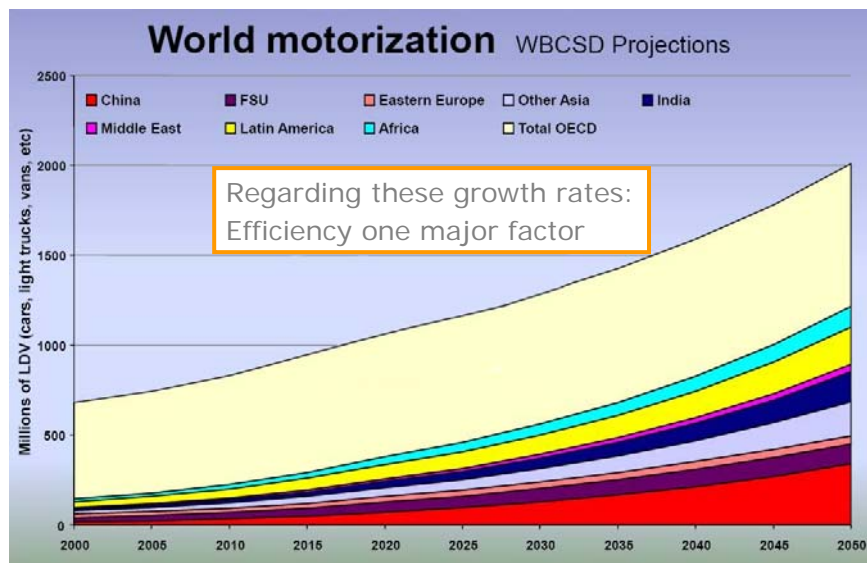


## Technical Reduction Possibilities and Goals

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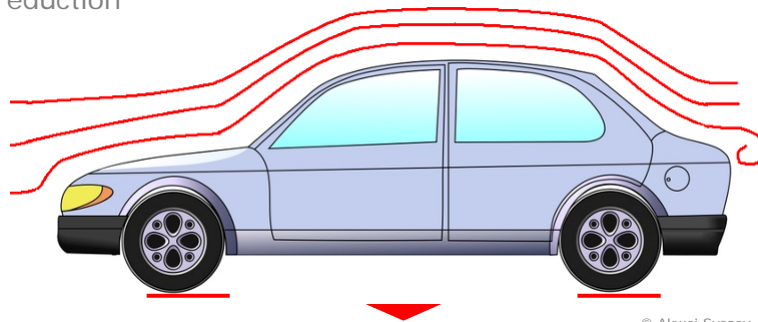
25<sup>th</sup> June 2008  
Symposium "Future Challenges of Transport and Environment"

### Projection of LDV ownership shows high growth rates



### *High variety of technology options to improve fuel efficiency of PC*

- | Improving the conventional internal combustion engine = up to 30 % reduction
- | Using hybrid systems
- | Improving transmission systems = up to 8 % reduction
- | Decreasing vehicle weight = more than 10 % reduction
- | Decreasing air and rolling resistance = more than 10 % reduction

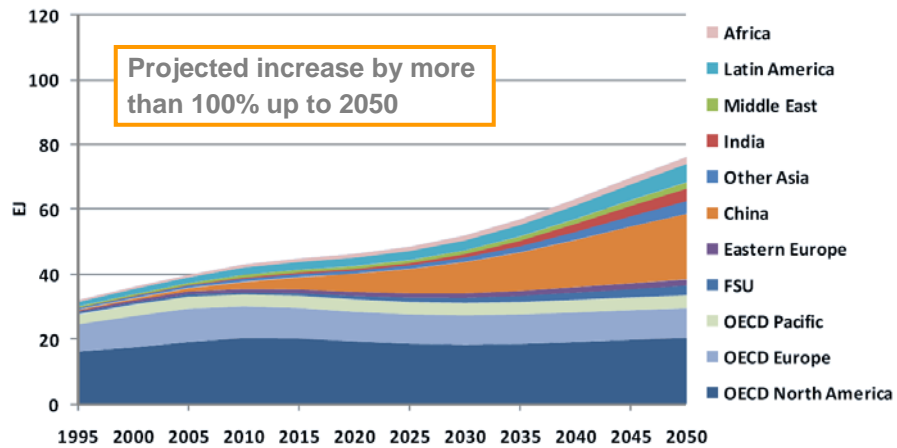


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### *High efficiency gains are feasible*

- | Even if they partly tap the same potential, high efficiency gains are feasible
- | Same technical options applicable to all regions of the world
- | Available technology could improve efficiency per car by ~35 %
- | Specific fuel consumption could be reduced by more than a half within the next 10 to 15 years by retaining today's characteristics
- | If reductions in power and vehicle size are taken into account, even higher reduction rates can be achieved

### Projection LDV energy demand shows high increase



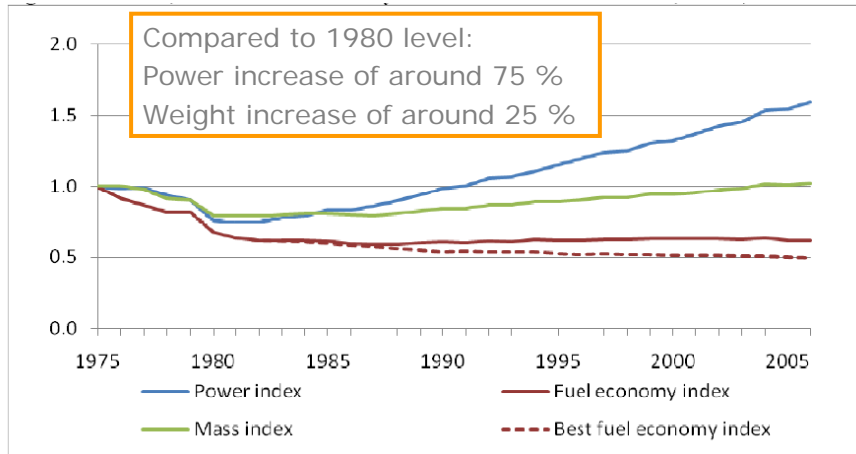
Source: ETP scenario, IEA

### Efficiency improvement by technical options alone is not sufficient

- Reminder:
  - Significant emission cuts necessary to avoid dramatic damages (50%-60% by 2050)
- The projected doubling of fuel demand/ $\text{CO}_2$  emissions cannot be counteracted by fuel efficiency technologies alone - without touching on car characteristics.

**In the face of the challenges of global climate change, the question arises as to whether the concept of "the car" itself has to be re-considered.**

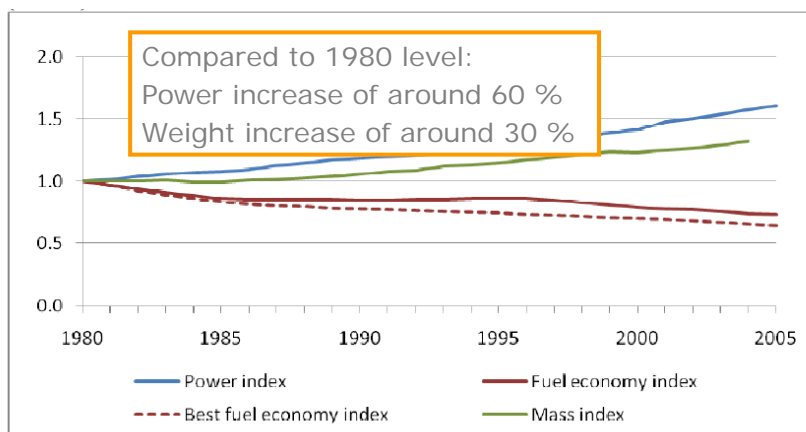
### Recent developments of weight and power in the US



Power, mass and fuel economy indices for the United States (1975=1)

Source: IEA

### Recent developments of power and weight in the EU



Estimates for power, mass and fuel economy indices in Western Europe (1980=1)

Source: IEA

**Reverse the trend towards "supersized" and "superpowered" vehicles**

| Power and maximum speed reduction

| Weight reduction

→ High potentials for fuel reduction

Could smaller and lower-powered vehicles enable automobility in the future with much lower energy requirements?

→ Various companies have already developed or designed low energy concept cars, e.g.



**Loremo LS**

1.5 l/100 km



**1 Litre-Car VW**

0.99 l/100 km



**SmILE**

3.3 l/100km

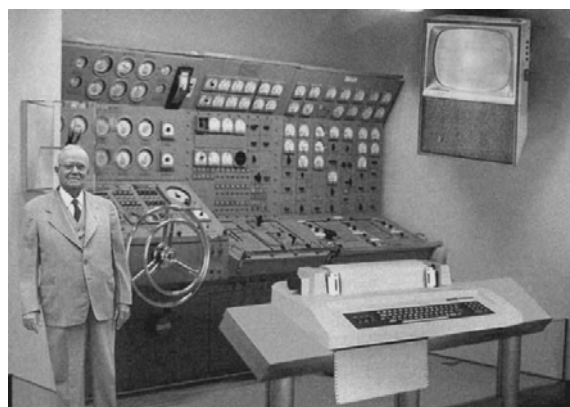


**Aptera Type 1**

<2 l/100km

www.eko-institut.de

**What we should not forget when debating future technologies**



In 1954 scientists from the well-established think tank RAND Corporation created a model to illustrate what a "home computer" might look like in 2004. RAND Corporation also claimed that the anticipated technology would not be economically feasible for the average home...

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## What is needed?

### Regulations for passenger cars

- Regulations for passenger cars in most OECD countries as well as in China are being planned or implemented in different ways.
- Aligning and expanding them to the rest of the developing world would guarantee a consistent fuel efficiency improvement – longer term goal
- Today's most important step: further enhancement and extension of existing regulations in key market countries

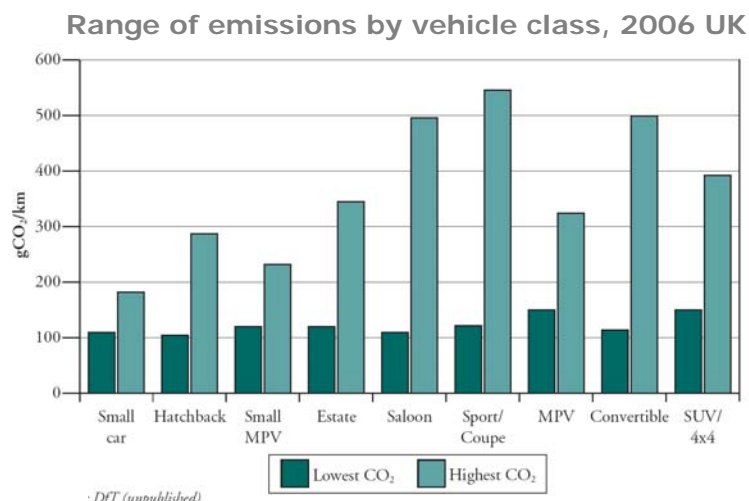
### Fuel taxation

- To avoid detrimental effects (additional mileage due to fuel/cost savings per km driven)

### R&D for advanced technologies

**But: Legislation for new cars and fuel taxes alone are not sufficient; consumer behaviour must also be addressed.**

## Consumer choices have high influence



**Choosing lowest emitter in class can improve efficiency by 25%!**

Source: Julia King

## Rethinking of cars

A change in consumer behaviour could be supported by:

- | **Fiscal signals** to stimulate the market, i.e. taxes based on CO<sub>2</sub> and consumer information, e.g. car labelling
- | **New communication strategies** to make smaller and lower powered cars more attractive are important on all sides of the equation – manufacturers, governments, NGOs
- | **Credits** for exceptionally efficient cars with repayments related to cost savings from reduced fuel consumptions
  - stimulate the demand for efficiency technologies
  - production rate would be accelerated
  - costs would be reduced by scale effects
- | **Tailoring the vehicle size** to the purpose associated with each car journey

## Similar to PC, high efficiency gains for HDV are feasible

- | Broad range of technical measures for heavy duty vehicles for significant reduction in fuel consumption
  - | Engine optimisation, speed and power reduction, hybrids, weight and aerodynamic improvements
  - | Inner urban transport buses: full potential of hybridisation
- | But in contrast to passenger cars, standards to measure fuel consumption of the entire vehicle are lacking
- | Estimation of driving resistance by coast down test on the road for each individual truck model
- | Such procedures are needed urgently as a basis for fuel consumption regulations and consumer information



### *Alternative technologies are long-term opportunities*

- | Long-term alternative propulsion system under development: the electrification of the power train in different stages by using fuel cells or batteries
- | Attractive due to independence of fossil oil and the high TtW efficiency (IEA 2005: 45% for FCEV and 74% for BEV)
- | Problems to solve: Development of energy storage in terms of energy and power density, required life cycle, costs are still high
- | Both technologies are potential long-term opportunities
  - | Possible progress in the development of battery technology through an increased demand for hybrid and plug-in vehicles could accelerate the development of BEV.

### *Alternative energy has to be supplied from renewable energy sources*

#### **Crucial point of alternative propulsion technologies:**

- | Target: Reduction in greenhouse gas emissions
  - ➔ the alternative energy carrier has to be supplied from renewable energy sources
- | In addition to further development of BEV and FCEV, the competing use options for renewables need to be considered

## Summary

- | Situation:
  - | Halving of the fuel consumption of today's cars is feasible in the next 10 to 15 years
  - | If reductions in power and vehicle size are taken into account, even higher reduction rates can be achieved
- | Target: Inverse the trend towards "supersized" and "superpowered" cars
- | Requirements:
  - | Legislation to push fuel efficient cars on the market
  - | Fuel tax to avoid counterproductive effects
  - | Stimulating the market by taxes, credits and labelling
  - | New communication strategies to make smaller, lower-powered and slower cars more attractive

**Thank you very much for your attention!**

0.99 l/100 km



from 1.6 l/100 km

1.5 l/100 km

3.3 l/100 km

~ 0.8 l/100 km

reference:  
www.greenpeace.de  
www.volkswagenag.com  
www.aptera.com, www.chevrolet.de  
www.think.no, evolution.loreemo.com

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