



Technische Hochschule  
Ingolstadt

Business School

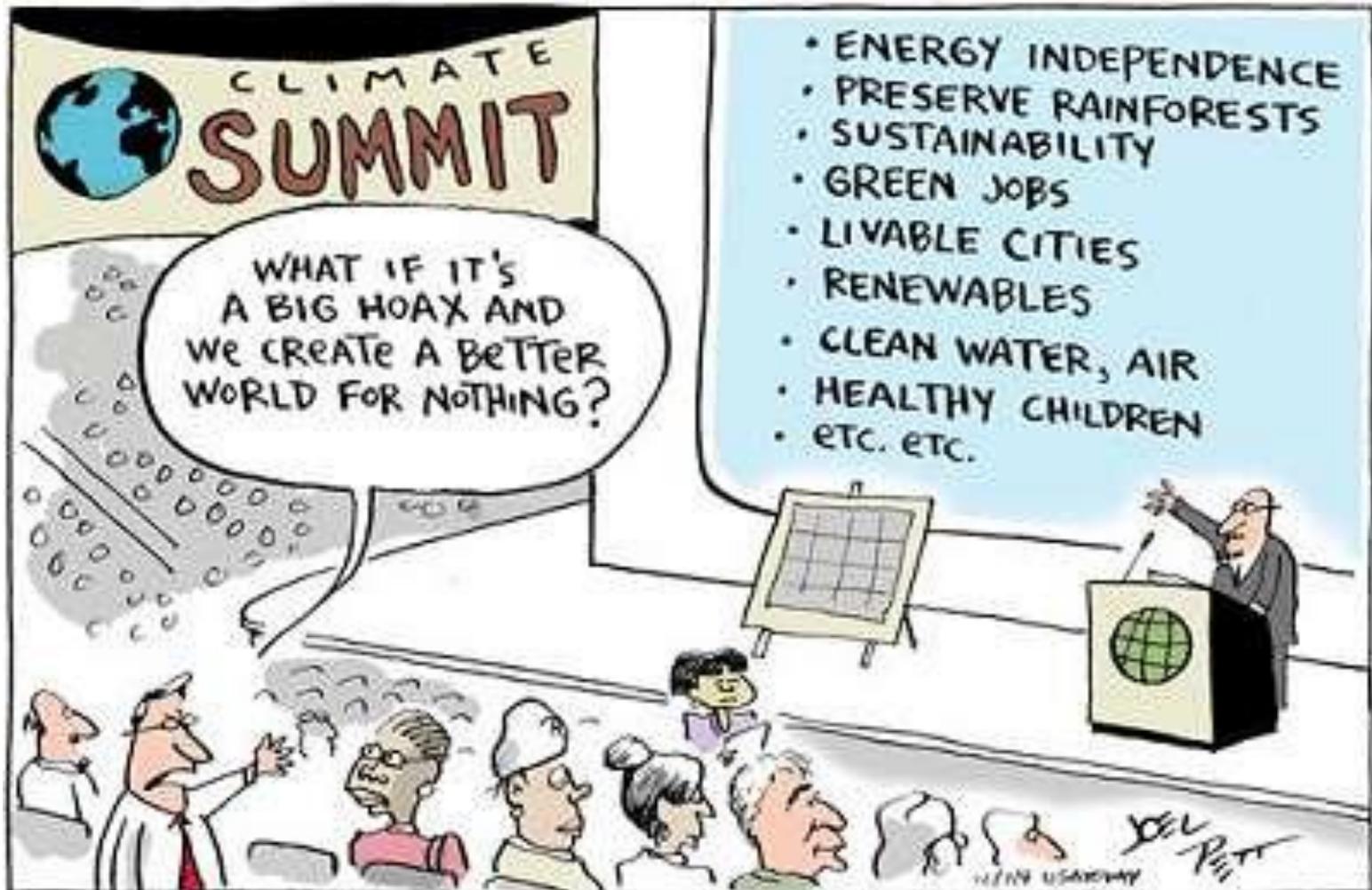
*Zukunft in  
Bewegung*

# *Energy Efficiency & Sustainability in the automotive industry*

Prof. Dr. Georg Stephan Barfuß 25.10.2013



*We will have to run that risk, don't you think?*





# Sustainability in the Automotive Sector: „title-page“ story!

## DAIMLER

Company Brands & Products Technology & Innovation Sustainability



Das Auto.

Produktwelt Innovation & Technik Volkswagen Live Unternehmen

Kontakt Sitemap English

Modell wählen Land wählen

### Volkswagen e-mobility.

Jetzt erleben

Einfach genial.

Einfach elektrisch.



Stromverbrauch e-upl in kWh/100 km: 11,7 (kombiniert), CO<sub>2</sub>-Emissionen in g/km: 0 (kombiniert), Effizienzklasse: A+ \*\*  
Kraftstoffverbrauch X11 in l/100 km: 0,9 (kombiniert), Stromverbrauch in kWh/100 km: 7,2 (kombiniert), CO<sub>2</sub>-Emissionen in g/km: 21 (kombiniert), Effizienzklasse: A+ \*\*



Mein BMW Alle BMW Modelle Finanzieren & Versichern Großkunden & Behörden BMW Partner

Home 1 3 4 5 6 7 X Z4 M BMW i Gebrauchtfahrzeuge Service & Zubehör Faszination

Willkommen bei BMW. > Login

## ELEKTRISCH. UND ELEKTRISIEREND.

Der neue BMW i3 mit eDrive.

Jetzt entdecken

Modelle Gesamtnavigation Merktzettel Händlersuche Weitere Aktionen

## Toyota Modelle

NICHTS IST UNMÖGLICH

Hybrid	Hybrid	Hybrid	Hybrid	Hybrid
Yaris Hybrid ab 16.950,00 €	Auris Hybrid ab 23.200,00 €	Auris Touring Sports Hybrid ab 24.400,00 €	Prius ab 26.800,00 €	Prius+ ab 29.900,00 €
Hybrid				
Prius Plug-in Hybrid ab 36.550,00 €	iQ ab 12.200,00 €	AYGO ab 9.550,00 €	Yaris ab 11.835,00 €	Verso-S ab 15.050,00 €

**Aktionen**

- Probefahrt vereinbaren
- Prospekt/E-Broschüre anfordern
- Konfigurator starten
- Kontakt aufnehmen

## *Why sustainability in the Automotive Sector?*

- **Economic reasons:**
  - energy and raw material prices up
  - market is becoming greener and more responsible
- **Customer demand:** „sustainability as the new premium“
- **Society:** License to Operate (meeting the different expectations from different stakeholders)
  
- Every minute 150 cars produced globally → 4,500 by the end of this lecture!  
→ **sustainable business model?**
  
- **Regulation**, e.g.: EU CO<sub>2</sub> 95g/km

## *The „Carbon War“ in the European Union*

“Merkel warns EU against tough CO<sub>2</sub> targets for carmakers”

[www.uk.reuters.com](http://www.uk.reuters.com)

“Angela Merkel 'blocks' EU plan on limiting emissions from new cars”

[www.theguardian.com](http://www.theguardian.com)



**BMW donation to Merkel's Christian Democrats prompts criticism**

[www.dw.de](http://www.dw.de)

## The new currency: CO<sub>2</sub>!

### Average CO<sub>2</sub>-Emissions new cars 2012 in Germany (g/km)

1. Smart	96,9	17. Mitsubishi	141,6
2. Toyota, Lexus	127,3	18. BMW, Mini	143,4
3. Seat	130,7	19. Audi	143,8
4. Citroen	133	20. Honda	143,9
5. Peugeot	133,9	21. Mazda	146,4
6. Daihatsu	134,6	22. Nissan, Infiniti	147,2
7. Skoda	136,1	23. Chevrolet	150,2
8. Fiat	136,2	24. Volvo	151
9. Alfa Romeo	138	25. Mercedes	153,9
10. Hyundai	138	26. Lancia	156
11. Ford	138,1	27. Subaru	159
12. Suzuki	139,2	28. Jaguar	181,4
13. VW	139,2	29. Land Rover	199,5
14. Opel	139,6	30. Porsche	209,1
15. Renault, Dacia	139,6	31. Chrysler, Jeep, Dodge	221,8
16. Kia	140,8		

2020 threshold limits:

- EU 95 g/km
- USA 121 g/km
- China 117 g/km
- Japan 105 g/km

Quelle: Kraftfahrt-Bundesamt



## *And Round 9 in the Dow Jones Sustainability Indices Arena goes to ...*

BMW Group Dow Jones Sustainability Index Leader for 8th consecutive year.

**“... to make Volkswagen the leading automaker in ecological terms”**

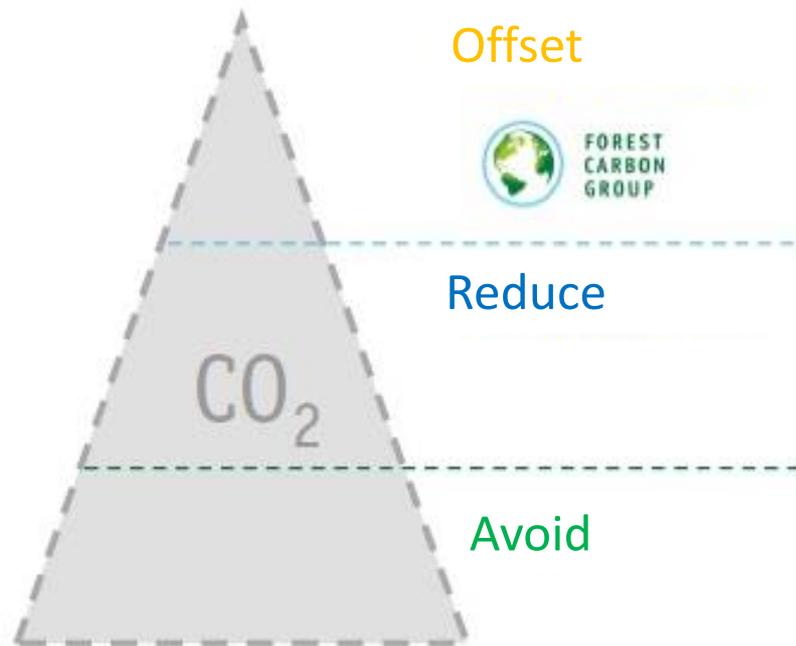
Prof. Dr. Martin Winterkorn, CEO VW Group



Source: [www.br.de](http://www.br.de)

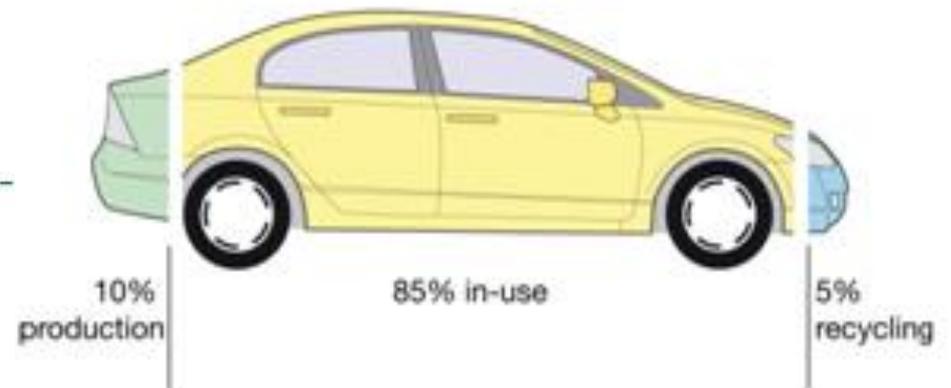
... The Volkswagen Group!

# The sustainability arena in the Automotive Sector



<http://www.energie-fokus.de/vom-energieversorger-zum-klimadiensteleister-1645/>

Source: SMMT (Society of Motor Manufacturers and Traders) UK



*Volkswagen Group: leveraging production*

250%

**less:**



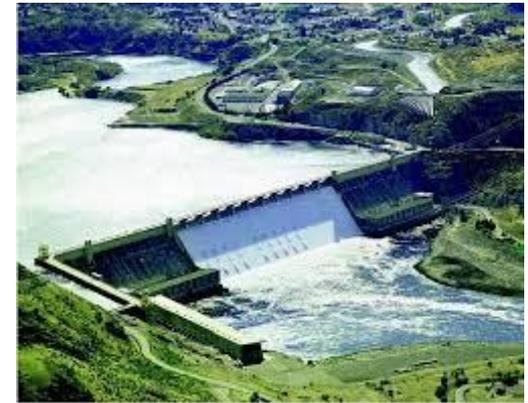
## *BMW i3: leveraging production, usage and recycling*



Source: [www.bmw.de](http://www.bmw.de)

Carbon vs. steel: -50% weight  
Carbon vs. Aluminum: -30% weight

Carbon Fibers produced in Moses Lake (USA): clean energy from large hydro-electric power plant



Production in Leipzig (Germany): 100 % of electricity from four wind power stations.  
10 MW and 26 Gwh.

## Example AUDI A3 g-tron



- ▶ Audi's first natural gas production vehicle
- ▶ Bivalent configuration:  
Cruising range on natural gas: >400 km  
Cruising range on petrol: >900 km
- ▶ Market launch End of 2013

Audi A3 g-tron: natural gas tanks



*Sounds familiar so far – you're still in the comfort zone?*



**...AND YOU THINK YOU HAVE STRESS..**

## New Materials: Dräxlmaier Group

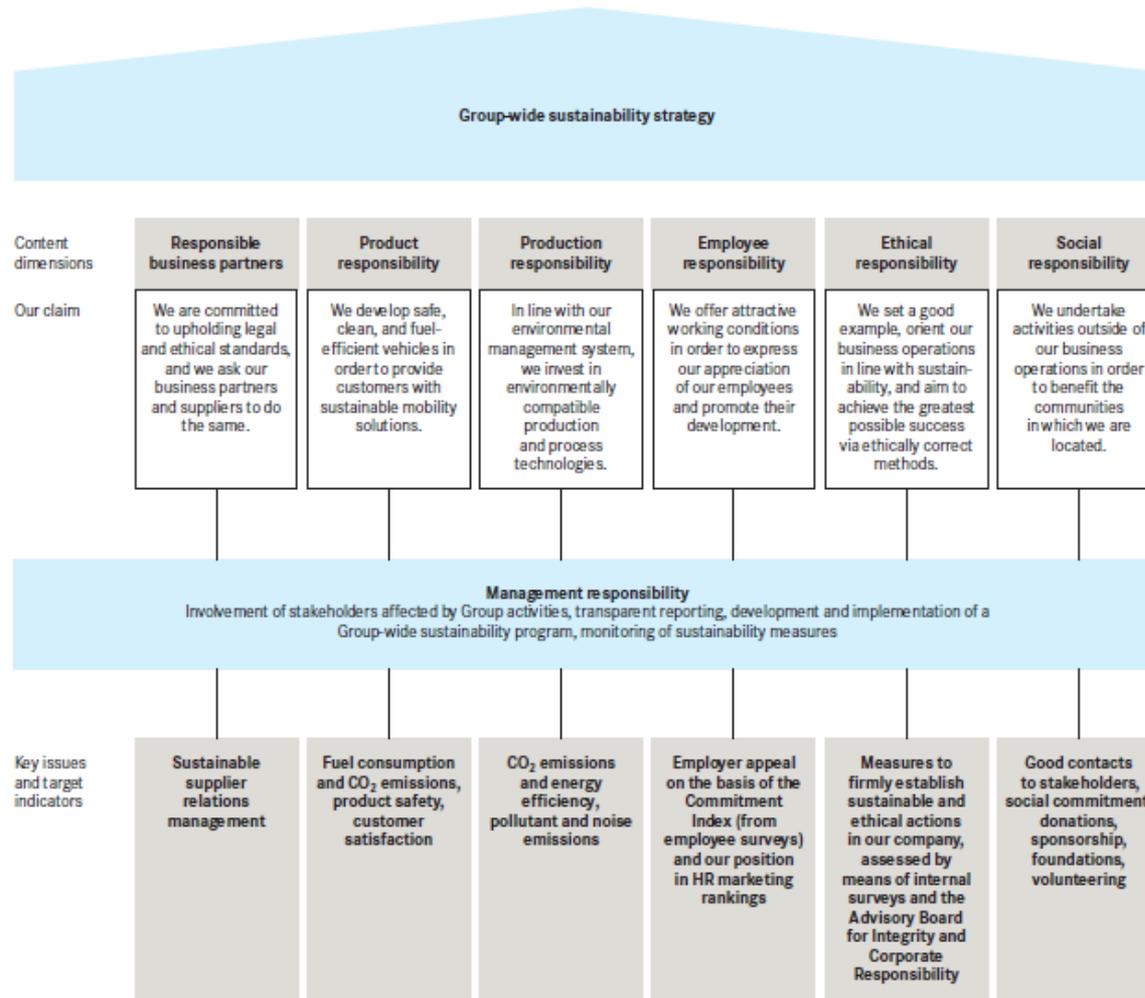


- Usage of **natural fibers** like kenaf for door trim panels in the BMW i3:
  - -25 % weight
  - -40 kg CO<sub>2</sub>-emissions per car
- Sustainable resource: plants keep re-growing, oil (plastics) doesn't!





# DAIMLER: sustainability integrated in conventional management





## *Sustainable is more than „green“: Example Conflict Minerals*



**AIAG**

[www.aiag.org](http://www.aiag.org)

“Conflict minerals“ (Dodd-Frank Act, USA): tin, tungsten, tantalum and gold from the Democratic Republic of Congo and eight other African countries. They are said to fund violence and warlike activities.

The auto industry is identifying whether these metals exist in their supply chain.

## *VW and AUDI: Silver Lines!*



Source: [www.spiegel.de](http://www.spiegel.de)



Source: [www.audi.de](http://www.audi.de)

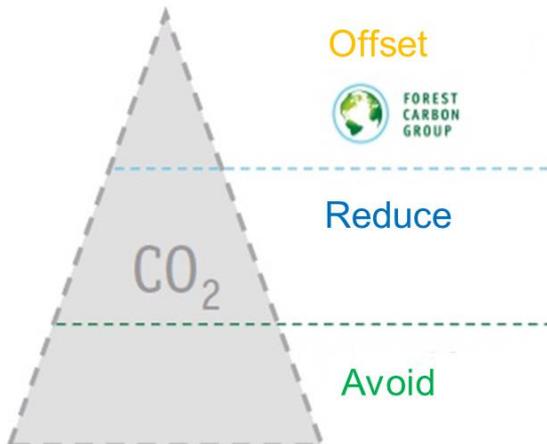
Working at an assembly line is hard:  
Workers above a certain age may work on the silver lines: same work, but more time to do it!

*What heritage we leave is up to us ...*



**"One day son this carbon footprint will  
be all yours."**

# Carbon offsetting



That part of your CO<sub>2</sub>-footprint that cannot be avoided or reduced can be offset!

Example: atomsfair! [www.atmosfair.de](http://www.atmosfair.de)

## Example: Dräxlmaier Group

Cooperation with NGOs: [www.klimareporting.de](http://www.klimareporting.de)

EINE KOOPERATION VON



GEFÖRDERT DURCH



BERATUNGSDIENSTLEISTUNG DURCH



## *The carbon footprint of CERN*

CO<sub>2</sub> of electricity at CERN:

200 Mw x 720 h x 112 kg CO<sub>2</sub>/Mwh = 16.000 t CO<sub>2</sub>

p.a. ~ 160.000 t CO<sub>2</sub> (∅ summer/winter months)

Per ton CO<sub>2</sub>: 80 beech trees

Per ton CO<sub>2</sub>: 0,33 ha



⇒ 12,8 million trees

⇒ 528 km<sup>2</sup>

Almost 2x canton of Geneva

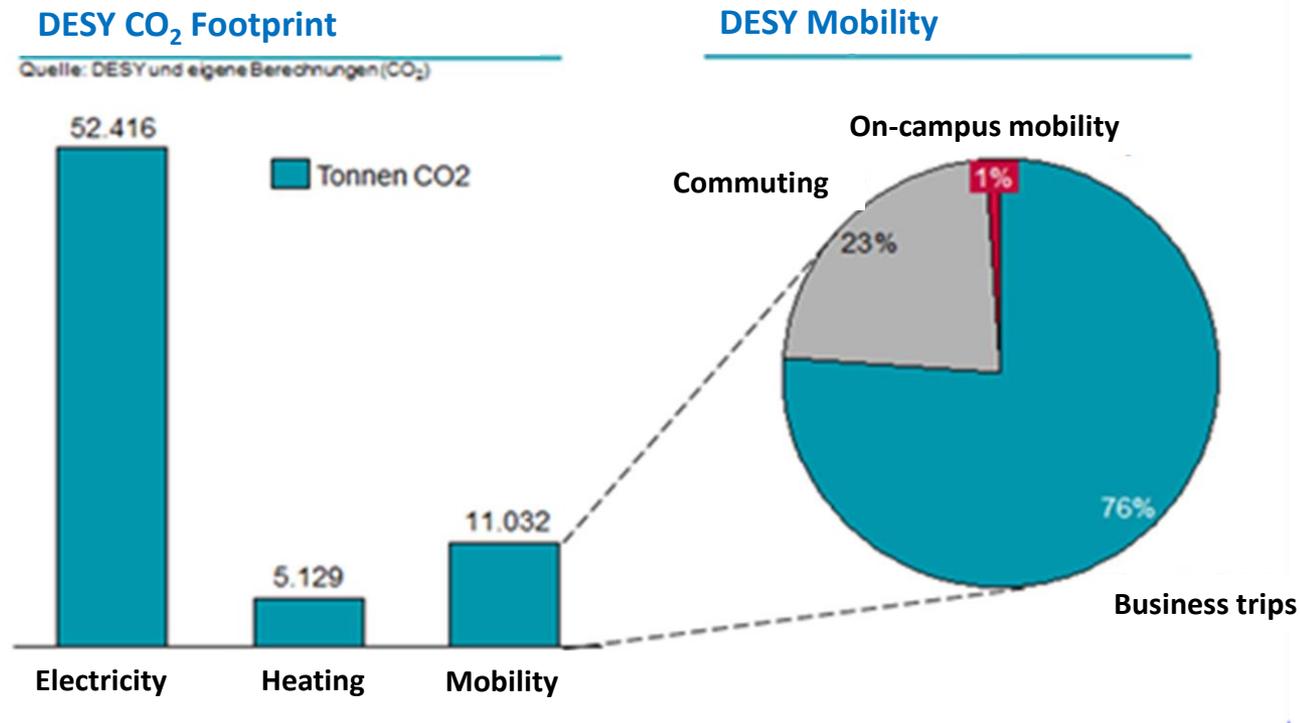
€ 4,5 Mio. CO<sub>2</sub> compensation

(20% of p.a. electricity bill)



## Wholistic view: the entire carbon footprint

Example: DESY in Hamburg! Some 16% of CO<sub>2</sub> footprint are due to mobility (commuting and business trips)



# Alternative uses of money – a thought experiment on CO<sub>2</sub>

	Costs \$ billion	Costs €	€ price compensation 1 to CO <sub>2</sub>	max. amount CO <sub>2</sub> compensation (in million t)	Swiss Carbon Footprint (million t)	years of Swiss Footprint compensated
Higgs Boson	13,250	10.000.000.000	28	357	42	8,5



Switzerland failed to meet its target for CO<sub>2</sub> reductions in 2012  
(Keystone)

Source: [www.swissinfo.ch](http://www.swissinfo.ch)

*(What) are you answering to them?*

## **CERN: a failure of democracy and sustainability?**



- *Scientific research for scientific research's sake?*
- *Fundamental physics vs. Pragmatic science to foster sustainable development: democratic legitimacy?*

## **How Much Does It Cost To Find A Higgs Boson?**

[www.Forbes.com](http://www.Forbes.com)

- *LHC cost: \$ 4.75 billion*
- *Electricity cost p.a. \$ 23.5 million*
- *Total operating cost p.a. \$ 1 billion*
- *Total cost of finding the Higgs boson \$ 13.25 billion*

→ Transparency & Stakeholder dialog: explain and listen!

## *Alternative financing: BMW and solar panels*

BMW factory in Dingolfing (Bavaria): 8 MW for 25 Mio. EUR.

Neither financed, nor run by BMW itself. Run by the PT Group, financed with external investors and partly by BMW employees on a private basis: they had the chance to finance part of the investment at preferred conditions.



Source:



- ✓ Green
- ✓ Economical:
  - ✓ locked-in energy prices
  - ✓ No up-front investment for BMW
- ✓ High employee commitment and motivation

Other example: energy contracting!

## *So what could be relevant for „Big Science“?*

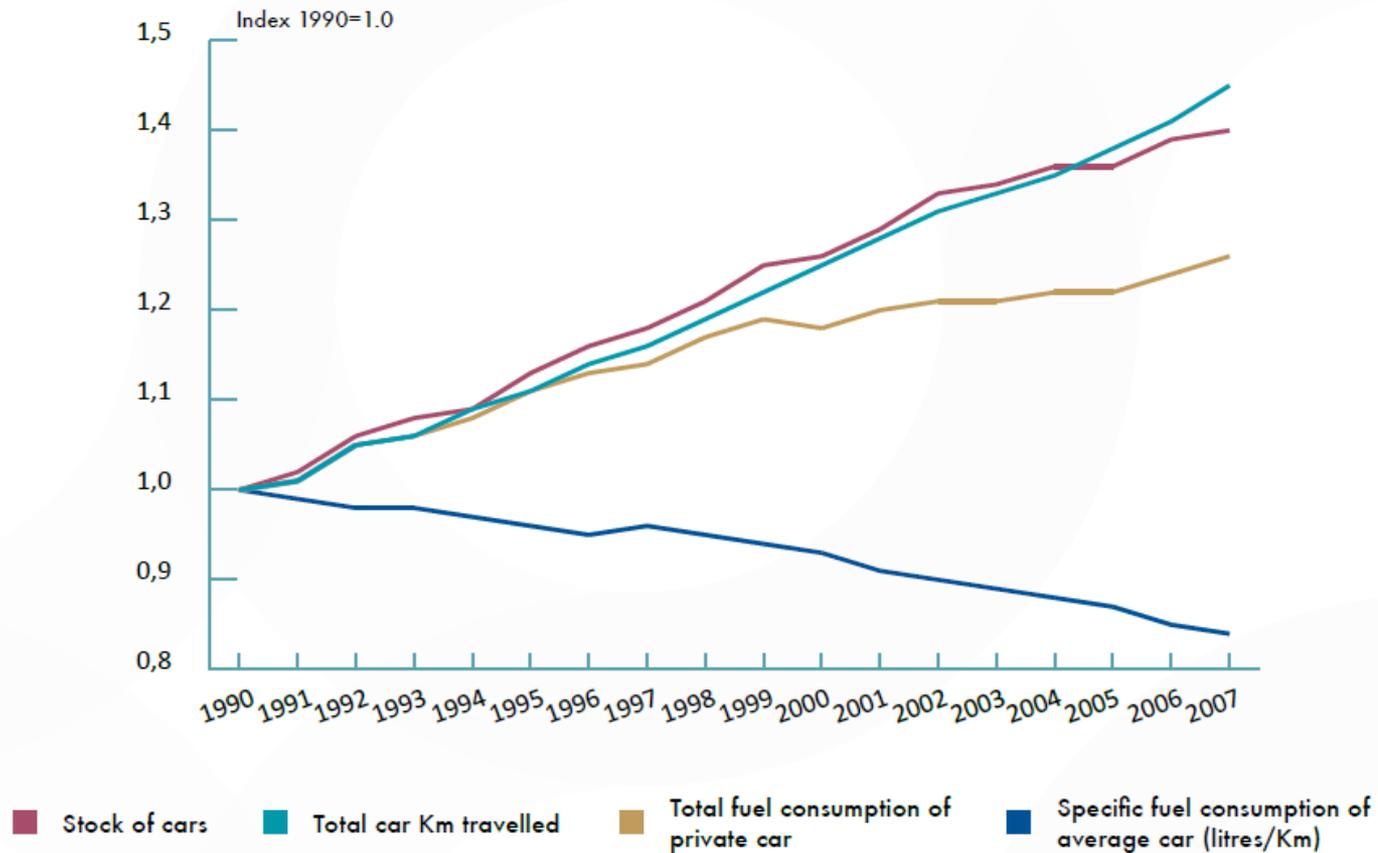
- Today/keep it up & intensify:
  - ✓ Transparency & Explanation to and dialogue with stakeholders
  - ✓ Benchmark with other industries:
    - ✓ „green factory“
    - ✓ sustainability organization & implementation in traditional management
    - ✓ Change management: how to deal with behavior and awareness patterns
  - ✓ Sustainability > green
- Future/start thinking about taking action:
  - ✓ Sustainability > operations (DESY mobility: commuting)
  - ✓ Carbon offsetting
  - ✓ New/other materials (e.g. copper vs. aluminum)
  - ✓ Alternative financing
  - ✓ Contact to and cooperation with NGOs



*Back up*

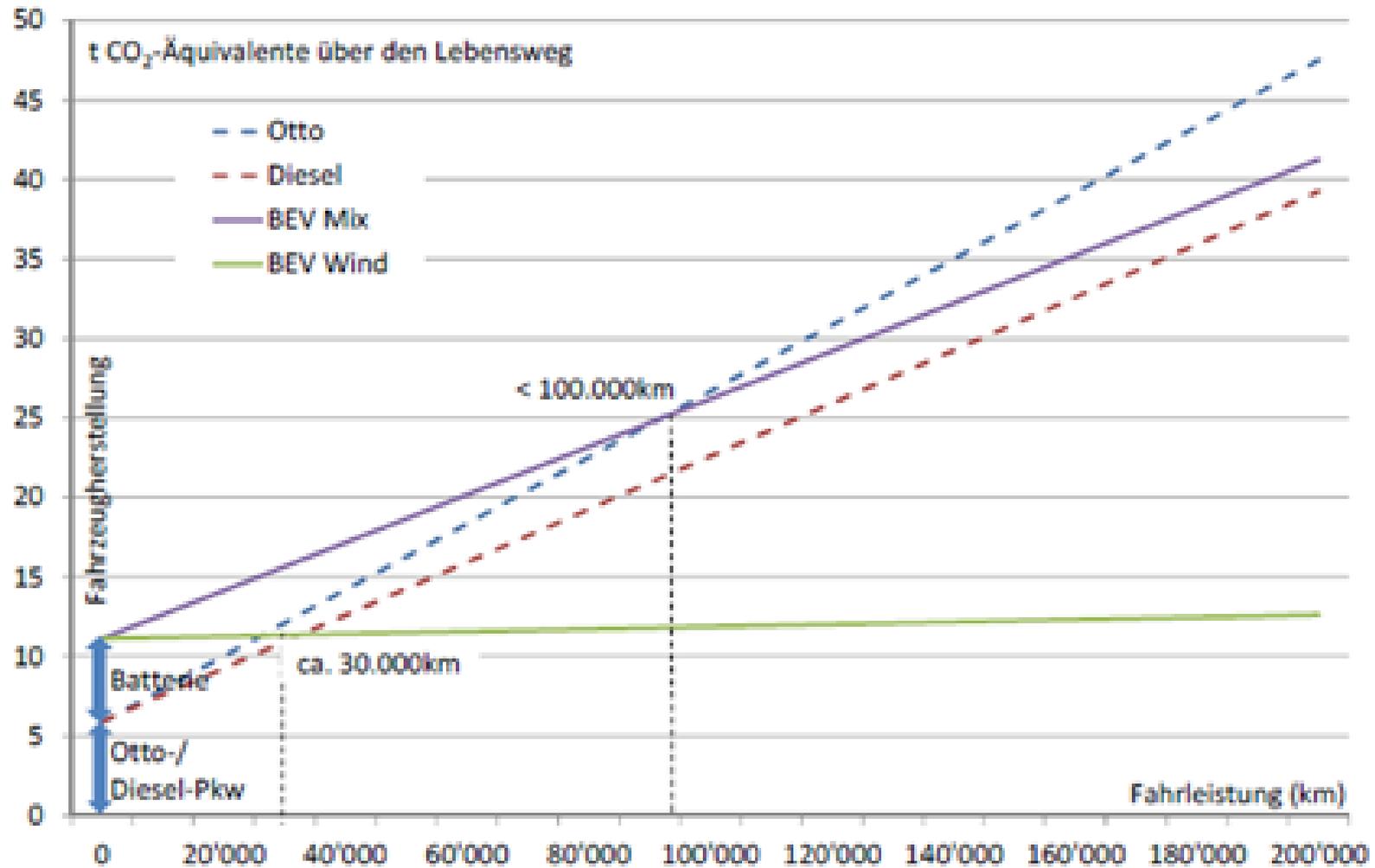
# Fuel efficiency cannot compensate rapid growth of the car stock

Figure 9 Fuel consumption of average car and total fuel consumption of private cars



Source : EC

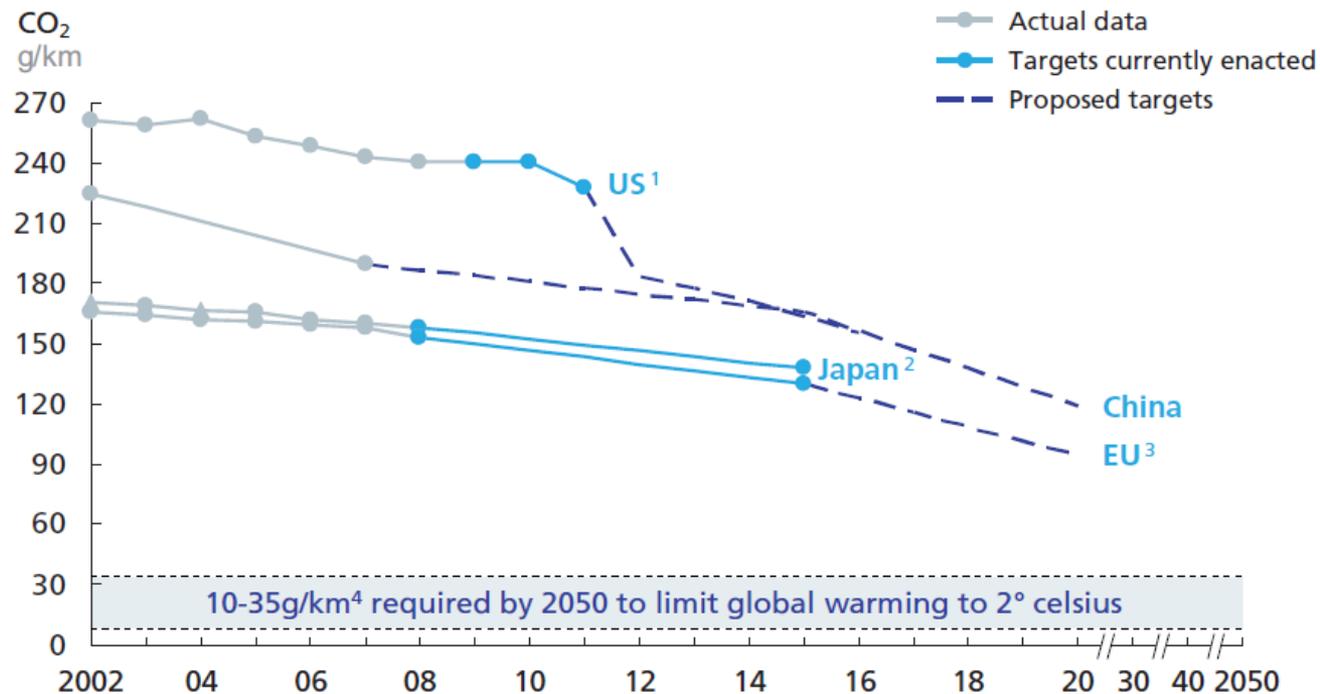
## Electric mobility ≠ automatically “good”!



# Governments everywhere intervene for the climate

**Figure 1: countries worldwide have chosen mandatory standards to regulate CO<sub>2</sub> emissions of new passenger cars**

Vehicle tail pipe emissions standards across the globe



1 Corporate average fuel economy for passenger cars and light trucks combined.

2 Average fleet emissions, calculated values (small car segment at 157g/km in 2002 and 147g/km in 2007; 2015 target: 125g/km).

3 Under discussion in 2013; revision of 95g CO<sub>2</sub>/km for 2020 possible.

4 Normed emissions; equivalent to 13-43g/km in real-life driving.

Sources: ACEA; EU Commission; DOE; EPA; DieselNet; JAMA; ICCT; National Automotive Standardization Technical Committee of China; McKinsey.

*True enough!*



“

*Sustainability is the biggest business case out there, by far bigger than the internet revolution.*

”

– Richard Branson, CEO Virgin Group

