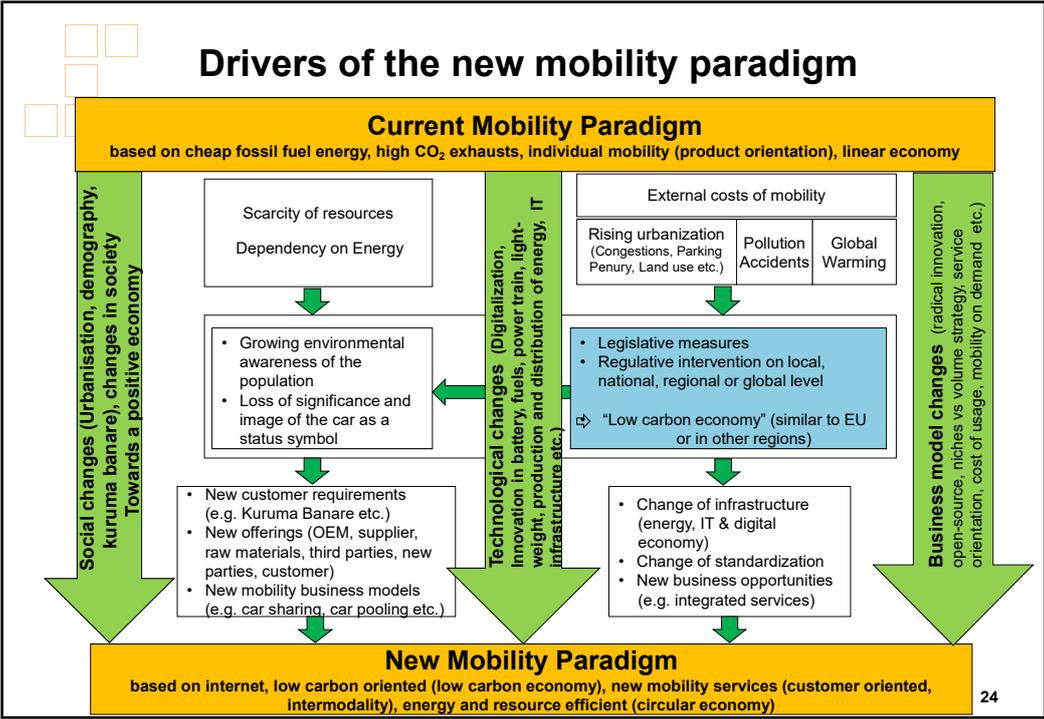


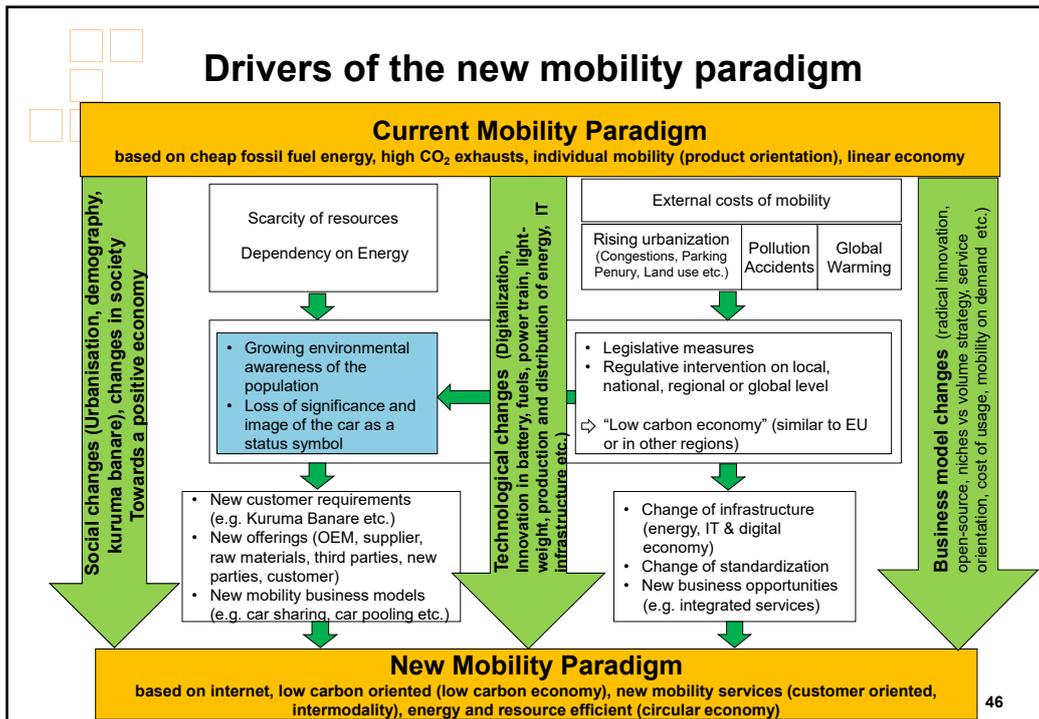
Pledges or promises that governments have made, including in submitted INDCs (Intended Nationally Determined Contributions):
Pledges end of 2014: + 3°
Pledges end of 2015: + 2,7°

climateactiontracker.org

IPCC is working on a special 1,5° report

Die Zeit 27.11. 2014





Drivers of the new mobility paradigm:

Kuruma Banare (車離れ)

- **Japan:**
 - Between 2001 and 2005 the Japanese population not possessing vehicles raised from 21,3 to 32,1 %
 - From 20 to 50y., more important than a car:
 - Internet (74 %)
 - Mobile (56 %)
 - Other reasons (Jama):
 - Growing urbanisation (congestion)
 - Local public transportation
 - Regulation & taxes

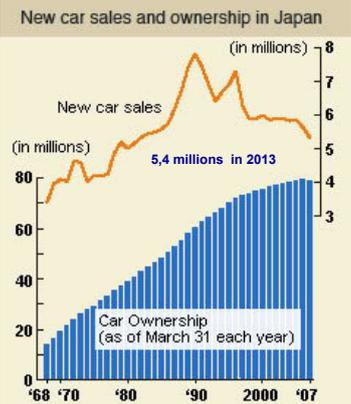




● A similar development can be observed in Germany and France

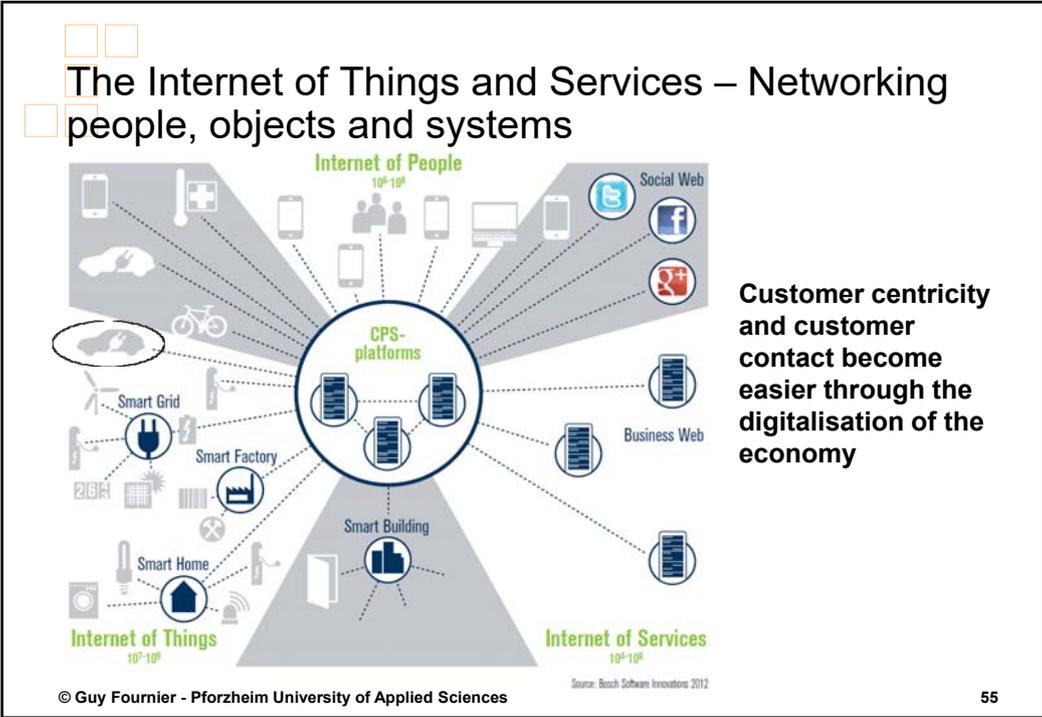
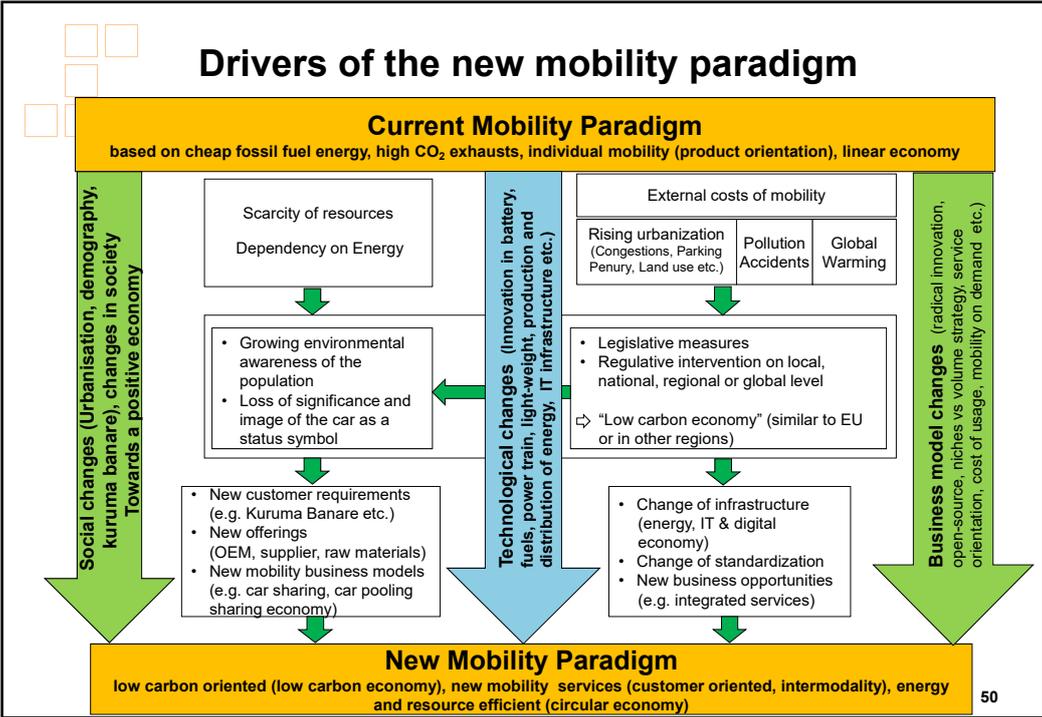






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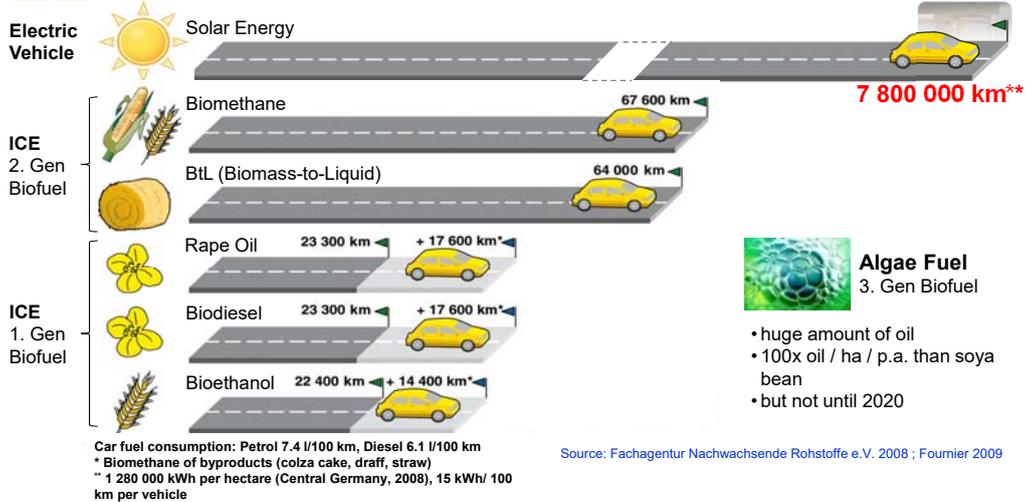
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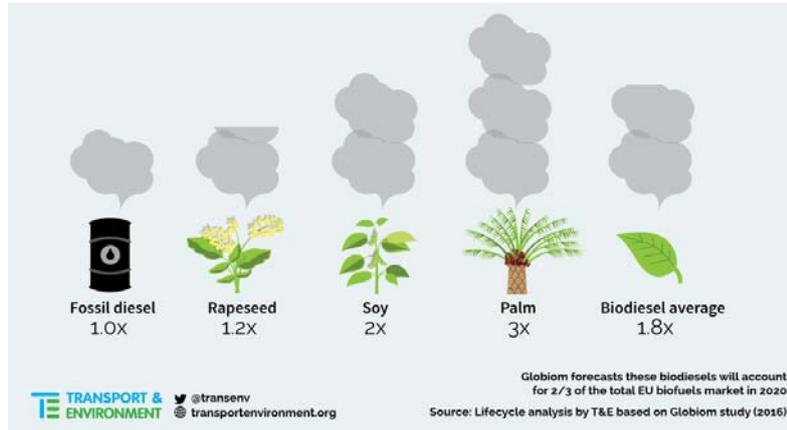
Range with one hectare (10,000 m²) cultivated area



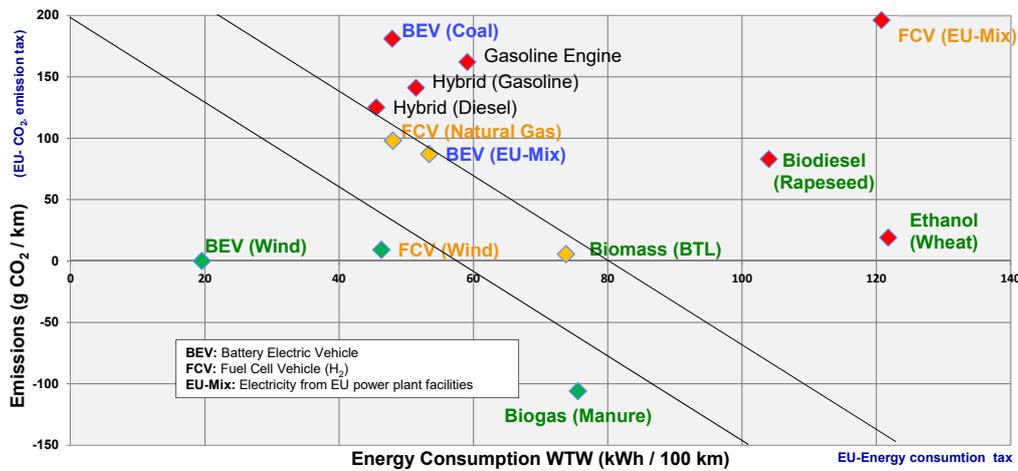
Solar Energy: 330-fold range compared to Rape Oil or Biodiesel, 115-fold to BtL



Biodiesel: cure worse than the disease: Fossil diesel emissions vs first-generation biodiesel

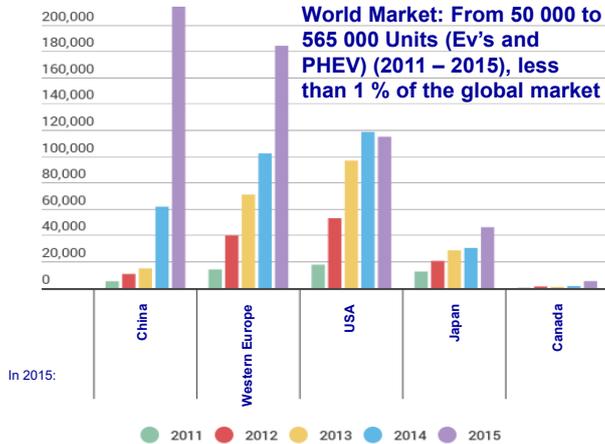


Drivers for the future mobility CO₂ and energy efficiency of power trains (Well-to-Wheel)



Source: based on data from Concaawe, Eucar, JCR 2007; Daimler Optiresource tool

Global Electric Vehicles and Plug-in Hybrid market landscape (2011-2015)



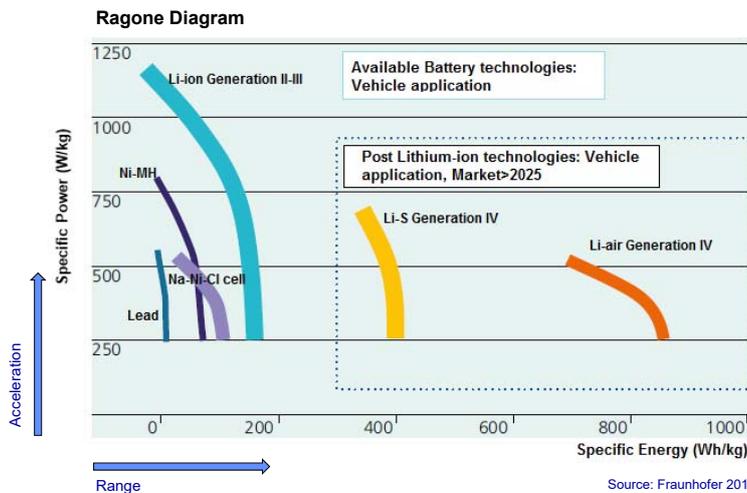
- China is in 2015 the biggest (38% of Global market sales) and fastest growing market (+ 245% between 2014 and 2015)
- Western Europe is the second biggest market with 33% of Global market sales
- US market represents 20% of global sales
- But: Global automobile production is 90,68 Million

Source: Avere France

Obstacles to the diffusion of EV's are range, costs and availability of charging stations 117

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Battery: key success factor for EV and Hybrid



- Limit of weight and range (Li-ion batteries): energy density of gasoline or diesel is 100 times higher in comparison to a Li-ion battery
- Limit of price (Li-ion)
- Limit of Lithium Carbonate and Cobalt

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Battery: key success factor for EV and Hybrid

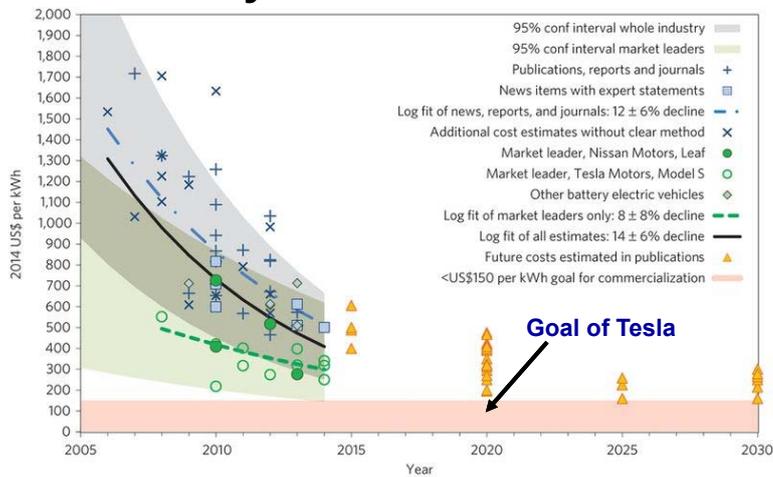


Figure 1 | Cost of Li-ion battery packs in BEV. Data are from multiple types of sources and trace both reported cost for the industry and costs for market-leading manufactures. If costs reach US\$150 per kWh this is commonly considered as the point of commercialization of BEV.

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Nykvist and Nilsson (2015)



Tesla model 3 in just 3 weeks: 300.000 pre-orders, 1000 \$ of reservation deposit included



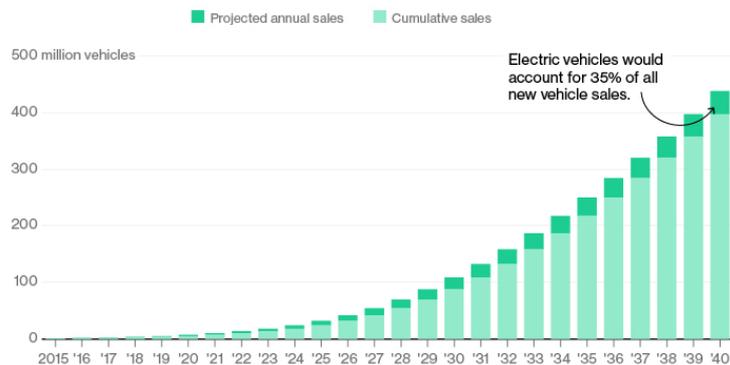
Tesla is now leader with the model S in USA and Germany in comparison with class S from Daimler



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Expected Rise of Electric Vehicles

By 2022 electric vehicles will cost the same as their internal-combustion counterparts. That's the point of liftoff for sales.



Sources: Data compiled by Bloomberg New Energy Finance, Marklines

Bloomberg

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Multimodal Mobility in La Rochelle: customer centric mobility services

L'agglomération rochelaise invente tous vos déplacements à la carte

Yélo c'est le nom du réseau de transport public de l'agglomération, accessible avec une carte unique : la carte Yélo...

Bus Vélo Bateau Yélobile

Parc relais TAXI TER Covoiturage

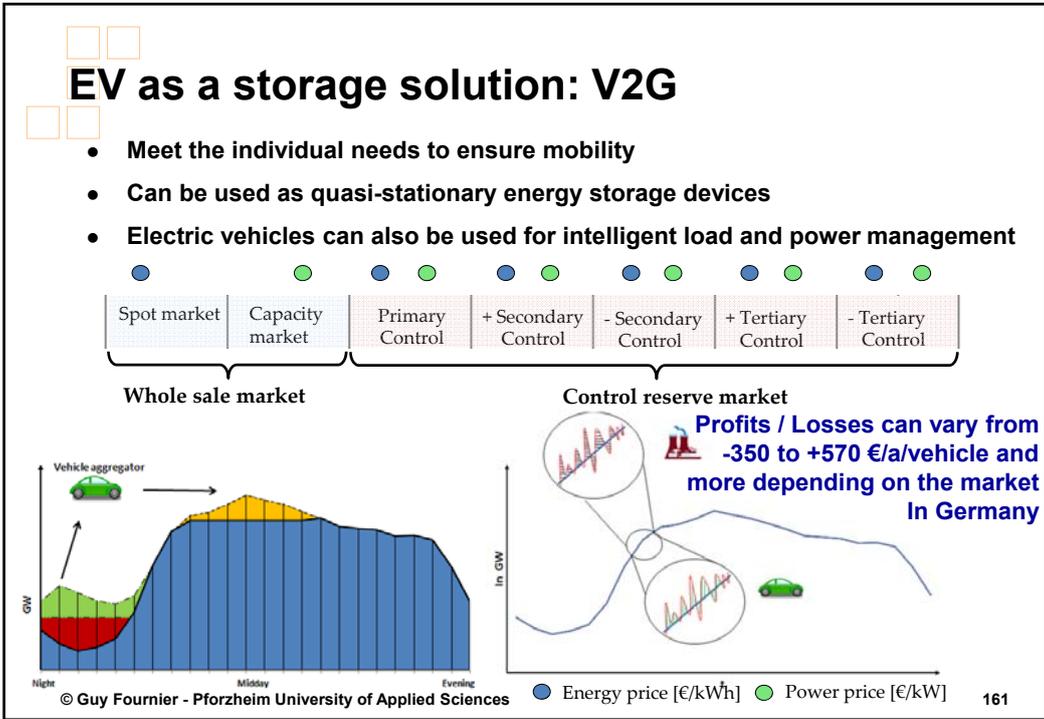
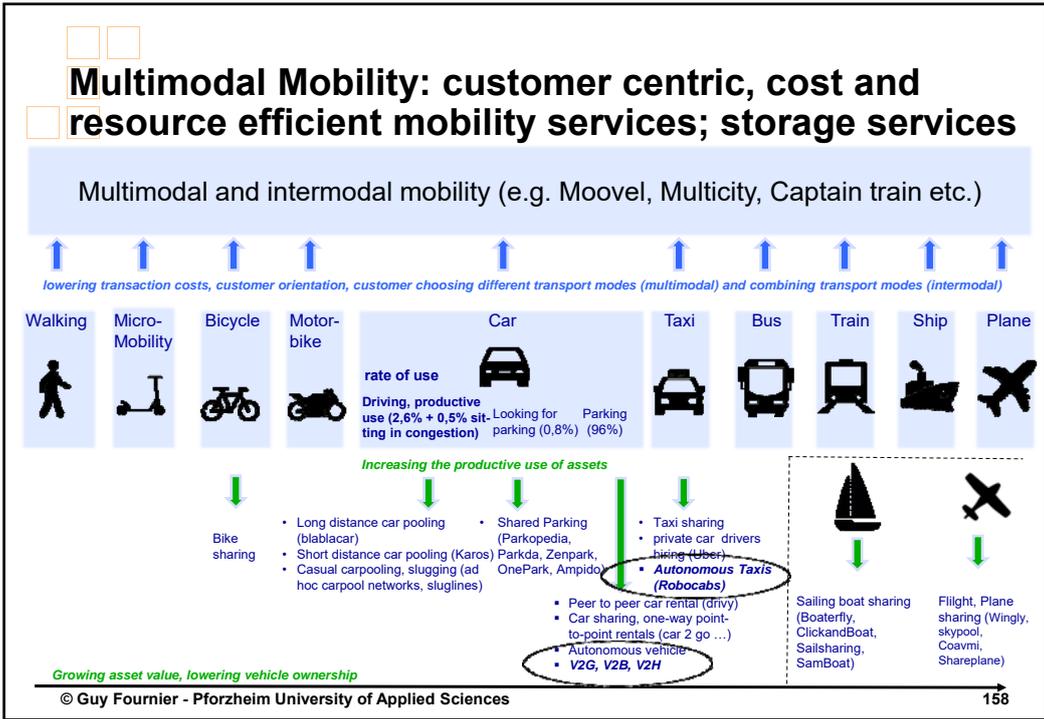
Nouveaux tarifs au 1er mars 2012
Nouveaux tarifs + plus

Communauté d'Agglomération de La Rochelle

Yélo : qui fait quoi ?
Yélo : le transport intelligent
Yélo tous les modes
Yélo le film

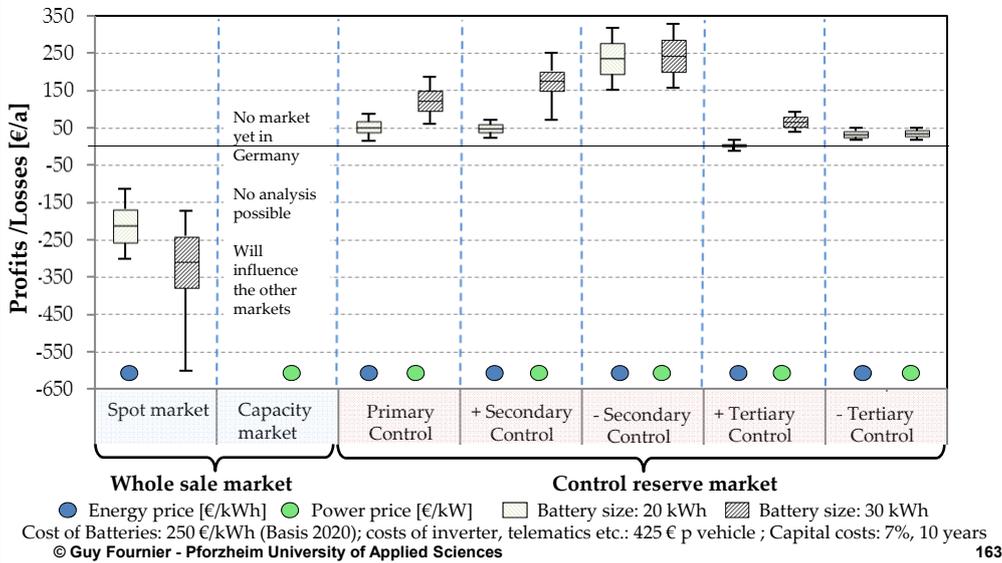
Newsletters Yélo Tendances

<http://www.yelo-larochelle.fr/>



EV as a storage solution: V2G

Evaluation of the V2G potential in Germany (Energy Market and Capacity Market)



Autonomous EV: the example of robocabs

(autonomous taxis) in New York



100 % Autonomous, Driverless and Electric transport vehicle, Navya in Singapur (2015) at NTU



Google autonomous vehicle



Daimler autonomous vehicle

- **Reducing greenhouse Gas (GHG) emissions by 87-94%** (in comparison with conventionally driven vehicles in 2014) is possible by 2030
- Replacement of New York's 13,000 yellow cabs with 9,000 self-driving ones could **lower costs per mile by 87% and reduce the waiting time by 15%** due to:
 - fewer taxis,
 - less empty miles and
 - reduced labor costs of the driver
- **Google, Uber, Daimler, Navya etc. are working on autonomous vehicles**

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Saving resources and energy: Frugal economy and Reverse Innovation (Govindarajan)



Created by Natalie Z. Wang for Jugaad Innovation, LLC.

What is jugaad innovation?

Jugaad is a Hindi word that roughly translates as “overcoming harsh constraints by improvising an effective solution using limited resources”. A such jugaad innovation is a frugal and flexible approach to innovation that is dominant in India. In the West it’s often called “Do It Yourself” (D-I-Y) innovation.

“Think Frugal, Be Flexible, Generate Breakthrough Growth.”



Mini-SUV „Kwid“ for the indian market (2015)

Indian Frugal Engineering with experience from Renault and Nissan:

- 97% localized
- most fuel-efficient petrol car in India: 25,17 kmpl (international business times sept. 29th 2015)
- Price: 4200 - 5500 Euro

Agenda

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 - Using surpluses of renewables for storage and mobility
 - Autonomous EV: Robocabs
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Conclusion:

The current mobility paradigm based on cheap fossil fuel energy, high CO₂ emissions and individual mobility brings our economical, social and environmental systems on their limits

Innovation in:

- **New powertrains (EV)** will improve their range and be cheaper in the future than ICE vehicles to satisfy individual mobility
- **Added value services** can satisfy customer centric multimodal mobility, integrate renewables and bring huge opportunities to save resources and energy
- **Developing countries**, so called *Jugaad* or *reverse innovation*, can help to satisfy mobility needs in a frugal economy

To conclude:

Innovation can save energy and resources, limit pollution and satisfy mobility needs in a more sustainable world



□ □
Conclusion:



“The best way to predict the future is to create it“
Peter F. Drucker

**Thank you for your
attention!**



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