MOVING THE GLOBAL ECONOMY

Potentials of E-Mobility

Solutions in industrial logistics

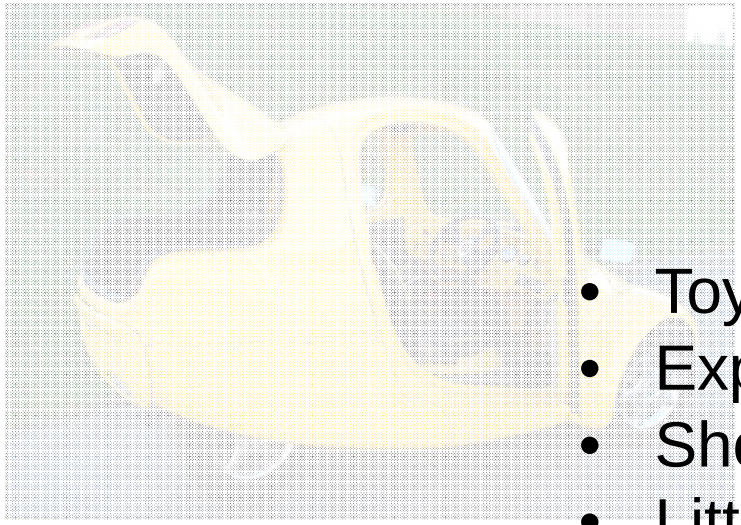
EUROGATE

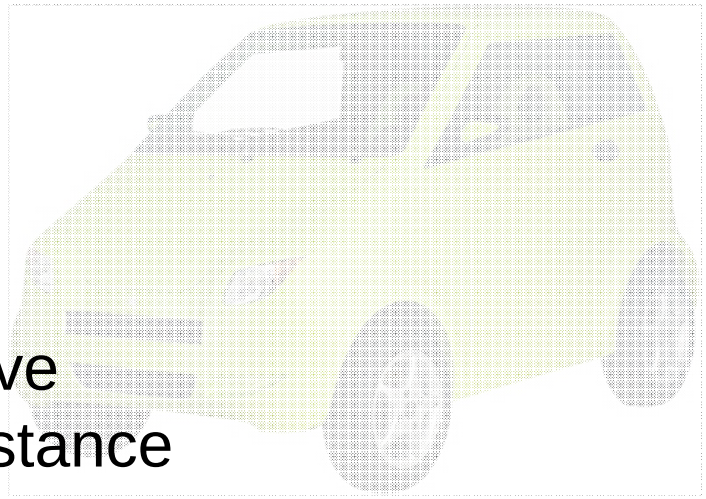
MOVING THE GLOBAL ECONOMY

- *Background*
- *Application*
- *Outlook*

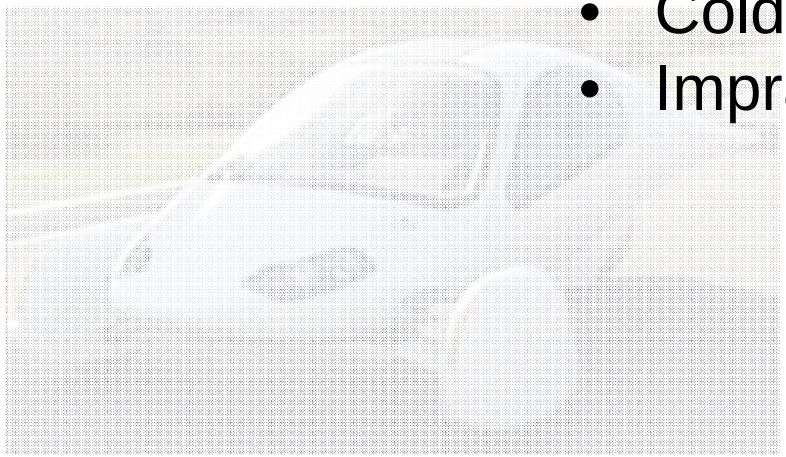
Images of E-mobility

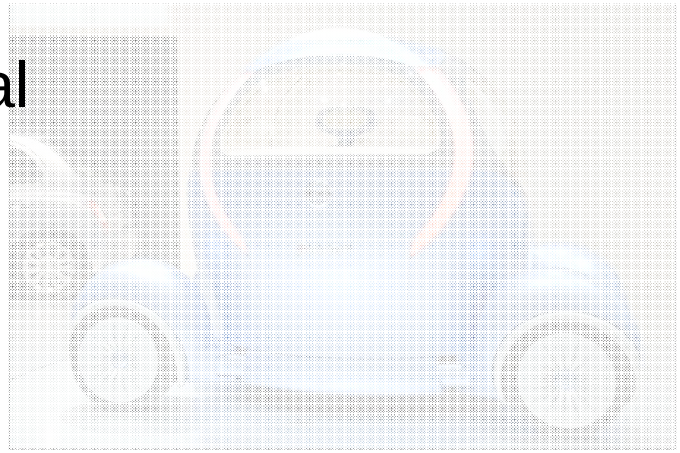
Images of E-mobility





- Toylike
- Expensive
- Short distance
- Little space
- Cold
- Impractical





E-mobility news today …

German Electric Car Goes 600km On A Single Charge

Posted on Oct 27, 10 12:12 AM PDT

- 605km (376m) from Munich to Berlin
- World record
- Average of 90 km/h (56mph)
- Including the use of heating and illumination
- Special Lithium-Metal-Polymer accumulator
- 4 seats and boot usable – battery small and powerful
- Lasts for 500.000km until it needs to be exchanged

The beginnings of E-Mobility

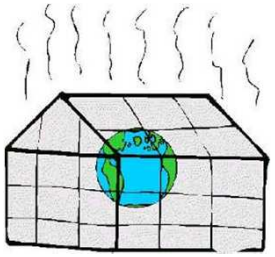
- **first electric passenger train in 1879.**
- **1881 first electric car by Gustave Trouvé**
  - combining modern engine and battery development
- **Predominant until the mid 1930s**
  - Longer distances
  - Faster: first car above 100km/h
  - quicker refuelling times
- **growing petroleum infrastructure + mass production of gasoline vehicles by Ford Motor Company removed E-Vehicles from US market by the 1930s**

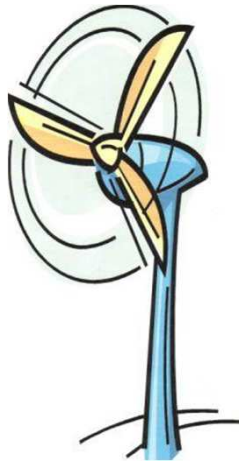
E-Mobility in Rail Transport

- **Today: Electric Rail transport in 134 countries,**
- **in Germany: 19,857 km electrified railway network**
- **Why?**
  - Better performance - faster
  - high efficiency of electric motors (often above 90%)
  - lower maintenance costs
  - lower energy costs
  - lack of direct pollution
  - quieter than diesel locomotives
  - regenerative braking

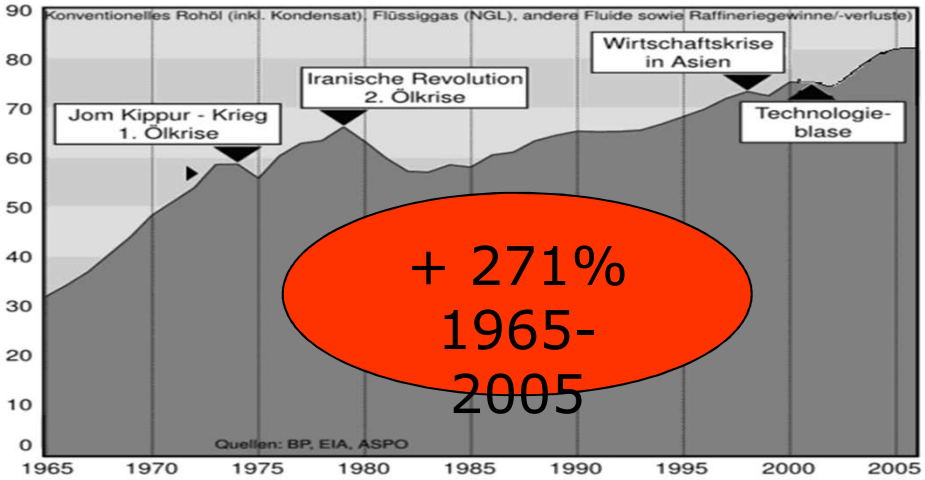
General reasons to develop E-mobility

- **No direct emissions**
  - CO; VOC; PM
  - important for urban environment
- **Less noise, Less vibration**
- **Less GHG emission**
  - 27% net reduction of CO2; CH4; NOx (coal based)
- **Grid stabilization potential**
  - off-peak electricity
  - variable-output power sources (PV, wind)
- **Energy resilience:**
  - electricity can be multi-sourced: Petroleum independence

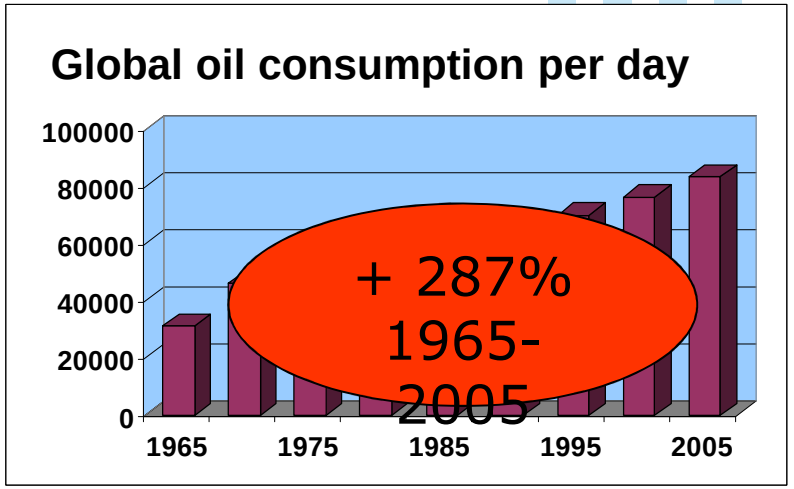




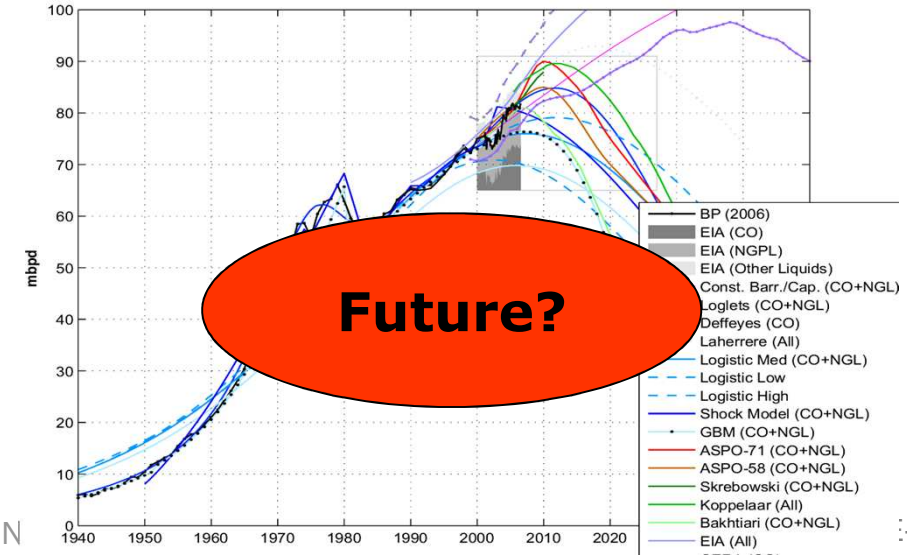
Petroleum dependence …

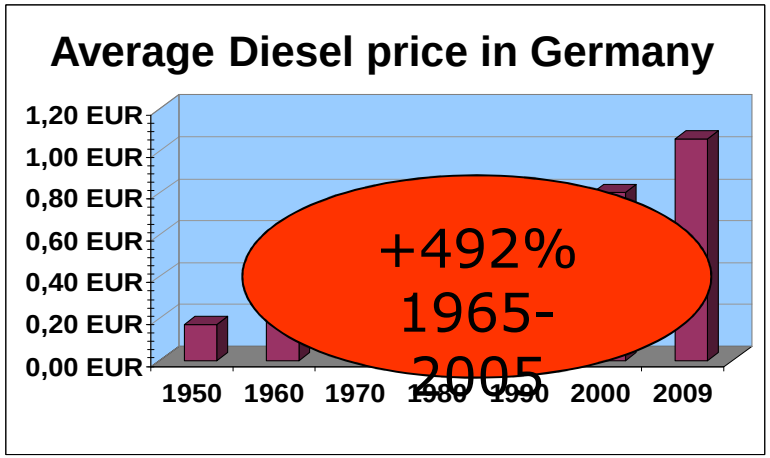


source: BP; EIA, ASPO



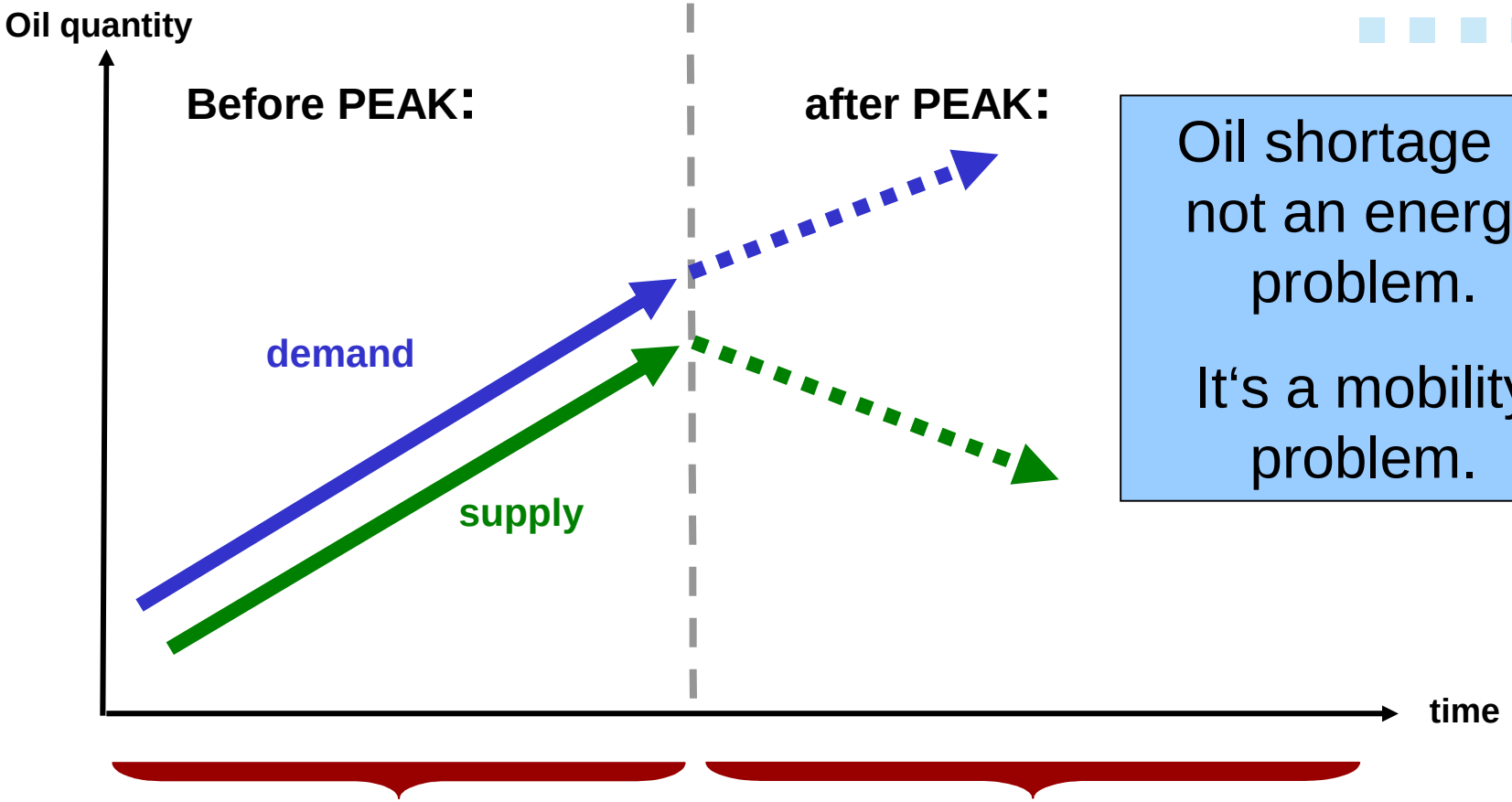
source: BP





source: German federal office of statistics

Peak Oil Problem



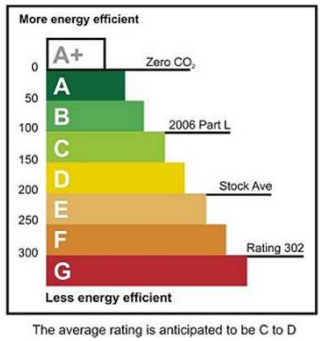
Oil shortage is not an energy problem.

It‘s a mobility problem.

Individual reasons to decide for E-mobility

Efficiency:

- Electric motors achieve 80-90%
- Combustion engines max. 43% (often only 15% to move)
- Regenerative braking and suspension



The average rating is anticipated to be C to D

	Electric	Combustion
kWh/100km	10 - 23	50 - 100
EUR/kWh	0,20 €	0,12 €
EUR/100km	2,00 € - 4,60 €	6,00 € - 12,00 €

Consumption / Costs

- Electric vehicle: 10-23 kWh/100 km
- Combustion car: to 50-100 kWh/100km

Practical reasons

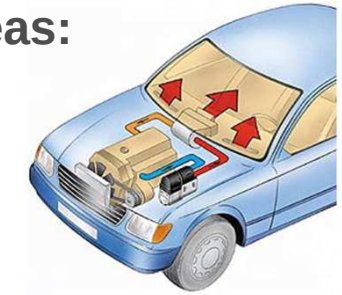
- No need for gearboxes -> high torque from rest
- simple driving schemes
- no oxygen demand – submarines, mines, workshops
- charging everywhere – no petrol station needed

Disadvantages – Problems …

Battery problems

- 6-10h charging
- range 100-150km
- Battery depletion over time
- High cost for batteries

Heating and cooling ideas:



- using solar power
- using super-insulated cabins
- using heat-exchanger connected with battery-core

Other:

- Lacking Infrastructure
- Dangerours silence to pedestrainians
- Longer braking distances -> safety protection
- Little experience of fire control

Charging and Storage - Solution

On-board rechargeable electricity storage system

- Various battery types: NiCd, NiMH, Zinc-air, Molten salt, Lead acid, Zinc-bromine flow…
- Modern research on Li-ion, Li-polymer:
  - ➔ high energy density
  - ➔ Long cycle lifetime
  - ➔ recharged in minutes instead of hours
  - ➔ 75-130W/kg
  - ➔ lithium reserves for 4 billion e-cars

Other possible systems

- Fluid replacement: vanadium-based electrolyte (expensive)
- Standardized inductive charging system minimized cabling
- Permanent charging

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Present E-Vehicles

- **Toyota Prius – 1997**
  - first mass produced - hybrid gasoline-electric car
  - most fuel efficient gasoline car in the U.S
  - regenerative braking

- **Th!nk City / Mitsubishi i MiEV - 2008/09**
  - crash-tested electric cars
  - 110 /130 km/h (67/80mph), 160km
  - 8h charging, Lithium battery

- **Teslar Roadstar 2010**
  - 320km (200mi) per charge
  - Max. 125 mph (201 km/h)

Application - *EUROGATE*

- **6months testing “Tazzari ZERO”**
  - On the terminal
  - Between terminals
  - Home use of staff
- **Technical Details:**
  - 13,5kWh/100km – (2,7EUR versus 6,5EUR)
  - Vmax: 100kmh, 140km per charge
  - lithium ion batteries
  - 80% charging in 1h, (100% in 9h)
  - 542kg,
- **First feedback:**
  - Huge interest
  - Simple interior, little comfort
  - Easy application, fast acceleration

E-Bus

Electric bus

- since 1992 a battery-electric minibus operates in St. Helen, GB
- has carried 11.3 million passengers
- Has run 3,100,000 kilometres (1,930,000 mi)

The 2008 Beijing Olympics

- 50 electric buses,
- range of 130 km (81 mi) despite air conditioning
- Lithium-ion batteries – completely replaced
- 0.62 kWh/km (1kWh/m) -> 6l fuel per 100km

E-Truck

Port of Los Angeles: Air Quality Management District

- E-truck for short-range heavy-duty
- hauling a 40-foot (12 m) cargo container up to 27t (60,000 lb)
- speeds up to 40 mph (64 km/h)
- range of 30-60 miles (48-97 km).
- 2kWh/m (1.2 kWh/km) - 12l/100km compared to 35l for normal Trucks

Further Application:

- Wherever: Frequent stopping, starting or idling is needed
- milk float, garbage trucks, …

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Figures and predictions

- in 2004: 55,852 Full-electric vehicles in US (+ 39% p.a.);
- In 2011: 1750 estimated in Germany

Centre of Automotive Research;
"by 2025, all passenger cars sold in Europe will be electric or hybrid"

Nissan CEO: “2020 one in 10 cars globally will run on battery power alone”

- US Department of Energy states: “84% of existing vehicles could be switched over to plug-in hybrids without requiring any new grid infrastructure”

Incentives and promotion

United States

- $2.4 billion for electric vehicles
- battery development, electric motors, plug-In Hybrids, electric infrastructure concepts

China:

- US$15 billion to initiate an electric car industry

Germany:

- 1 Mio. Vehicles until 2020 planned
- 500Mio. funding for research and development

Denmark:

- privileged taxation,
- Free parking/charging in large cities

Portugal:

- public network of 1 385 charging points –
- 50 fast ones (25cities)

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Thank you for your attention

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